

NEW DISTRICT ADMINISTRATION BUILDING

New Caney Independent School District



Issue for Bid

New Caney ISD CSP # 999-2023

May 8, 2025

GPD Group Professional Corporation

2121 Sage Road, Suite 240

Houston, Texas 77056

GPD Group Project No. 2023140.00



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New Caney ISD New Administration Building

New Caney Independent School District

GPD Group Project No. 2023159.00
Pasadena ISD CSP#999-2023

May 8, 2025



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E-107-E1 ELECTRICAL LIGHTING FIRST FLOOR AREA – E1
E-108-F1 ELECTRICAL LIGHTING FIRST FLOOR AREA – F1
E-109-G1 ELECTRICAL LIGHTING FIRST FLOOR AREA – G1
E-111-A2 ELECTRICAL LIGHTING SECOND FLOOR AREA – A2
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E-113-C2 ELECTRICAL LIGHTING SECOND FLOOR AREA – C2
E-114-D2 ELECTRICAL LIGHTING SECOND FLOOR AREA – D2
E-115-D2.2 ELECTRICAL LIGHTING SECOND FLOOR AREA – D2.2
E-116-E2 ELECTRICAL LIGHTING SECOND FLOOR AREA – E2

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E-206-D1.2	ELECTRICAL POWER FIRST FLOOR AREA – D1.2
E-207-E1	ELECTRICAL POWER FIRST FLOOR AREA – E1
E-208-F1	ELECTRICAL POWER FIRST FLOOR AREA – F1
E-209-G1	ELECTRICAL POWER FIRST FLOOR AREA – G1
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T-104-B1	TECHNOLOGY FIRST FLOOR AREA – B1
T-105-C1	TECHNOLOGY FIRST FLOOR AREA – C1
T-106-D1	TECHNOLOGY FIRST FLOOR AREA – D1
T-107-D1.2	TECHNOLOGY FIRST FLOOR AREA – D1.2
T-108-E1	TECHNOLOGY FIRST FLOOR AREA – E1
T-109-F1	TECHNOLOGY FIRST FLOOR AREA – F1
T-110-G1	TECHNOLOGY FIRST FLOOR AREA – G1
T-111-A2	TECHNOLOGY SECOND FLOOR AREA – A2
T-112-B2	TECHNOLOGY SECOND FLOOR AREA – B2
T-113-C2	TECHNOLOGY SECOND FLOOR AREA – C2
T-114-D2	TECHNOLOGY SECOND FLOOR AREA – D2
T-115-D2.2	TECHNOLOGY SECOND FLOOR AREA – D2.2
T-116-E2	TECHNOLOGY SECOND FLOOR AREA – E2
T-117-F2	TECHNOLOGY SECOND FLOOR AREA – F2
T-118-G2	TECHNOLOGY SECOND FLOOR AREA – G2
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T-202	TECHNOLOGY OVERALL FIRE ALARM PLAN – LEVEL 2
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T-402	TECHNOLOGY DETAILS
T-403	TECHNOLOGY DETAILS
T-404	TECHNOLOGY DETAILS
T-405	TECHNOLOGY DETAILS
T-406	TECHNOLOGY SCHEMATIC DESIGN
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**REQUEST FOR COMPETITIVE SEALED PROPOSALS
CSP JOB #999-2023**

Project: New District Administration Building

Location:

**New District Administration Building
21330 Valley Ranch Parkway
New Caney, TX. 77357**

ISSUED BY (Owner):

New Caney Independent School District
22784 Hwy 59S Building E
Porter, TX 77365

SUBMIT INQUIRIES TO:

Name: Tanci Foster, Project Manager
22784 Hwy 59S Building E, Porter, TX 77365
Email: tfoster@newcaneyisd.org

New Caney ISD website: www.newcaneyisd.org

SECTION 1 – PROJECT OVERVIEW

Project Overview and Scope: New Caney Independent School District (“NCISD,” “District,” “Owner”) is seeking **Competitive Sealed Proposals** from qualified proposers to provide construction services for the New District Administration Building located at 21330 Valley Ranch Pkwy. New Caney, TX. 77357. project scope of work consists of a new 135,000 sf two story administration building.

Estimated Budget: The estimated budget for this project is **\$35,000,000.00**

Award/Contract Approval: This procurement, any award under this procurement, and the resulting contract, if any, is subject to approval by the NCISD Board. Subsequent to required approval, the only person authorized to commit NCISD contractually is the Superintendent or his designee. This solicitation is an invitation for sealed proposals and neither this solicitation nor the response or the proposal from any prospective proposer/contractor shall create a contractual relationship that would bind NCISD until such time as both NCISD and the selected proposer/contractor sign a legally binding contract, which includes, without limitation, the terms required by NCISD.

Pre-Proposal Meeting: Pre-Proposal meeting agenda will include review of topics that may affect proper preparation and submittal of proposals and is scheduled for 9:30 a.m. on May 19, 2025 at 22784 Hwy 59S Building E, Porter, TX 77365. Attendance at the pre-proposal meeting is not mandatory, but all proposers are highly encouraged to attend.

Proposal Deadline; Opening Time/Location: Sealed proposals for the construction work to be performed as required and/or contemplated under this request for competitive sealed proposals and as described herein and in the construction documents will be received no later than **June 10, 2025 by 2:00 p.m.** **Sealed Alternate Proposals for the construction work to be performed as required and/or contemplated under this request for competitive sealed proposals and as described herein and in the construction documents will be received no later than June 10, 2025 by 3:00 p.m.** Proposals will be publicly opened and read aloud at **3:05 p.m. on June 10, 2025.**

Proposals shall be submitted by hard copies delivered by U.S. Postal mail, courier, or hand delivery to NCISD on or before the date and time set to receive proposals. Proposers shall submit 1 original and 1 copy of proposals in a sealed envelope and are responsible for ensuring that their proposals are time-stamped to evidence timely submission. Hard copies of proposals will only be accepted at NCISD's Facilities and Construction Building, located at 22784 Hwy 59S Building E, Porter, TX 77365, between the hours of 8:00 a.m. and 3:00 p.m., Monday through Friday, on NCISD business days.

Proposals that have been opened may not be changed for the purpose of correcting an error in the price. Other than price, a proposer may have the right to change any other error or mistake in the proposal as may be permitted by applicable law and subject to the approval of NCISD, unless such change would be in contravention of statutory or common law requirements or unless such change would give an unfair advantage to the proposer making such change.

Contract Term: Actual work to be performed and the schedule for performance under this solicitation will be upon the terms, conditions, and timelines agreed upon by NCISD and the selected contractor. **Time is of the essence for this project. All Work listed in the construction documents shall be substantially completed as follow:**

Estimated substantial completion is October 24, 2026.

Final completion shall be completed no later than thirty (30) days following Substantial Completion date.

Reservations and Waivers: This procurement solicitation shall be in accordance with applicable law and NCISD policies and general terms, including the following:

1. This Request for Competitive Sealed Proposals does not obligate NCISD to award a contract or pay any costs incurred by the proposer in the preparation and submittal of a proposal. NCISD assumes no financial responsibility for any costs incurred by proposers in developing and submitting a proposal, participating in pre-bid meetings, or any other costs incurred by proposers in connection with this procurement solicitation.
2. **NCISD, IN ITS SOLE DISCRETION, RESERVES THE RIGHT TO ACCEPT ANY PROPOSAL AND/OR REJECT ANY AND ALL PROPOSALS OR A PART OF A PROPOSAL, WITHOUT REASON OR CAUSE, SUBMITTED IN RESPONSE TO THIS SOLICITATION.**
3. **NCISD RESERVES THE RIGHT TO REJECT ANY NON-RESPONSIVE OR CONDITIONAL PROPOSAL.**
4. **NCISD RESERVES THE RIGHT TO WAIVE ANY FORMALITIES, IRREGULARITIES, AND/OR TECHNICALITIES IN THIS SOLICITATION, THE CONSTRUCTION AND/OR PROCUREMENT DOCUMENTS, AND/OR ANY PROPOSALS RECEIVED OR SUBMITTED.**

5. **BY SUBMITTING A PROPOSAL, PROPOSER AGREES TO WAIVE ANY CLAIM IT HAS OR MAY HAVE AGAINST NEW CANEY INDEPENDENT SCHOOL DISTRICT, AND/OR NCISD'S BOARD MEMBERS, ADMINISTRATORS, EMPLOYEES, AND/OR AGENTS ARISING OUT OF OR IN CONNECTION WITH (1) THE ADMINISTRATION, EVALUATION, OR RECOMMENDATION OF ANY PROPOSAL; (2) ANY REQUIREMENTS UNDER THE SOLICITATION, PROCUREMENT PACKAGE, OR RELATED DOCUMENTS; (3) THE REJECTION OF ANY PROPOSAL OR ANY PART OF ANY PROPOSAL; AND/OR (4) THE AWARD OF A CONTRACT, IF ANY.**
6. NCISD reserves the right to withdraw/cancel this solicitation at any time for any reason, remove any scope component for any reason and to issue such clarifications, modifications and/or amendments as deemed appropriate by NCISD, in its sole discretion.
7. A response to this procurement solicitation is an offer to contract with NCISD based upon the terms, conditions, scope of work, and specifications contained in this procurement solicitation and the construction documents. A contract is not formed unless and until a proposal is accepted and awarded by NCISD after approval by the NCISD Board of Trustees. NCISD will utilize the AIA Document A101-2017 contract, as modified by NCISD, along with the AIA Document A201 General and Supplementary Conditions, as modified by NCISD. NCISD's modifications to the AIA Documents are included herein as Attachment Exhibit C. Any exceptions to NCISD's modifications to the AIA Documents must be clearly indicated in the proposer's submission. Each Proposer, by making its proposal, represents that the Proposer has read, understands, and agrees to NCISD's modifications to the AIA Documents.
8. A proposal that has been submitted may be withdrawn prior to the deadline for submission of proposals.
9. Proposals received will become a part of NCISD's official files without further obligation to the respondents.
10. Respondents shall not, under penalty of law, offer any gratuities, favors, or anything of monetary value to any officer or employee of NCISD, or to any consultant, employee, or member of NCISD for the purpose of or having the effect of influencing favorable disposition toward their own proposal or any other proposal submitted hereunder.
11. No employee, officer or member of NCISD shall participate in the selection, development of a response to this procurement solicitation, award or administration of a contract resulting from this procurement solicitation if a conflict of interest, real or apparent, would be involved.
12. Proposers shall not engage in any activity that will restrict or eliminate competition. This does not preclude joint ventures or subcontracts.

SECTION 2 – INSTRUCTIONS TO PROPOSERS

1. **Definitions:**

Procurement Documents include the procurement requirements and the proposed contract documents. The procurement requirements consist of this Request for Competitive Sealed Proposals, including its exhibits and attachments, and all addenda. The proposed Contract Documents consist of the AIA Document A101-2017 contract, as modified by NCISD; Exhibit A to the AIA Document A101-2017, Insurance and Bonds, as modified by NCISD; AIA Document A201 General Conditions, as modified by NCISD; the Drawings and Specifications. The AIA Documents, as modified by NCISD, are included herein as Exhibit C.

2. **Review of Construction Documents**

A complete set of documents (collectively, “Procurement Documents”) shall be used in preparing a proposal; neither NCISD nor NCISD’s architect assumes responsibility for errors or misinterpretations resulting from the use of incomplete sets of construction and/or procurement documents. Each prospective proposer should carefully review the construction documents and take such steps as may be reasonably necessary to ascertain the resulting contract performance requirements. Failure to do so will not relieve proposers from the responsibility of estimating properly the difficulty/level of effort or cost of successfully performing any resulting contract. After the proposals have been opened, NCISD shall have the right to review the proposals and examine the credentials and qualifications of each proposer to determine whether any or all of the proposals are responsive and to make a determination as to whether any one or more proposers are qualified, responsible contractors.

Proposers shall carefully study and compare the Procurement Documents with each other, shall examine the site and local conditions, and shall at once report to the architect errors, inconsistencies, or ambiguities discovered.

3. **Explanation to Proposers; Questions; Registration with Architect**

Any explanation desired by a prospective proposer regarding the meaning or interpretation of the Procurement Documents must be requested in writing and with sufficient time allowed (a minimum of ten (10) calendar days before the date set to receive proposals) for a response to reach prospective proposers before the submission of their proposals. Any NCISD interpretations, corrections, and/or changes to the procurement or construction documents will be in the form of an addendum. Interpretations, corrections and changes of the Procurement Documents made in any other manner will not be binding, and Proposers shall not rely upon them.

All such addenda shall be posted where the original procurement documents were placed. Receipt of any addenda issued by NCISD shall be acknowledged by the proposer with the proposal submission.

Procurement Documents may be obtained from the issuing office designated in the Advertisement for Sealed Proposals in the number and for the deposit sum, if any, stated therein. The deposit will be refunded to Proposers who return the Procurement Documents to the issuing office in good condition and in good order within ten days after proposal opening. The cost of replacement of missing or damaged Procurement Documents will be deducted from the deposit. A Proposer receiving a Contract award may retain the Procurement Documents and the Proposer’s deposit will be refunded.

- Additional complete sets of Procurement Documents, if available, may be obtained by Proposers and sub-proposers from the issuing office for the cost of reproduction and mailing, which costs are not refundable. It shall be understood by entities obtaining additional sets and paying the reproduction and mailing costs

that such additional sets remain the Owner's exclusive property and shall be returned to the office from where the Procurement Documents were issued.

All questions and/or requests for information must be sent directly to the architect and responsible/consultant via email:

1. Architectural/General – **GPD Group**

2121 Sage Rd. #240
Houston, TX 77056

Felipe Silva

Email: fsilva@gpdgroup.com

2. Landscape Architect - **Mary L. Goldsby Associates**

112 Northwood Street
Houston, TX. 77009

Mary Goldsby

Email: mary@mlga-landscape.com

3. Civil – **Dally + Associates, Inc.**

9800 Richmond Ave, Suite 460
Houston, TX 77042

Carlos Pacas

Email: cpacas@dallyassociates.com

4. Structural – **Dally + Associates, Inc.**

9800 Richmond Ave, Suite 460
Houston TX, 77042

Lauren Madison

Email: lmadison@dallyassociates.com

5. MEPT – **Salas O'Brien**

10930 W. Sam Houston N. Suite 900
Houston, TX 77064

Allen Penn

Email: alan.penn@salasobrien.com

All questions and/or requests for information shall be responded to in writing by return email only to the original sender, if there are no changes to the Contract Documents.

For all proposers preparing to submit a proposal for the work enumerated in the construction documents to NCISD, please **register with NCISD's architectural firm for this project**: GPD Group. This registration will allow NCISD to maintain a proposer list and have the opportunity to submit responses to proposers' questions/requests for information equally with all proposers.

Prospective proposers are responsible for obtaining issued addenda to the request for competitive sealed proposals to ensure they have the most current and complete Procurement Documents.

4. **General Requirements**

- a. NCISD is seeking proposals from qualified, responsible contractors to provide construction services.
- b. The contractor must have the administrative and fiscal capability as well as experience to provide and manage the services requested.
- c. The contractor must comply with all applicable federal, state, and local laws, ordinances, rules, regulations and orders of all authorities having jurisdiction over the contract.
- d. The contractor must be adequately insured and bonded.
- e. The contractor must employ qualified personnel with adequate training and experience and in adequate numbers.

5. **Proposer Eligibility for Contract Award**

In order for a proposer to be eligible to be awarded a contract, the proposal must be responsive to the solicitation and NCISD must be able to determine that the proposer is responsible to perform the resulting contract satisfactorily.

Responsive proposals are those that comply with all material aspects of the solicitation, conform to the Procurement Documents, and meet the requirements set forth in this solicitation. Proposals that do not comply with the terms and conditions of the solicitation will be rejected as non-responsive.

Each proposer shall complete, and submit with the proposal, the applicable forms contained in the solicitation. When a special license or permit is required by Federal, State or Local law or ordinance or required by a company or otherwise to perform the work, the proposer must be properly licensed prior to submitting a proposal to NCISD and must furnish evidence of such licensing or credentials with the proposal.

Responsible proposers, at a minimum, must meet all of the following requirements:

- Be an experienced contractor who has served as a prime contractor on similar construction projects for schools/governmental entities and be knowledgeable about requirements for construction of and building elements for schools including, without limitation, applicable building code requirements;
- Provide a warranty and support for any equipment installed as part of the construction services;
- Possess or is able to obtain adequate financial resources as required to perform under any contract resulting from this procurement solicitation;
- Have a responsible safety record, as detailed in this procurement solicitation;
 - Proposers must submit with their sealed proposal the following evidence of proposer's safety record: proposer's OSHA (Occupational Safety and Health Administration) inspection logs for the last three years, a loss analysis from the proposer's insurance carrier, and a loss history covering all lines of insurance coverage carried by the proposer.
- **Be able to obtain payment and performance bonds of the types and in the amounts described in this procurement solicitation;**
 - Proposers must provide a letter of statement from a bonding company that the proposer general contractor is eligible to obtain both payment and performance bonds of the types described in this procurement solicitation. **Proposers must include such letters in their proposals.**
 - Payment and performance bonds shall be provided after the proposal/contract award in order to proceed with contract execution.
 - Proposers shall include the related bond cost within their proposal amount.
- **Comply with all prevailing wage rate requirements;**
 - The contractor who is awarded a contract resulting from this procurement solicitation must pay not less than the prevailing wage rates determined by NCISD to a worker employed by it in the execution of a contract and must keep a record of such, as detailed in this procurement solicitation.
- **Be able to obtain all required permits.**
 - All permit costs, inspection costs by governmental authorities having jurisdiction and associated fees, including but not necessarily limited to, building permits, sprinkler permits, canopy permits, fence permits, etc. will be paid by the selected proposer.
 - Proposers shall include the related permitting and inspection costs within their proposal amount.
- Submit all required proposal forms. If there are any missing proposal form pages, proposers may be disqualified.
- Be able to comply with the required performance schedule, taking into consideration all existing business commitments;
- Have necessary management and technical capability to perform any resulting contract;
- Be qualified as an established firm regularly engaged in the type of business to provide the items/work required by this solicitation;

- Be registered to do business in the State of Texas;
- Be in good standing with the State of Texas;
- Be otherwise qualified and eligible to receive a contract award under applicable laws and regulations.

Proposals deviating or taking exceptions to the solicitation requirements may not be considered. A person is not eligible to be considered for award of this solicitation or any resulting contract or to be a subcontractor of the proposer or prime contractor if the person assisted in the development of this solicitation or any part of this solicitation or if the person participated in a project related to this solicitation when such participation would give the person special knowledge that would give that person or a prime contractor an unfair advantage over other proposers.

6. **Preparation for Proposal; Proposal Submittal**

- A proposal shall be complete, must include information provided on the attached forms, and may include any other forms or documents to support the proposal submitted by the contractor and shall be signed by an authorized official of the company submitting the proposal. The person signing the proposal shall initial any changes or erasures appearing on the proposal forms.
- Proposers may respond to this CSP using by submitting hard copies of proposals. A proposal shall be submitted by delivering proposals no later than the exact date/time and at the place indicated in the solicitation. The required documentation and forms must be completed, signed, scanned, and enclosed in Proposer's sealed envelope. Hard copies of proposals will only be accepted at NCISD's Facilities and Construction Building, located at 22784 Hwy 59S Building E, Porter, TX 77365, between the hours of 8:00 a.m. and 3:00 p.m., Monday through Friday, on NCISD business days. The envelope shall identify the name and address of the proposer and shall contain the proposal security and other required documents.
- All proposal packages must be sealed and must be clearly marked with the following:
 - Proposer's name, address and telephone number
 - Project Description/Title
 - Proposal Opening Date/Time

All hard copies of proposals shall be submitted to:

NEW CANEY INDEPENDENT SCHOOL DISTRICT
Attn: Tanci Foster
NCISD Facilities and Construction Building
22784 Hwy 59S Building E
Porter, TX 77365

- Proposal security shall be submitted with each proposal in the amount of ten percent (10%) of the Base Proposal amount.**

7. **Selection Criteria**

In accordance with Sections 2269.153, 2269.155, and 2269.055 of the Texas Government Code, NCISD will evaluate proposals on the basis of the following selection criteria:

Selection Criteria Weight Table	
Detailed Methodology for Scoring	Criteria Weight
<p>Price – Proposed Price</p> <p>Proposers will receive an assigned share of the total available points for this criterion based on the total monetary value of the Proposal according to banded point categories shown in the “Table of Awarded Points,” below. A formula will be used as follows to determine the award band for proposals based on each proposer’s percentage above the low bid: Percentage Above Low Bid=(Your combination of fees and general conditions/lowest proposed combination of fees and general conditions. The result of the formula will be used to proportion the points awarded based on the “Table of Awarded Points,” below.</p>	50
<p>Proposer’s Experience & Reputation</p> <p>The Owner will consider the proposer’s experience and reputation and the proposer’s answers to the Questionnaire, including, but not limited to, the record of past performance, general reputation of the proposer, and the proposer’s knowledge, reliability, character, integrity, skill, and stability; the proposer’s experience completing projects of similar size and scope in the Greater Houston Area, the proposer’s experience with NCISD, and the proposer’s reputation for handling warranty work. Proposer’s references (listed in proposer’s A305) will be reviewed and evaluated.</p>	15
<p>Quality of Proposer’s Goods or Services</p> <p>Proposer demonstrates consistent and average past and current workload to staff ratio, showing ability to adequately staff the work and company stability. Proposer shows no or limited past history of claims, suits, and failure to perform. Proposer shows ability to maintain cost with no cost increases. Proposer has a record of timely completion of work, compliance with laws, and warranty service. Owner will consider the answers to the Questionnaire which relate to the quality of the Proposer’s services.</p>	15
<p>Whether Proposer’s financial capability is appropriate to the size and scope of the project</p> <p>Proposer’s financial and technical resources will be evaluated. Proposer has a positive asset to liability ratio and adequate bonding capacity. Evaluation of Proposer’s responses to Financial Information Questionnaire of this RFP.</p>	5
<p>Proposer’s Proposed Personnel</p> <p>Proposer’s <u>individual personnel</u> proposed for the work in the RFP demonstrate similar project experience by showing high proportion of Montgomery County school district/governmental entity work, the proposer’s experience completing projects of similar size and scope in the Greater Houston Area, projects of comparable cost, complexity, and timeframe to the work in the RFP. Organizational approach to the project is clear. Owner will review and evaluate the answers to the Questionnaire and resumes in proposer’s A305.</p>	5
<p>Proposer’s Safety Record</p> <p>NCISD will consider the safety record of the proposer in determining to whom to award a contract resulting from this procurement solicitation. The safety record shall be as defined in this RFP.</p>	2
<p>Proposer’s Ability to Complete Project on Time</p> <p>Proposer’s ability to complete project on time; Proposer’s proposed construction schedule meets or exceeds the Substantial Completion and Final Completion dates set forth herein.</p>	5

Proposer's Performance in Responding to Warranty Proposer has a positive demonstrated performance in responding to warranty claims.	3
Total	100

Table of Awarded Points

Percentage Above Low	Percentage of Available Points Allocated
0% to 0.0125%	100.00%
0.0126% to 0.25%	99.00%
0.26% to 0.51%	97.50%
0.52% to 0.77%	96.00%
0.78% to 1.03%	94.50%
1.04% to 1.29%	93.00%
1.3% to 1.55%	91.50%
1.56% to 1.81%	90.00%
1.82% to 2.07%	88.50%
2.08% to 2.33%	86.50%
2.34% to 2.59%	84.50%
2.6% to 2.85%	82.50%
2.86% to 3.11%	80.50%
3.12% to 3.37%	78.50%
3.38% to 3.63%	77.50%
3.64% to 3.89%	76.50%
3.9% to 4.15%	75.50%
4.16% to 4.41%	74.50%
4.42% to 4.67%	73.50%
4.68% to 4.93%	72.50%
4.94% to 5.19%	71.50%
5.2% to 5.45%	70.50%
5.46% to 5.71%	69.50%
5.72% to 5.97%	68.50%
5.98% to 6.23%	67.50%
6.24% to 6.49%	66.50%
6.5% to 6.75%	65.50%
6.76% to 7.01%	62.50%
7.02% to 7.27%	59.50%
7.28% to 7.53%	56.50%
7.54% to 7.79%	53.50%
7.8% to 8.05%	50.50%
8.06% to 8.31%	47.50%
8.32% to 8.57%	44.50%
8.58% to 8.83%	41.50%
8.84% to 9.09%	38.50%
9.1% to 9.35%	35.50%
9.36% to 9.61%	32.50%
9.62% to 9.87%	29.50%
9.88% to 10.13%	26.50%

10.14% to 10.24%	23.50%
10.25% to 11%	17.50%
11.01% to 12%	11.50%
12.01% to 13%	5.50%
13.01% to 100%	0.00%

8. **Terms and Conditions**

This procurement solicitation shall be in accordance with applicable law, including Subchapter D of Chapter 2269 of the Texas Government Code (Competitive Sealed Proposal Method of Procurement), NCISD policy, and the following terms and conditions of this procurement solicitation:

- a. **Contract Award.** Award of a contract, if any, will be made to the proposer who submits the proposal that offers the best value for NCISD, based on (a) the selection criteria in this request for competitive sealed proposals and the weighted value for those criteria listed in this procurement solicitation; and (b) NCISD's ranking evaluation. Tex. Gov't Code § 2269.155(a). NCISD must first attempt to negotiate a contract with the selected proposer. NCISD and its architect and/or engineer may discuss with the selected proposer options for a scope or time modification and any price change associated with the modification. Tex. Gov't Code § 2269.155(b). If NCISD is unable to negotiate a satisfactory contract with the selected proposer, NCISD must, formally and in writing, end negotiations with that proposer and proceed to the next proposer in the order of the selection ranking until a contract is reached or all proposals are rejected. Tex. Gov't Code § 2269.155(c).
- b. **Taxes.** NCISD is exempt from taxation, and no proposal shall include any costs for taxes to be assessed against NCISD.
- c. **Appropriated Funds.** The purchase of services and/or products that arises from this solicitation is contingent upon the availability of appropriated funds. In addition to other termination rights contained in the resulting contract, if any, NCISD shall have the right to terminate the resulting contract at the end of the current or each succeeding NCISD fiscal year if funds are not appropriated by NCISD's Board of Trustees for the next fiscal year that would permit continuation of the resulting contract. If funds are withdrawn or do not become available, NCISD reserves the right to terminate the contract by giving the contractor a thirty (30) day written notice of its intention to terminate without penalty or any further obligations on the part of NCISD or the contractor. Upon termination of the contract, NCISD shall not be responsible for any payment of any service or product received that occurs after the end of the current contract period or the effective date of termination, whichever is the earlier to occur.
- d. **Insurance.** Contractor must obtain and keep in effect during the term of the contract, insurance coverage in the below listed types and minimum amounts. As evidence of insurance coverage, **Contractor must furnish to NCISD certificate(s) of insurance as detailed in Exhibit A to the AIA Document A 101-2017 (see Section A. 3.1.1).**

Type of Coverage	Amount of Coverage
Liability and other insurance	As detailed in Exhibit A to the AIA Document A101-2017, Insurance and Bonds, as modified by NCISD
Workers Compensation & Employers Liability Insurance	As detailed in

	Exhibit A hereto and Exhibit A to the AIA Document A101-2017, Insurance and Bonds, as modified by NCISD
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Contractor must perform the duties and responsibilities pertaining to required workers' compensation coverages, as detailed in Exhibit A and in Exhibit A to the AIA Document A101-2017, Insurance and Bonds, as modified by NCISD.

Contractor shall provide NCISD with a certificate of coverage for each person providing services on the project, prior to that person's beginning work on the project. This provision 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 contracts directly with the contractor and regardless of whether that person has employees. This includes, but is not limited to, independent contractors, subcontractors, leasing companies, motor carriers, owner-operators, employees of any such entity, or employees of any entity furnishing persons to perform services on the contract. Services include, but are not limited to, providing, hauling, or delivering equipment or materials, or providing labor, transportation, or other services related to a project. Services do not include activities unrelated to the project, such as food/beverage vendors, office supply deliveries, and delivery of portable toilets.

Contractor shall provide NCISD with a new certificate of coverage showing extension of coverage:

- (1) Before the end of the coverage period, if the contractor's current certificate shows that the coverage period ends during the duration of the project; and
- (2) No later than seven days after the expiration of the coverage for each other person providing services on the project whose current certificate shows that the coverage period ends during the duration of the project.

- e. Performance and Payment Bonds. The successful contractor, before beginning the work under any contract resulting from this procurement solicitation, is required to execute a performance bond and a payment bond as detailed in Exhibit A to the AIA Document A101-2017, Insurance and Bonds, as modified by NCISD (enclosed herein as Exhibit C).

Proposers must provide, with their proposals, a letter of statement from a bonding company that the proposer general contractor is eligible to obtain both payment and performance bonds of the types described in this procurement solicitation.

- f. Prevailing Wage Rates. A worker, laborer, or mechanic employed on a public work by or on behalf of NCISD 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.

The NCISD Board has determined the general prevailing rate of per diem wages in the locality in which the public work is to be performed for each craft or type of worker needed to execute the contract and the prevailing rate for legal holiday and overtime work. Attached hereto as Exhibit B are the prevailing wage rates adopted by the NCISD Board.

The contractor who is awarded a public works contract by NCISD or a subcontractor of the contractor shall pay not less than the prevailing wage rates determined by NCISD to a worker employed by it in the execution of the public works contract. A contractor or subcontractor who violates the requirement to pay prevailing wage rates shall pay to NCISD, \$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 public works contract; NCISD shall specify this penalty in the public works contract.

Obligation to keep Prevailing Wage Rates Records. A contractor and subcontractor employed on an NCISD public works contract shall keep a record showing:

- (1) the name and occupation of each worker employed by the contractor or subcontractor in the construction of the public work; and
- (2) the actual per diem wages paid to each worker.

The record shall be open at all reasonable hours to inspection by NCISD officers and agents. Tex. Gov't Code § 2258.024.

- g. **Permitting; Inspections.** Contractor and all subcontractors shall maintain all required licenses, certifications, permits, and any other documentation necessary to perform the contract resulting from this procurement solicitation. Contractor must comply with all state and local building code requirements.
- h. **Safety Record of Proposer.** NCISD will consider the safety record of the proposer in determining to whom to award a contract resulting from this procurement solicitation. The safety record shall be defined as a proposer's OSHA (Occupational Safety and Health Administration) inspection logs for the last three years, a loss analysis from the proposer's insurance carrier, and a loss history covering all lines of insurance coverage carried by the proposer. *See* NCISD Policy CVB (Local).

Proposers shall submit with their proposals:

- a. Proposer's OSHA (Occupational Safety and Health Administration) inspection logs for the last three years,
 - b. a loss analysis from the proposer's insurance carrier, and
 - c. a loss history covering all lines of insurance coverage carried by the proposer.
- i. **Conflict of Interest.** NCISD is required to comply with Texas Local Government Code Chapter 176, Disclosure of Certain Relationships with Local Government Officers. House Bill 23 significantly changed Chapter 176 as well as the required disclosures and the corresponding forms. As of September 1, 2015, any company who does business with NCISD or who seeks to do business with NCISD must fill out the new Conflict of Interest Questionnaire (CIQ) whether or not a conflict of interest exists. *See* Attachment D – Proposer Certification Forms.
 - j. **Discrepancies.** Any discrepancies within the Construction Documents, including between the Drawings and Specifications, or errors must be reported to the architect for interpretation. The architect will at all times endeavor to explain and interpret all discrepancies but does not bind itself for any interpretation not in writing. In the event of discrepancies which have not been interpreted in writing or conflicts within the Contract Documents, including drawings and specifications, the Proposer shall consider that the greater value or quantity shall apply and the submitted Competitive Sealed Proposal shall reflect this fact.
 - k. **Materials.** Any reference in the Construction Documents to materials, products, equipment, fixtures, etc., shall not be construed as limiting competition in any manner; however, only the architect/engineer shall have the authority to determine whether a material is equal. No substitution will be allowed unless authorized in writing by the architect or engineer. *See* below section regarding Substitutions.

Where a definite material is specified, it is to set a standard, unless so noted that NO substitution allowed. Manufacturers of products not named in the Construction Documents will be required to show evidence satisfactory to the architect/engineer, that their product is equal in construction, similar in design, and will serve the intended purpose as the item specifically named.

l. Substitutions. The materials, products and equipment described in the Construction Documents establish a standard of required function, dimension, appearance and quality to be met by any proposed substitution. **No substitution will be considered prior to receipt of Proposals unless written request for approval has been received by the Architect at least ten days prior to the date for receipt of Proposals.** Such requests shall include the name of the material or equipment for which it is to be substituted and a complete description of the proposed substitution including drawings, performance and test data, and other information necessary for an evaluation. A statement setting forth changes in other materials, equipment or other portions of the Work, including changes in the work of other contracts that incorporation of the proposed substitution would require, shall be included. The burden of proof of the merit of the proposed substitution is upon the Proposer. The Architect's decision of approval or disapproval of a proposed substitution shall be final. If the Architect approves a proposed substitution prior to receipt of Proposals, such approval will be set forth in an Addendum. Proposer shall not rely upon approvals made in any other manner. No substitutions will be considered after the Contract award unless specifically provided for in the Contract Documents.

m. Appeal/Protest Process. Any Proposer who submitted a proposal may appeal NCISD's award, if the appeal is based on deviations from laws, rules, regulations, or NCISD Board policies. NCISD Board Policy GF (Local) applies to any Proposer wishing to appeal a proposal and/or award of a contract. In accordance with Policy GF (Local), a Proposer shall submit a complaint/appeal form by hand-delivery, fax, or U.S. mail, to NCISD's Executive Director of Operations. Complaints/appeals must be received by the close of business on or before the 15th NCISD business day after award of the contract. In the event Proposer is unsure about the award of the contract, it is the Proposer's responsibility to contact NCISD on the next business day after the award is announced and verify details concerning the award.

8. **Proposal Format**

All proposals must include the following:

1. Title Page
2. Table of Contents
3. Business Identification
4. Compliance with Procurement Documents
5. Evidence to be used for evaluation/selection criteria
6. All required documentation and attachments (see #9, below)

Documentation must be complete.

9. **Required Documentation and Attachments**

The documentation and attachments listed below are required to be included with the proposal. All forms must be completed and signed.

Include the following for the Base Proposal:

1. Proof of Insurance – certificates of insurance of the types and amounts described in this procurement solicitation, including in Exhibit A and in Exhibit A to the AIA Document A101-2017, Insurance and Bonds, as modified by NCISD (enclosed as Exhibit C hereto)
2. Letter of statement from a bonding company that the proposer is eligible to obtain both payment and performance bonds of the types described in this procurement solicitation
3. Proposal security – Proposal security shall be submitted with each proposal in the amount of ten percent (10%) of the proposed amount
4. A list of proposed subcontractors for the Project
 1. Concrete
 2. Masonry

3. Structural Steel
4. Cold-formed Metal Framing & Gypsum Board Assemblies
5. Roofing
6. Hardware
7. Curtainwall & Glazing Systems
8. Fire Suppression
9. Plumbing
10. HVAC
11. Electrical
12. Communications
13. Electronic Access Control System
14. Video Surveillance System
15. Fire Detection and Alarm
16. Earthwork
17. Utilities
18. Tiling/Flooring/Carpet
19. Paint
5. Proof of Proposer's Safety Record – Proposers must submit:
 - a. Proposer's OSHA (Occupational Safety and Health Administration) inspection logs for the last three years,
 - b. a loss analysis from the proposer's insurance carrier, and
 - c. a loss history covering all lines of insurance coverage carried by the proposer.
6. Attachment A – Proposal Form – Base Proposal and Certification of Proposer; Alternate Proposals
7. Attachment B – Proposer Questionnaire and Qualification Statement
8. Attachment C – Proposer Certification Forms
9. Attachment D – Asbestos-Free Materials and Inspection
10. Attachment E – Acknowledgement of Final Completion Documents
11. Attachment F – W-9 Form
12. Attachment G – Criminal History Certification Form

10. Documents to be submitted PRIOR to Proposal

Each Proposer must submit the following items to the office of the Architect no later than 5:00 p.m. on Thursday, May 22, 2025:

- a. A properly executed and current Contractor's Qualification Statement, AIA Document A305, and Contractor's references with the names of contact persons, telephone numbers and email addresses on the form included as **Attachment 1**;
- b. A resume for the Proposer's proposed Project Manager, stating his/her qualifications and experience on projects of similar scope and size; and
- c. A resume for the Proposer's proposed Project Superintendent, stating his/her qualifications and experience on projects of similar scope and size.

Exhibit A – NCISD’s Required Workers’ Compensation Insurance Coverages

NCISD shall use the following language for bid specifications and contracts for building or construction, without any additional words or changes, except those required to accommodate the specific document in which they are contained or to impose stricter standards of documentation.

A copy of a certificate of insurance, a certificate of authority to self-insure issued by the Texas Department of Insurance (TDI), or a coverage agreement (DWC-81, DWC-82, DWC-83, or DWC-84), showing statutory workers’ compensation insurance coverage for the person’s or entity’s employees providing services on a project is required for the duration of the project.

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.

Persons providing services on the project (“subcontractor” in Texas Labor Code 406.096) include 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 contracted directly with the contractor and 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, or employees of any entity that 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 do not include activities unrelated to the project, such as food/beverage vendors, office supply deliveries, and delivery of portable toilets.

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 401.011(44) for all employees of the contractor providing services on the project for the duration of the project.

The contractor must provide a certificate of coverage to the governmental entity prior to being awarded the contract.

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.

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 project, 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.

The contractor shall retain all required certificates of coverage for the duration of the project and for one year thereafter.

The contractor shall notify the governmental entity in writing by certified mail or personal delivery, within ten 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.

The contractor shall post on each project site a notice, in the text, form, and manner prescribed by the TDI, 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 of coverage.

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 meets the statutory requirements of Texas Labor Code 401.011(44) for all of its employees providing services on the project for the duration of the project;
2. Provide to 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, 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.
4. Obtain from each other person with whom it contracts, and provide to the contractor:
 - a. A certificate of coverage, prior to the other person beginning work on the project; and
 - b. 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 ten 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 items 1–6, with the certificates of coverage to be provided to the person for whom they are providing services.

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 TDI's Division of Self-Insurance Regulation. Providing false or misleading information may subject the contractor to administrative penalties, criminal penalties, civil penalties, or other civil actions.

The contractor's failure to comply with any of these provisions is a breach of contract by the contractor that 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.

The coverage requirement recited above does not apply to sole proprietors, partners, and corporate officers who are excluded from coverage in an insurance policy or certificate of authority to self-insure that is delivered, issued for delivery, or renewed on or after January 1, 1996.

Exhibit B – Prevailing Wage Rates

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:
take cognizance of complaints of all violations of this chapter committed in the execution of the contract;
and

- (1) withhold money forfeited or required to be withheld under this chapter from the payments to the contractor under the contract, except that the public body may not withhold money from other than the final payment without a determination by the public body that there is good cause to believe that the contractor has violated this chapter.

Prevailing Wage Rates – School Construction Trades

June 1, 2022 – Texas Gulf Coast Area

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

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

Prevailing Wage Rates – Worker Classification Definition Sheet

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

Exhibit C – AIA Documents A101-2017, Exhibit A to the AIA Document A101-2017, Insurance and Bonds; and A201-2017, all as amended by NCISD

See Separate Exhibit C, attached

Attachment 1 – Contractor References
 Project: New Caney Independent School District's
 New Administration Building
 Project #: 999-2023

General Contractor Name: _____

***Submit with AIA A305 These Projects are to have been completed with-in the last 5 years.**

Project Name:	
Description:	Completion Date:
Contract Amount: \$	Square Footage:
OWNER	ARCHITECT
Contact Name:	Contact Name:
Phone Number:	Phone Number:
Email Address:	Email Address:

Project Name:	
Description:	Completion Date:
Contract Amount: \$	Square Footage:
OWNER	ARCHITECT
Contact Name:	Contact Name:
Phone Number:	Phone Number:
Email Address:	Email Address:

Project Name:	
Description:	Completion Date:
Contract Amount: \$	Square Footage:
OWNER	ARCHITECT
Contact Name:	Contact Name:
Phone Number:	Phone Number:
Email Address:	Email Address:

Project Name:	
Description:	Completion Date:
Contract Amount: \$	Square Footage:
OWNER	ARCHITECT
Contact Name:	Contact Name:
Phone Number:	Phone Number:
Email Address:	Email Address:

Project Name:	
Description:	Completion Date:
Contract Amount: \$	Square Footage:
OWNER	ARCHITECT
Contact Name:	Contact Name:
Phone Number:	Phone Number:
Email Address:	Email Address:

PROPOSAL FORM - ALTERNATE PROPOSALS

PROJECT TITLE: **New Caney Independent School District's- New Administration Building**

Location: 21330 Valley Ranch Pkwy. New Caney, TX. 77357

Name of Proposer/Contractor: _____

Address: _____

Telephone: _____

Fax: _____

E-mail: _____

1a	Alternate No. 1a: Air Cooled Chillers by Daikin	_____ amount written (this governs)	\$ _____
1b	Alternate No. 1b: Air Cooled Chillers by JCI/York	_____ amount written (this governs)	\$ _____
2	Alternate No. 2: Drilled and Under Reamed Footings	_____ amount written (this governs)	\$ _____
	Base Bid Adjustment :	_____ amount written (this governs)	\$ _____

The undersigned hereby proposes to furnish all labor, materials, supervision, and any other services necessary to complete the above-referenced project for the proposal amount(s) listed.

Proposal prices are firm for acceptance by NCISD for 60 days from the date opening of proposals has occurred.

Signed By: _____

Name: _____
(Type or Print)

Title: _____
(Type or Print)

ATTEST: _____
(Secretary, if Proposer is a Corporation)

SEAL:
(If Corporation)

ATTACHMENT A: PROPOSAL FORM – BASE PROPOSAL

PROJECT TITLE: **New Caney Independent School District's- New Administration Building**

Location: 21330 Valley Ranch Pkwy. New Caney, TX. 77357

Name of Proposer/Contractor: _____

Address: _____

Telephone: _____

Fax: _____

E-mail: _____

Receipt of Addenda: _____

Substantial completion for the entire Project shall be: _____ (Proposer to insert date)

	Total Amount Base Proposal:	_____ (amount written) this governs	\$ _____
	Unit Pricing (Site Concrete):	Add/Delete 60" Wide Sidewalks Add/Delete Non-Traffic Concrete Flatwork Add/Delete 6" Concrete Curb Add/Delete 6" Reinforced Concrete Paving Add/Delete 7" Reinforced Concrete Paving	_____ Lin Foot (LF) _____ Sq Foot (SF) _____ Lin Foot (LF) _____ Sq Foot (SF) _____ Sq Foot (SF)

The undersigned hereby proposes to furnish all labor, materials, supervision and any other services necessary to complete the above-referenced project for the proposal amount(s) listed.

Proposal prices are firm for acceptance by NCISD for 60 days from the date opening of proposals has occurred.

Signed By: _____

Name: _____
(Type or Print)

Title: _____
(Type or Print)

ATTEST: _____
(Secretary, if Proposer is a Corporation)

SEAL:
(If Corporation)

CERTIFICATION OF PROPOSER

The undersigned Proposer has carefully examined all instructions, requirements, specifications, terms and conditions of this procurement solicitation and the construction documents and certifies:

1. It is a reputable company regularly engaged in providing construction services necessary to meet the requirements, specifications, terms and conditions of the procurement solicitation.
2. The Proposer has visited the site, become familiar with local conditions under which the Work is to be performed and has correlated the Proposer's personal observations with the requirements of the proposed Contract Documents.
3. It has the necessary experience, knowledge, abilities, skills, and resources to satisfactorily perform the requirements, specifications, terms and conditions of this procurement solicitation. Further, if awarded, the Proposer agrees to perform the requirements, specifications, terms and conditions of this procurement solicitation and to obtain final completion for the entire project on or before October 24, 2026.
4. Proposer proposes to furnish all labor, materials, supervision and any other services necessary to complete the project for the proposal amount(s) listed on Attachment A. The Proposal is based upon the materials, equipment and systems required by the Procurement Documents without exception. The undersigned certifies that the amount(s) contained in Attachment A have been carefully checked and are submitted as correct and final.
5. All statements, information, and representations prepared and submitted in response to this procurement solicitation are current, complete, true, and accurate. Proposer acknowledges that NCISD will rely on such statements, information, and representations in selecting the successful proposer. Proposer shall be bound by all statements, representations, warranties, and guarantees made in its proposal.
6. It is not currently barred or suspended from doing business with the Federal government, any of the members represented, or any of their respective agencies.
7. That all of the requirements of this procurement solicitation and the construction documents have been read and understood, including any amendments/addenda. In addition, compliance with all requirements, terms and conditions will be assumed by NCISD if not otherwise noted in the proposal.
8. The individual signing below has authority to submit this proposal on behalf of Proposer.

PROJECT TITLE:	NCISD – New Administration Building		
PROPOSER NAME:			
AUTHORIZED SIGNATURE:			
PRINT NAME:			
TITLE:			
DATE:			
ADDRESS:			
CITY, STATE, ZIP CODE:			
PHONE:		FAX:	
EMAIL ADDRESS:			
WEBSITE URL:			

ATTACHMENT B – BUSINESS QUESTIONNAIRE & QUALIFICATION STATEMENT

FIRM NAME: _____

CONTACT PERSON'S NAME AND PHONE NUMBER:

Do you or any officer, partner, owner, sales representative, and/or spouse work for New Caney Independent School District? ☐ Yes ☐ No

If yes, please specify: _____

Please indicate how you became aware of this procurement.

Source: _____

I. ORGANIZATION

1. Type of Organization

_____ Individual _____ Sole Proprietorship
_____ Partnership _____ Corporation, Incorporated in _____

2. Federal Employer Identification Number: _____

3. Number of persons currently employed: _____

4. How many years has your organization been in business as a contractor? _____

5. How many years has your organization been in business under its present business name? _____

List any other or former names your organization has operated under:

6. If your organization is a corporation, answer the following:

Date of incorporation: _____

State of incorporation: _____

President's name: _____

Vice-president's name: _____

7. If your organization is a partnership, answer the following:

Date of organization: _____

Type of partnership (if applicable): _____

Names(s) of general partner(s): _____

8. If your organization is individually owned, answer the following:

Date of organization: _____

Name of owner: _____

9. If the form of your organization is other than those listed above, describe it and name the principals/owners: _____

II. LICENSING

1. List the jurisdiction(s) and trade categories in which your organization is legally qualified to do business, and indicate registration or license numbers, if applicable.

2. List the jurisdiction(s) in which your organization's partnership or trade name is filed.

III. EXPERIENCE

1. List the categories of work that your organization normally performs with its own forces.

2. Claims and Suits: (If the answer to any of the questions below is yes, please attach details.)

Has your organization ever failed to complete any work awarded to it?

☐ Yes ☐ No

Are there any judgments, claims, arbitration proceedings or suits pending or outstanding against your organization or its officers? ☐ Yes ☐ No

Has your organization filed any lawsuits or requested arbitration with regard to construction contracts within the last five years? ☐ Yes ☐ No

3. On a separate sheet, list major construction projects your organization has in progress, giving the name of the project, owner, architect, contract amount, percent complete, and scheduled completion date.

Personnel

4. Given the scope and schedule of the Project, identify key personnel who would work on the Project including the Project Manager, Superintendent, and Estimator. Provide a resume and references for each individual, including information on projects they have worked on that are similar to this RFP. What assurances can you provide that these team members will be available for project start?

5. Describe, in detail, the proposed Project assignments and lines of authority and communication for each team member you anticipate to be directly involved in the Project. Indicate the estimated percentage of time these team members will be involved in the Project.
6. Provide a description of your firm's home office location, satellite office locations, number and types of equipment available to support this Project.

IV. FINANCING

Name of Proposer's Financial Institution: _____

Contact Person: _____

Title: _____

1. Attach a financial statement, preferably audited, including your organization's latest balance sheet and income statement showing the following items:
 - a. Current Assets (e.g., cash, joint venture accounts, accounts receivable, notes receivable, accrued income, deposits, materials inventory and prepaid expenses)
 - b. Net Fixed Assets
 - c. Other Assets
 - d. Current Liabilities (e.g., accounts payable, notes payable, accrued expenses, provisions for income taxes, advances, accrued salaries and accrued payroll taxes)
 - e. Other Liabilities (e.g., capital, capital stock, authorized and outstanding shares par values, earned surplus and retained earnings)
2. Name and address of firm/individual preparing attached financial statement, and date thereof:

3. Is the attached financial statement for the identical organization (proposer) named on page one?

☐ Yes ☐ No

If no, explain the relationship and financial responsibility of the organization whose financial statement is provided (e.g., parent-subsiary):

4. Will the organization whose financial statement is attached act as a guarantor of the contract for construction? ☐ Yes ☐ No

ATTACHMENT C – PROPOSER CERTIFICATION FORMS

CERTIFICATION OF RESIDENCY

The State of Texas has a law concerning non-resident vendors. This law can be found in Texas Education Code under Chapter 2252, Subchapter A. This law makes it necessary for NCISD to determine the residency of its Vendors. In part, this law reads as follows:

Section: 2252.001: "Non-resident bidder" refers to a person who is not a resident. "Resident bidder" refers to a person whose principal place of business is in this state, including a vendor 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 non-resident bidder unless the nonresident underbids the lowest bid submitted by a 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."

Company submitting bid is a resident bidder: ☐ Yes ☐ No

City and state of vendor's principal place of business: _____

Contractor's Name/Company Name: _____

Address, City, State, and Zip Code: _____

Phone Number: _____ Fax Number: _____

Printed Name and Title of Authorized Representative: _____

Email Address: _____

Signature of Authorized Representative: _____

Date: _____

CERTIFICATION REGARDING TERRORIST ORGANIZATIONS

Vendor 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.

_____ Initials of Authorized Representative of Vendor

CERTIFICATION REGARDING BOYCOTTING OF ISRAEL

If (a) Vendor is not a sole proprietorship; (b) Vendor has ten (10) or more full-time employees; and (c) this Agreement has a value of \$100,000 or more, the following certification shall apply; otherwise, this certification is not required. Pursuant to Chapter 2270 of the Texas Government Code, the Vendor hereby certifies and verifies that neither the Vendor, nor any affiliate, subsidiary, or parent company of the Vendor, if any (the "Vendor Companies"), boycotts Israel, and the Vendor agrees that the Vendor and Vendor Companies will not boycott Israel during the term of this Agreement. For purposes of this Agreement, the term "boycott" shall mean and include refusing to deal with, terminating business activities with, 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, but does not include an action made for ordinary business purposes.

_____ Initials of Authorized Representative of Vendor, if applicable

CERTIFICATION REGARDING CONTRACTING INFORMATION

If Vendor is not a governmental body and (a) this Agreement has a stated expenditure of at least \$1 million in public funds for the purchase of goods or services by NCISD; or (b) this Agreement results in the expenditure of at least \$1 million in public funds for the purchase of goods or services by NCISD in a fiscal year of NCISD, the following certification shall apply; otherwise, this certification is not required. As required by Tex. Gov't Code § 552.374(b), the following statement is included in the RFP and the Agreement (unless the Agreement is (1) related to the purchase or underwriting of a public security; (2) is or may be used as collateral on a loan; or (3) proceeds from which are used to pay debt service of a public security of loan): "The requirements of Subchapter J, Chapter 552, Government Code, may apply to this RFP and Agreement and the contractor or vendor agrees that the contract can be terminated if the contractor or vendor knowingly or intentionally fails to comply with a requirement of that subchapter." Pursuant to Subchapter J, Chapter 552, Texas Government Code, the Vendor hereby certifies and agrees to (1) preserve all contracting information related to this Agreement as provided by the records retention requirements applicable to NCISD for the duration of the Agreement; (2) promptly provide to NCISD any contracting information related to the Agreement that is in the custody or possession of the Vendor on request of NCISD; and (3) on completion of the Agreement, either (a) provide at no cost to NCISD all contracting information related to the Agreement that is in the custody or possession of Vendor, or (b) preserve the contracting information related to the Agreement as provided by the records retention requirements applicable to NCISD.

_____ Initials of Authorized Representative of Vendor, if applicable

Vendor agrees to comply with all federal, state, and local laws, rules, regulations and ordinances, as applicable. It is further acknowledged that vendor certifies compliance with all provisions, laws, acts, regulations, etc. as specifically noted above.

Vendor's Name/Company Name: _____
Address, City, State, and Zip Code: _____
Phone Number: _____ Fax Number: _____
Printed Name and Title of Authorized Representative: _____
Email Address: _____
Signature of Authorized Representative: _____
Date: _____

NCISD CONFLICT OF INTEREST DISCLOSURE STATEMENT

New Caney Independent School District (NCISD) is required to comply with Texas Local Government Code Chapter 176, Disclosure of Certain Relationships with Local Government Officers. House Bill 23 significantly changed Chapter 176 as well as the required disclosures and the corresponding forms. As of September 1, 2015, any vendor who does business with NCISD or who seeks to do business with NCISD must fill out the new Conflict of Interest Questionnaire (CIQ) whether or not a conflict of interest exists. A conflict of interest exists in the following situations:

- 1) If the vendor has an employment or other business relationship with a local government officer of NCISD or a family member of the officer, as described by section 176.003(a)(2)(A) of the Texas Local Government Code; or
- 2) If the vendor has given a local government officer of NCISD, or a family member of the officer, one or more gifts with the aggregate value of \$100, excluding any gift accepted by the officer or a family member of the officer if the gift is: (a) a political contribution as defined by Title 15 of the Election Code; or (b) a gift of food accepted as a guest; or
- 3) If the vendor has a family relationship with a local government officer of NCISD.

“Vendor” means a person who enters or seeks to enter into a contract with a local governmental entity. The term includes an agent of a vendor. The term includes an officer or employee of a state agency when that individual is acting in a private capacity to enter into a contract. The term does not include a state agency except for Texas Correctional Industries. *Texas Local Government Code 176.001(7).*

“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. *Texas Local Government Code 176.001(3).*

“Family relationship” means a relationship between a person and another person within the third degree by consanguinity or the second degree by affinity, as those terms are defined by Subchapter B, Chapter 573, Government Code. *Texas Local Government Code 176.001(2-a).*

“Local government officer” means: (A) a member of the governing body of a local governmental entity; (B) a director, superintendent, administrator, president, or other person designated as the executive officer of a local governmental entity; or (C) an agent of a local governmental entity who exercises discretion in the planning, recommending, selecting, or contracting of a vendor. *Texas Local Government Code 176.001(4).*

- ***NCISD Board of Trustees and Superintendent include:***

Creg Mixon, President	Dennis Alters
Elizabeth Rhoden Harrell, Vice-President	Ty Trout
Wendy Sharp, Secretary	Beth Whittington
Angela Tompkins, Assistant Secretary	Matt Calvert, Superintendent

- ***Current local government officers include, but are not limited to:***

Blake Carroll	Nicole Land
Scott Castleberry	Loree Munro
Brandy Chelette	Scott Powers
Cesar Condarco	Kristi Shofner
Christie Gates	Richard Ressler

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. In the event of changed circumstances, an updated CIQ must be filed within seven (7) business days after the vendor becomes aware that a conflict of interest exists.

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

FORM CIQ

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

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.

NCISD CERTIFICATE OF INTERESTED PARTIES – FORM 1295

NCISD is required to comply with HB 1295, which amended the Texas Government Code by adding Section 2252.908, Disclosure of Interested Parties. Section 2252.908 applies to a contract of NCISD that (1) requires an action or vote by the NCISD Board of Trustees before the contract may be signed; (2) has a value of at least \$1 million; or (3) is for services that would require a person to register as a lobbyist under Tex. Gov't Code Chapter 305. If applicable, the business entity must submit a Disclosure of Interested Parties (Form 1295) to NCISD at the time business entity submits the signed contract. The Form 1295 requirement does not apply to: (1) a contract with a publicly traded business entity or wholly owned subsidiary of the same; (2) an electric utility; or (3) a gas utility. The Texas Ethics Commission has adopted rules requiring the business entity to file Form 1295 electronically with the Texas Ethics Commission. The following **definitions** apply:

- (1) **“Business Entity”** means an entity recognized by law through which business is conducted, including a sole proprietorship, partnership, or corporation. TEX. GOV'T CODE § 2252.908(1).
- (2) **“Interested Party”** means a person:
 - a) who has a controlling interest in a business entity with whom NCISD 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. TEX. GOV'T CODE § 2252.908(3).
- (3) **“Controlling interest”** means:
 - a) an ownership interest or participating interest in a business entity by virtue of units, percentage, shares, stock, or otherwise that exceeds 10 percent;
 - b) 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
 - c) 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. *Subsection (c) does not apply to an officer of a publicly held business entity or its wholly owned subsidiaries.* TEX. ETHICS COMM. RULE 46.3(c).
- (4) **“Intermediary”** means a person who actively participates in the facilitation of the contract or negotiating the contract, including a broker, adviser, attorney, or representative of or agent for the business entity who:
 - a) receives compensation from the business entity for the person's participation;
 - b) communicates directly with the governmental entity or state agency on behalf of the business entity regarding the contract; and
 - c) is not an employee of the business entity. TEX. ETHICS COMM. RULE 46.3(e).

As a “business entity,” vendors must:

- (1) **complete 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
 - **All vendors must complete Form 1295, even if no interested parties exist**
 - In Section 2, insert “New Caney Independent School District”
 - In Section 3, insert the NCISD CSP # for this proposal
- (2) **print a copy of the completed form** (make sure that it has a computer-generated certification number in the “Office Use Only” box)
- (3) have an authorized agent of the business entity **sign the form**
- (4) **submit** the completed Form 1295 by **attaching the form to your proposal.**

NCISD 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 receipt. After NCISD 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 NCISD.

FELONY CONVICTION NOTICE FORM

FELONY CONVICTION NOTIFICATION

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 an agreement 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 the agreement 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”.

Subsection (c) states “this section does not apply to 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 information furnished is true to the best of my knowledge.

Contractor's Name/Company Name: _____

Authorized Official's Name (Printed or Typed): _____

You must select one and sign below:

- ☐ Firm is a publicly held corporation; therefore the above reporting requirement does not apply per Section 44.034, Texas Education Code, Subsection (c).
- ☐ Contractor/Firm **is not** owned nor operated by anyone who has been convicted of a felony.
- ☐ Contractor/Firm **is** operated or owned by the following individual(s) who has/have been convicted of a felony:

Name of Individual(s): _____

Detail of Conviction(s): _____

(Attach additional pages if necessary.)

Signature of Company Official: _____

Date: _____

CONFIDENTIALITY DECLARATION FORM

INFORMATION SUBMITTED TO NCISD IN CONNECTION WITH THIS PROCUREMENT SOLICITATION OR THE AGREEMENT IS GOVERNED BY TEXAS GOVERNMENT CODE, CHAPTER 552

As a governmental body, NCISD is subject to the Texas Public Information Act found in Chapter 552, Texas Government Code. Proposals and other information submitted to NCISD in connection with this procurement solicitation or the Agreement may be subject to release as public information. If a Vendor believes that part(s) of its proposal or any other information submitted by Vendor to NCISD in connection with this procurement solicitation or the Agreement contain confidential, proprietary, and/or trade secret information or otherwise may be excepted from disclosure under Texas law, the Vendor must clearly and conspicuously mark the applicable information as “CONFIDENTIAL.”

Marking information as “CONFIDENTIAL” does not guarantee that the information will be withheld from disclosure. If NCISD receives a request for public information involving information that Vendor has clearly and conspicuously marked as “CONFIDENTIAL,” NCISD will respond pursuant to Chapter 552, Texas Government Code, which may or may not require that NCISD provide notice of the request to Vendor. Vendor understands and agrees that it is solely responsible for submitting to the Attorney General of Texas each reason why the requested information should be withheld and a letter, memorandum, or brief in support of that reason. NCISD assumes no obligation or responsibility relating to the disclosure or nondisclosure of information submitted by Vendors, and **Vendor hereby waives any claim against and releases from liability NCISD, its respective officers, employees, agents, and attorneys with respect to disclosure of information provided under or in connection with this procurement solicitation or the Agreement or otherwise created, assembled, maintained, or held by Vendor or NCISD and determined by NCISD, the Attorney General of Texas, or a court of law to be subject to disclosure under the Texas Public Information Act.** Further, even if Vendor marks information as “CONFIDENTIAL,” **Vendor expressly agrees that NCISD may disclose Vendor’s proposal, including, but not limited to, pricing information, to other governmental entities.**

Please check **ONLY ONE** of the following options:

Declaration of Confidentiality – Vendor **HAS** clearly and conspicuously marked information contained in its proposal and/or other information submitted by Vendor to NCISD in connection with this procurement solicitation or the Agreement as “CONFIDENTIAL.” Vendor declares that the information marked by Vendor as “CONFIDENTIAL” contains confidential, proprietary, and/or trade secret information and is excepted from disclosure under Chapter 552, Texas Government Code.

Waiver of Confidentiality – Vendor **HAS NOT** marked any information contained in its proposal and/or other information submitted by Vendor to NCISD in connection with this procurement solicitation or the Agreement as “CONFIDENTIAL.” Vendor certifies that it has not submitted any confidential, proprietary, and/or trade secret information to NCISD and that its proposal and all other information—including any pricing information—submitted by Vendor to NCISD in connection with this procurement solicitation or the Agreement is subject to disclosure under Chapter 552, Texas Government Code. Vendor hereby expressly waives any claim of confidentiality with respect to its proposal and/or any other information—including any pricing information—submitted by Vendor to NCISD in connection with this procurement solicitation or the Agreement.

Vendor Name

Printed Name of Authorized Officer/Representative of Vendor

Title

Signature

Date

ATTACHMENT D – ASBESTOS-FREE MATERIALS AND INSPECTION

If awarded the project, the Contractor shall be responsible for ensuring that no asbestos containing building materials are used in the construction. The Contractor shall take whatever measures it deems necessary to ensure that all employees, suppliers, fabricators, and subcontractors, comply with this requirement.

At Final Completion the Contractor shall provide a certification letter certifying that the work does not contain asbestos containing building materials.

I hereby certify that I have read, understood and agree to the terms mentioned in this document.

Signature: _____

Printed Name & Title: _____

Company Name: _____

Date: _____

ATTACHMENT E – ACKNOWLEDGEMENT OF FINAL COMPLETION DOCUMENTS

If awarded this project, the General Contractor shall provide the following items at the project's final completion stage. The retainage shall not be released until all of the items have been fulfilled.

1. Completion of all discrepancies (punch list items) noted at the time of Substantial Completion
2. Submission of record drawings and specifications, and other record documents as required by contract documents.
3. Completion of all Owner training
4. Submission of all contractually-required attic stock and spare parts
5. Submission of all final Operation & Maintenance documents and other closeout deliverables
6. Submission of consent of surety to release retainage and final payment application.
7. Submission and approval of all remaining change order proposals, claims, and applications for payment
8. Payment of all costs incurred for equipment, material, labor and services against the Project
9. Submission of Asbestos Free Materials certification letter and certifications for lead and PCB's.
10. No liens have been attached against the project
11. No suits are pending by reason of Work on the Project Under the Contract for Construction
12. All workers' compensation claims are covered by Workers' Compensation Insurance as required by law
13. All insurance required of the Contractor beyond final payment, if any, is in effect and will not be cancelled or allowed to be expired without notice to the owner
14. All public liability claims are adequately covered by insurance and that the builder shall save, protect, defend, indemnify, and hold the Owner harmless from and against any and all claims which arise as direct or indirect result of any transaction, event occurrence, or omission related to performance of the work completed under said Contract for Construction
15. All Work and Material Warranties Provided.
16. Unconditional Final Payment Release and Waiver Document Provided.
17. All inspections by governmental authorities having jurisdiction over the project must have been finalized and any remedial work required by those authorities must also be completed. .
18. Certificate of Occupancy Provided.

I hereby certify that I have acknowledged and agree to provide the items listed in this document during the final completion stage if I were to be awarded with this project.

Signature: _____

Printed Name & Title: _____

Company Name: _____

Date: _____

ATTACHMENT F – W-9 FORM

Form W-9 (Rev. October 2018) Department of the Treasury Internal Revenue Service	Request for Taxpayer Identification Number and Certification ► Go to www.irs.gov/FormW9 for instructions and the latest information.	Give Form to the requester. Do not send to the IRS.
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Print or type. See Specific Instructions on page 3.	<div style="border-bottom: 1px solid black; padding-bottom: 5px;">1 Name (as shown on your income tax return). Name is required on this line; do not leave this line blank.</div> <div style="border-bottom: 1px solid black; padding-bottom: 5px;">2 Business name/disregarded entity name, if different from above</div> <div style="display: flex; border-bottom: 1px solid black; padding-bottom: 5px;"> <div style="width: 70%;"> <div style="border-bottom: 1px solid black; padding-bottom: 5px;">3 Check appropriate box for federal tax classification of the person whose name is entered on line 1. Check only one of the following seven boxes.</div> <div style="display: flex; justify-content: space-between; font-size: small;"> <div> <input type="checkbox"/> Individual/sole proprietor or single-member LLC <input type="checkbox"/> Limited liability company. Enter the tax classification (C=C corporation, S=S corporation, P=Partnership) ► _____ Note: Check the appropriate box in the line above for the tax classification of the single-member owner. Do not check LLC if the LLC is classified as a single-member LLC that is disregarded from the owner unless the owner of the LLC is another LLC that is not disregarded from the owner for U.S. federal tax purposes. Otherwise, a single-member LLC that is disregarded from the owner should check the appropriate box for the tax classification of its owner. <input type="checkbox"/> Other (see instructions) ► _____ </div> <div> <input type="checkbox"/> C Corporation <input type="checkbox"/> S Corporation <input type="checkbox"/> Partnership <input type="checkbox"/> Trust/estate </div> </div> </div> <div style="width: 30%;"> <div style="border-bottom: 1px solid black; padding-bottom: 5px;">4 Exemptions (codes apply only to certain entities, not individuals; see instructions on page 3):</div> <div style="border-bottom: 1px solid black; padding-bottom: 5px;">Exempt payee code (if any) _____</div> <div style="border-bottom: 1px solid black; padding-bottom: 5px;">Exemption from FATCA reporting code (if any) _____</div> <div style="font-size: x-small;">(Applies to accounts maintained outside the U.S.)</div> </div> </div> <div style="display: flex; border-bottom: 1px solid black; padding-bottom: 5px;"> <div style="width: 60%;">5 Address (number, street, and apt. or suite no.) See instructions.</div> <div style="width: 40%;">Requester's name and address (optional)</div> </div> <div style="border-bottom: 1px solid black; padding-bottom: 5px;">6 City, state, and ZIP code</div> <div style="border-bottom: 1px solid black; padding-bottom: 5px;">7 List account number(s) here (optional)</div>
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Part I Taxpayer Identification Number (TIN)	
Enter your TIN in the appropriate box. The TIN provided must match the name given on line 1 to avoid backup withholding. For individuals, this is generally your social security number (SSN). However, for a resident alien, sole proprietor, or disregarded entity, see the instructions for Part I, later. For other entities, it is your employer identification number (EIN). If you do not have a number, see <i>How to get a TIN</i> , later. Note: If the account is in more than one name, see the instructions for line 1. Also see <i>What Name and Number To Give the Requester</i> for guidelines on whose number to enter.	<div style="border: 1px solid black; padding: 2px;">Social security number</div> <div style="border: 1px solid black; height: 20px; margin: 2px;"></div> <div style="text-align: center; font-size: small;">or</div> <div style="border: 1px solid black; padding: 2px;">Employer identification number</div> <div style="border: 1px solid black; height: 20px; margin: 2px;"></div>

Part II Certification	
Under penalties of perjury, I certify that:	
1. The number shown on this form is my correct taxpayer identification number (or I am waiting for a number to be issued to me); and 2. I am not subject to backup withholding because: (a) I am exempt from backup withholding, or (b) I have not been notified by the Internal Revenue Service (IRS) that I am subject to backup withholding as a result of a failure to report all interest or dividends, or (c) the IRS has notified me that I am no longer subject to backup withholding; and 3. I am a U.S. citizen or other U.S. person (defined below); and 4. The FATCA code(s) entered on this form (if any) indicating that I am exempt from FATCA reporting is correct.	
Certification instructions. You must cross out item 2 above if you have been notified by the IRS that you are currently subject to backup withholding because you have failed to report all interest and dividends on your tax return. For real estate transactions, item 2 does not apply. For mortgage interest paid, acquisition or abandonment of secured property, cancellation of debt, contributions to an individual retirement arrangement (IRA), and generally, payments other than interest and dividends, you are not required to sign the certification, but you must provide your correct TIN. See the instructions for Part II, later.	
Sign Here	<div style="border-bottom: 1px solid black; width: 100%;">Signature of U.S. person ►</div> <div style="border-bottom: 1px solid black; width: 100%;">Date ►</div>

General Instructions Section references are to the Internal Revenue Code unless otherwise noted. Future developments. For the latest information about developments related to Form W-9 and its instructions, such as legislation enacted after they were published, go to www.irs.gov/FormW9 . Purpose of Form An individual or entity (Form W-9 requester) who is required to file an information return with the IRS must obtain your correct taxpayer identification number (TIN) which may be your social security number (SSN), individual taxpayer identification number (ITIN), adoption taxpayer identification number (ATIN), or employer identification number (EIN), to report on an information return the amount paid to you, or other amount reportable on an information return. Examples of information returns include, but are not limited to, the following.	<ul style="list-style-type: none"> Form 1099-DIV (dividends, including those from stocks or mutual funds) Form 1099-MISC (various types of income, prizes, awards, or gross proceeds) Form 1099-B (stock or mutual fund sales and certain other transactions by brokers) Form 1099-S (proceeds from real estate transactions) Form 1099-K (merchant card and third party network transactions) Form 1098 (home mortgage interest), 1098-E (student loan interest), 1098-T (tuition) Form 1099-C (canceled debt) Form 1099-A (acquisition or abandonment of secured property) <p>Use Form W-9 only if you are a U.S. person (including a resident alien), to provide your correct TIN.</p> <p><i>If you do not return Form W-9 to the requester with a TIN, you might be subject to backup withholding. See What is backup withholding, later.</i></p>
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By signing the filled-out form, you:

1. Certify that the TIN you are giving is correct (or you are waiting for a number to be issued),
2. Certify that you are not subject to backup withholding, or
3. Claim exemption from backup withholding if you are a U.S. exempt payee. If applicable, you are also certifying that as a U.S. person, your allocable share of any partnership income from a U.S. trade or business is not subject to the withholding tax on foreign partners' share of effectively connected income, and
4. Certify that FATCA code(s) entered on this form (if any) indicating that you are exempt from the FATCA reporting, is correct. See *What is FATCA reporting*, later, for further information.

Note: If you are a U.S. person and a requester gives you a form other than Form W-9 to request your TIN, you must use the requester's form if it is substantially similar to this Form W-9.

Definition of a U.S. person. For federal tax purposes, you are considered a U.S. person if you are:

- An individual who is a U.S. citizen or U.S. resident alien;
- A partnership, corporation, company, or association created or organized in the United States or under the laws of the United States;
- An estate (other than a foreign estate); or
- A domestic trust (as defined in Regulations section 301.7701-7).

Special rules for partnerships. Partnerships that conduct a trade or business in the United States are generally required to pay a withholding tax under section 1446 on any foreign partners' share of effectively connected taxable income from such business. Further, in certain cases where a Form W-9 has not been received, the rules under section 1446 require a partnership to presume that a partner is a foreign person, and pay the section 1446 withholding tax. Therefore, if you are a U.S. person that is a partner in a partnership conducting a trade or business in the United States, provide Form W-9 to the partnership to establish your U.S. status and avoid section 1446 withholding on your share of partnership income.

In the cases below, the following person must give Form W-9 to the partnership for purposes of establishing its U.S. status and avoiding withholding on its allocable share of net income from the partnership conducting a trade or business in the United States.

- In the case of a disregarded entity with a U.S. owner, the U.S. owner of the disregarded entity and not the entity;
- In the case of a grantor trust with a U.S. grantor or other U.S. owner, generally, the U.S. grantor or other U.S. owner of the grantor trust and not the trust; and
- In the case of a U.S. trust (other than a grantor trust), the U.S. trust (other than a grantor trust) and not the beneficiaries of the trust.

Foreign person. If you are a foreign person or the U.S. branch of a foreign bank that has elected to be treated as a U.S. person, do not use Form W-9. Instead, use the appropriate Form W-8 or Form 8233 (see Pub. 515, Withholding of Tax on Nonresident Aliens and Foreign Entities).

Nonresident alien who becomes a resident alien. Generally, only a nonresident alien individual may use the terms of a tax treaty to reduce or eliminate U.S. tax on certain types of income. However, most tax treaties contain a provision known as a "saving clause." Exceptions specified in the saving clause may permit an exemption from tax to continue for certain types of income even after the payee has otherwise become a U.S. resident alien for tax purposes.

If you are a U.S. resident alien who is relying on an exception contained in the saving clause of a tax treaty to claim an exemption from U.S. tax on certain types of income, you must attach a statement to Form W-9 that specifies the following five items.

1. The treaty country. Generally, this must be the same treaty under which you claimed exemption from tax as a nonresident alien.
2. The treaty article addressing the income.
3. The article number (or location) in the tax treaty that contains the saving clause and its exceptions.
4. The type and amount of income that qualifies for the exemption from tax.
5. Sufficient facts to justify the exemption from tax under the terms of the treaty article.

Example. Article 20 of the U.S.-China income tax treaty allows an exemption from tax for scholarship income received by a Chinese student temporarily present in the United States. Under U.S. law, this student will become a resident alien for tax purposes if his or her stay in the United States exceeds 5 calendar years. However, paragraph 2 of the first Protocol to the U.S.-China treaty (dated April 30, 1984) allows the provisions of Article 20 to continue to apply even after the Chinese student becomes a resident alien of the United States. A Chinese student who qualifies for this exception (under paragraph 2 of the first protocol) and is relying on this exception to claim an exemption from tax on his or her scholarship or fellowship income would attach to Form W-9 a statement that includes the information described above to support that exemption.

If you are a nonresident alien or a foreign entity, give the requester the appropriate completed Form W-8 or Form 8233.

Backup Withholding

What is backup withholding? Persons making certain payments to you must under certain conditions withhold and pay to the IRS 24% of such payments. This is called "backup withholding." Payments that may be subject to backup withholding include interest, tax-exempt interest, dividends, broker and barter exchange transactions, rents, royalties, nonemployee pay, payments made in settlement of payment card and third party network transactions, and certain payments from fishing boat operators. Real estate transactions are not subject to backup withholding.

You will not be subject to backup withholding on payments you receive if you give the requester your correct TIN, make the proper certifications, and report all your taxable interest and dividends on your tax return.

Payments you receive will be subject to backup withholding if:

1. You do not furnish your TIN to the requester,
2. You do not certify your TIN when required (see the instructions for Part II for details),
3. The IRS tells the requester that you furnished an incorrect TIN,
4. The IRS tells you that you are subject to backup withholding because you did not report all your interest and dividends on your tax return (for reportable interest and dividends only), or
5. You do not certify to the requester that you are not subject to backup withholding under 4 above (for reportable interest and dividend accounts opened after 1983 only).

Certain payees and payments are exempt from backup withholding. See *Exempt payee code*, later, and the separate Instructions for the Requester of Form W-9 for more information.

Also see *Special rules for partnerships*, earlier.

What is FATCA Reporting?

The Foreign Account Tax Compliance Act (FATCA) requires a participating foreign financial institution to report all United States account holders that are specified United States persons. Certain payees are exempt from FATCA reporting. See *Exemption from FATCA reporting code*, later, and the Instructions for the Requester of Form W-9 for more information.

Updating Your Information

You must provide updated information to any person to whom you claimed to be an exempt payee if you are no longer an exempt payee and anticipate receiving reportable payments in the future from this person. For example, you may need to provide updated information if you are a C corporation that elects to be an S corporation, or if you no longer are tax exempt. In addition, you must furnish a new Form W-9 if the name or TIN changes for the account; for example, if the grantor of a grantor trust dies.

Penalties

Failure to furnish TIN. If you fail to furnish your correct TIN to a requester, you are subject to a penalty of \$50 for each such failure unless your failure is due to reasonable cause and not to willful neglect.

Civil penalty for false information with respect to withholding. If you make a false statement with no reasonable basis that results in no backup withholding, you are subject to a \$500 penalty.

Criminal penalty for falsifying information. Willfully falsifying certifications or affirmations may subject you to criminal penalties including fines and/or imprisonment.

Misuse of TINs. If the requester discloses or uses TINs in violation of federal law, the requester may be subject to civil and criminal penalties.

Specific Instructions

Line 1

You must enter one of the following on this line; **do not** leave this line blank. The name should match the name on your tax return.

If this Form W-9 is for a joint account (other than an account maintained by a foreign financial institution (FFI)), list first, and then circle, the name of the person or entity whose number you entered in Part I of Form W-9. If you are providing Form W-9 to document a joint account, each holder of the account that is a U.S. person must provide a Form W-9.

a. **Individual.** Generally, enter the name shown on your tax return. If you have changed your last name without informing the Social Security Administration (SSA) of the name change, enter your first name, the last name as shown on your social security card, and your new last name.

Note: ITIN applicant: Enter your individual name as it was entered on your Form W-7 application, line 1a. This should also be the same as the name you entered on the Form 1040/1040A/1040EZ you filed with your application.

b. **Sole proprietor or single-member LLC.** Enter your individual name as shown on your 1040/1040A/1040EZ on line 1. You may enter your business, trade, or "doing business as" (DBA) name on line 2.

c. **Partnership, LLC that is not a single-member LLC, C corporation, or S corporation.** Enter the entity's name as shown on the entity's tax return on line 1 and any business, trade, or DBA name on line 2.

d. **Other entities.** Enter your name as shown on required U.S. federal tax documents on line 1. This name should match the name shown on the charter or other legal document creating the entity. You may enter any business, trade, or DBA name on line 2.

e. **Disregarded entity.** For U.S. federal tax purposes, an entity that is disregarded as an entity separate from its owner is treated as a "disregarded entity." See Regulations section 301.7701-2(c)(2)(iii). Enter the owner's name on line 1. The name of the entity entered on line 1 should never be a disregarded entity. The name on line 1 should be the name shown on the income tax return on which the income should be reported. For example, if a foreign LLC that is treated as a disregarded entity for U.S. federal tax purposes has a single owner that is a U.S. person, the U.S. owner's name is required to be provided on line 1. If the direct owner of the entity is also a disregarded entity, enter the first owner that is not disregarded for federal tax purposes. Enter the disregarded entity's name on line 2, "Business name/disregarded entity name." If the owner of the disregarded entity is a foreign person, the owner must complete an appropriate Form W-8 instead of a Form W-9. This is the case even if the foreign person has a U.S. TIN.

Line 2

If you have a business name, trade name, DBA name, or disregarded entity name, you may enter it on line 2.

Line 3

Check the appropriate box on line 3 for the U.S. federal tax classification of the person whose name is entered on line 1. Check only one box on line 3.

IF the entity/person on line 1 is a(n) . . .	THEN check the box for . . .
• Corporation	Corporation
• Individual • Sole proprietorship, or • Single-member limited liability company (LLC) owned by an individual and disregarded for U.S. federal tax purposes.	Individual/sole proprietor or single-member LLC
• LLC treated as a partnership for U.S. federal tax purposes, • LLC that has filed Form 8832 or 2553 to be taxed as a corporation, or • LLC that is disregarded as an entity separate from its owner but the owner is another LLC that is not disregarded for U.S. federal tax purposes.	Limited liability company and enter the appropriate tax classification. (P= Partnership; C= C corporation; or S= S corporation)
• Partnership	Partnership
• Trust/estate	Trust/estate

Line 4, Exemptions

If you are exempt from backup withholding and/or FATCA reporting, enter in the appropriate space on line 4 any code(s) that may apply to you.

Exempt payee code.

- Generally, individuals (including sole proprietors) are not exempt from backup withholding.
- Except as provided below, corporations are exempt from backup withholding for certain payments, including interest and dividends.
- Corporations are not exempt from backup withholding for payments made in settlement of payment card or third party network transactions.
- Corporations are not exempt from backup withholding with respect to attorneys' fees or gross proceeds paid to attorneys, and corporations that provide medical or health care services are not exempt with respect to payments reportable on Form 1099-MISC.

The following codes identify payees that are exempt from backup withholding. Enter the appropriate code in the space in line 4.

- 1—An organization exempt from tax under section 501(a), any IRA, or a custodial account under section 403(b)(7) if the account satisfies the requirements of section 401(f)(2)
- 2—The United States or any of its agencies or instrumentalities
- 3—A state, the District of Columbia, a U.S. commonwealth or possession, or any of their political subdivisions or instrumentalities
- 4—A foreign government or any of its political subdivisions, agencies, or instrumentalities
- 5—A corporation
- 6—A dealer in securities or commodities required to register in the United States, the District of Columbia, or a U.S. commonwealth or possession
- 7—A futures commission merchant registered with the Commodity Futures Trading Commission
- 8—A real estate investment trust
- 9—An entity registered at all times during the tax year under the Investment Company Act of 1940
- 10—A common trust fund operated by a bank under section 584(a)
- 11—A financial institution
- 12—A middleman known in the investment community as a nominee or custodian
- 13—A trust exempt from tax under section 664 or described in section 4947

The following chart shows types of payments that may be exempt from backup withholding. The chart applies to the exempt payees listed above, 1 through 13.

IF the payment is for . . .	THEN the payment is exempt for . . .
Interest and dividend payments	All exempt payees except for 7
Broker transactions	Exempt payees 1 through 4 and 6 through 11 and all C corporations. S corporations must not enter an exempt payee code because they are exempt only for sales of noncovered securities acquired prior to 2012.
Barter exchange transactions and patronage dividends	Exempt payees 1 through 4
Payments over \$600 required to be reported and direct sales over \$5,000 ¹	Generally, exempt payees 1 through 5 ²
Payments made in settlement of payment card or third party network transactions	Exempt payees 1 through 4

¹ See Form 1099-MISC, Miscellaneous Income, and its instructions.

² However, the following payments made to a corporation and reportable on Form 1099-MISC are not exempt from backup withholding: medical and health care payments, attorneys' fees, gross proceeds paid to an attorney reportable under section 6045(f), and payments for services paid by a federal executive agency.

Exemption from FATCA reporting code. The following codes identify payees that are exempt from reporting under FATCA. These codes apply to persons submitting this form for accounts maintained outside of the United States by certain foreign financial institutions. Therefore, if you are only submitting this form for an account you hold in the United States, you may leave this field blank. Consult with the person requesting this form if you are uncertain if the financial institution is subject to these requirements. A requester may indicate that a code is not required by providing you with a Form W-9 with "Not Applicable" (or any similar indication) written or printed on the line for a FATCA exemption code.

A—An organization exempt from tax under section 501(a) or any individual retirement plan as defined in section 7701(a)(37)

B—The United States or any of its agencies or instrumentalities

C—A state, the District of Columbia, a U.S. commonwealth or possession, or any of their political subdivisions or instrumentalities

D—A corporation the stock of which is regularly traded on one or more established securities markets, as described in Regulations section 1.1472-1(c)(1)(i)

E—A corporation that is a member of the same expanded affiliated group as a corporation described in Regulations section 1.1472-1(c)(1)(i)

F—A dealer in securities, commodities, or derivative financial instruments (including notional principal contracts, futures, forwards, and options) that is registered as such under the laws of the United States or any state

G—A real estate investment trust

H—A regulated investment company as defined in section 851 or an entity registered at all times during the tax year under the Investment Company Act of 1940

I—A common trust fund as defined in section 584(a)

J—A bank as defined in section 581

K—A broker

L—A trust exempt from tax under section 664 or described in section 4947(a)(1)

M—A tax exempt trust under a section 403(b) plan or section 457(g) plan

Note: You may wish to consult with the financial institution requesting this form to determine whether the FATCA code and/or exempt payee code should be completed.

Line 5

Enter your address (number, street, and apartment or suite number). This is where the requester of this Form W-9 will mail your information returns. If this address differs from the one the requester already has on file, write NEW at the top. If a new address is provided, there is still a chance the old address will be used until the payor changes your address in their records.

Line 6

Enter your city, state, and ZIP code.

Part I. Taxpayer Identification Number (TIN)

Enter your TIN in the appropriate box. If you are a resident alien and you do not have and are not eligible to get an SSN, your TIN is your IRS individual taxpayer identification number (ITIN). Enter it in the social security number box. If you do not have an ITIN, see *How to get a TIN* below.

If you are a sole proprietor and you have an EIN, you may enter either your SSN or EIN.

If you are a single-member LLC that is disregarded as an entity separate from its owner, enter the owner's SSN (or EIN, if the owner has one). Do not enter the disregarded entity's EIN. If the LLC is classified as a corporation or partnership, enter the entity's EIN.

Note: See *What Name and Number To Give the Requester*, later, for further clarification of name and TIN combinations.

How to get a TIN. If you do not have a TIN, apply for one immediately. To apply for an SSN, get Form SS-5, Application for a Social Security Card, from your local SSA office or get this form online at www.SSA.gov. You may also get this form by calling 1-800-772-1213. Use Form W-7, Application for IRS Individual Taxpayer Identification Number, to apply for an ITIN, or Form SS-4, Application for Employer Identification Number, to apply for an EIN. You can apply for an EIN online by accessing the IRS website at www.irs.gov/Businesses and clicking on Employer Identification Number (EIN) under Starting a Business. Go to www.irs.gov/Forms to view, download, or print Form W-7 and/or Form SS-4. Or, you can go to www.irs.gov/OrderForms to place an order and have Form W-7 and/or SS-4 mailed to you within 10 business days.

If you are asked to complete Form W-9 but do not have a TIN, apply for a TIN and write "Applied For" in the space for the TIN, sign and date the form, and give it to the requester. For interest and dividend payments, and certain payments made with respect to readily tradable instruments, generally you will have 60 days to get a TIN and give it to the requester before you are subject to backup withholding on payments. The 60-day rule does not apply to other types of payments. You will be subject to backup withholding on all such payments until you provide your TIN to the requester.

Note: Entering "Applied For" means that you have already applied for a TIN or that you intend to apply for one soon.

Caution: A disregarded U.S. entity that has a foreign owner must use the appropriate Form W-8.

Part II. Certification

To establish to the withholding agent that you are a U.S. person, or resident alien, sign Form W-9. You may be requested to sign by the withholding agent even if item 1, 4, or 5 below indicates otherwise.

For a joint account, only the person whose TIN is shown in Part I should sign (when required). In the case of a disregarded entity, the person identified on line 1 must sign. Exempt payees, see *Exempt payee code*, earlier.

Signature requirements. Complete the certification as indicated in items 1 through 5 below.

1. Interest, dividend, and barter exchange accounts opened before 1984 and broker accounts considered active during 1983. You must give your correct TIN, but you do not have to sign the certification.

2. Interest, dividend, broker, and barter exchange accounts opened after 1983 and broker accounts considered inactive during 1983. You must sign the certification or backup withholding will apply. If you are subject to backup withholding and you are merely providing your correct TIN to the requester, you must cross out item 2 in the certification before signing the form.

3. Real estate transactions. You must sign the certification. You may cross out item 2 of the certification.

4. Other payments. You must give your correct TIN, but you do not have to sign the certification unless you have been notified that you have previously given an incorrect TIN. "Other payments" include payments made in the course of the requester's trade or business for rents, royalties, goods (other than bills for merchandise), medical and health care services (including payments to corporations), payments to a nonemployee for services, payments made in settlement of payment card and third party network transactions, payments to certain fishing boat crew members and fishermen, and gross proceeds paid to attorneys (including payments to corporations).

5. Mortgage interest paid by you, acquisition or abandonment of secured property, cancellation of debt, qualified tuition program payments (under section 529), ABLE accounts (under section 529A), IRA, Coverdell ESA, Archer MSA or HSA contributions or distributions, and pension distributions. You must give your correct TIN, but you do not have to sign the certification.

What Name and Number To Give the Requester

For this type of account:	Give name and SSN of:
1. Individual	The individual
2. Two or more individuals (joint account) other than an account maintained by an FFI	The actual owner of the account or, if combined funds, the first individual on the account ¹
3. Two or more U.S. persons (joint account maintained by an FFI)	Each holder of the account
4. Custodial account of a minor (Uniform Gift to Minors Act)	The minor ²
5. a. The usual revocable savings trust (grantor is also trustee)	The grantor-trustee ¹
b. So-called trust account that is not a legal or valid trust under state law	The actual owner ¹
6. Sole proprietorship or disregarded entity owned by an individual	The owner ³
7. Grantor trust filing under Optional Form 1099 Filing Method 1 (see Regulations section 1.671-4(b)(2)(i)(A))	The grantor*
For this type of account:	Give name and EIN of:
8. Disregarded entity not owned by an individual	The owner
9. A valid trust, estate, or pension trust	Legal entity ⁴
10. Corporation or LLC electing corporate status on Form 8832 or Form 2553	The corporation
11. Association, club, religious, charitable, educational, or other tax-exempt organization	The organization
12. Partnership or multi-member LLC	The partnership
13. A broker or registered nominee	The broker or nominee

For this type of account:	Give name and EIN of:
14. Account with the Department of Agriculture in the name of a public entity (such as a state or local government, school district, or prison) that receives agricultural program payments	The public entity
15. Grantor trust filing under the Form 1041 Filing Method or the Optional Form 1099 Filing Method 2 (see Regulations section 1.671-4(b)(2)(i)(B))	The trust

¹ List first and circle the name of the person whose number you furnish. If only one person on a joint account has an SSN, that person's number must be furnished.

² Circle the minor's name and furnish the minor's SSN.

³ You must show your individual name and you may also enter your business or DBA name on the "Business name/disregarded entity" name line. You may use either your SSN or EIN (if you have one), but the IRS encourages you to use your SSN.

⁴ List first and circle the name of the trust, estate, or pension trust. (Do not furnish the TIN of the personal representative or trustee unless the legal entity itself is not designated in the account title.) Also see *Special rules for partnerships*, earlier.

***Note:** The grantor also must provide a Form W-9 to trustee of trust.

Note: If no name is circled when more than one name is listed, the number will be considered to be that of the first name listed.

Secure Your Tax Records From Identity Theft

Identity theft occurs when someone uses your personal information such as your name, SSN, or other identifying information, without your permission, to commit fraud or other crimes. An identity thief may use your SSN to get a job or may file a tax return using your SSN to receive a refund.

To reduce your risk:

- Protect your SSN,
- Ensure your employer is protecting your SSN, and
- Be careful when choosing a tax preparer.

If your tax records are affected by identity theft and you receive a notice from the IRS, respond right away to the name and phone number printed on the IRS notice or letter.

If your tax records are not currently affected by identity theft but you think you are at risk due to a lost or stolen purse or wallet, questionable credit card activity or credit report, contact the IRS Identity Theft Hotline at 1-800-908-4490 or submit Form 14039.

For more information, see Pub. 5027, Identity Theft Information for Taxpayers.

Victims of identity theft who are experiencing economic harm or a systemic problem, or are seeking help in resolving tax problems that have not been resolved through normal channels, may be eligible for Taxpayer Advocate Service (TAS) assistance. You can reach TAS by calling the TAS toll-free case intake line at 1-877-777-4778 or TTY/TDD 1-800-829-4059.

Protect yourself from suspicious emails or phishing schemes.

Phishing is the creation and use of email and websites designed to mimic legitimate business emails and websites. The most common act is sending an email to a user falsely claiming to be an established legitimate enterprise in an attempt to scam the user into surrendering private information that will be used for identity theft.

The IRS does not initiate contacts with taxpayers via emails. Also, the IRS does not request personal detailed information through email or ask taxpayers for the PIN numbers, passwords, or similar secret access information for their credit card, bank, or other financial accounts.

If you receive an unsolicited email claiming to be from the IRS, forward this message to phishing@irs.gov. You may also report misuse of the IRS name, logo, or other IRS property to the Treasury Inspector General for Tax Administration (TIGTA) at 1-800-366-4484. You can forward suspicious emails to the Federal Trade Commission at spam@uce.gov or report them at www.ftc.gov/complaint. You can contact the FTC at www.ftc.gov/idtheft or 877-IDTHEFT (877-438-4338). If you have been the victim of identity theft, see www.IdentityTheft.gov and Pub. 5027.

Visit www.irs.gov/IdentityTheft to learn more about identity theft and how to reduce your risk.

Privacy Act Notice

Section 6109 of the Internal Revenue Code requires you to provide your correct TIN to persons (including federal agencies) who are required to file information returns with the IRS to report interest, dividends, or certain other income paid to you; mortgage interest you paid; the acquisition or abandonment of secured property; the cancellation of debt; or contributions you made to an IRA, Archer MSA, or HSA. The person collecting this form uses the information on the form to file information returns with the IRS, reporting the above information. Routine uses of this information include giving it to the Department of Justice for civil and criminal litigation and to cities, states, the District of Columbia, and U.S. commonwealths and possessions for use in administering their laws. The information also may be disclosed to other countries under a treaty, to federal and state agencies to enforce civil and criminal laws, or to federal law enforcement and intelligence agencies to combat terrorism. You must provide your TIN whether or not you are required to file a tax return. Under section 3406, payers must generally withhold a percentage of taxable interest, dividend, and certain other payments to a payee who does not give a TIN to the payer. Certain penalties may also apply for providing false or fraudulent information.

Ch. 22 Criminal History Records Contractor Certification: Contractor/Subcontractor Employees

Background: Texas Education Code Chapter 22 requires that criminal history records be obtained regarding covered employees of entities that contract with a school district to provide services to the school district (“Contractors”) and entities that contract with school district contractors (“Subcontractors”). Covered employees with disqualifying criminal histories are prohibited from serving at a school district. Contractors/Subcontractors shall (1) complete this form certifying compliance with the requirements of Texas Education Code Chapter 22 to NCISD; and (2) require that each of their subcontractors complies with the requirements of Texas Education Code Chapter 22.

Criminal history records will be obtained by either the Contractor/Subcontractor or NCISD, as follows:

- (1) **Contractor/Subcontractor:** The only Contractors/Subcontractors who will be granted access to obtain criminal history record information are those “qualified school contractors” that (1) contract or subcontract to provide services to NCISD; and (2) are determined eligible by the Texas Department of Public Safety (DPS) to obtain criminal history record information under the National Child Protection Act of 1993 (34 U.S.C. § 40101 *et seq.*) (NCPA), specifically, those contractors/subcontractors who provide “care or care placement services” and are based in Texas, for an employee, applicant for employment, or volunteer of the “qualified school contractor.” All “qualified school contractors” are required to obtain their covered employees’ criminal histories, certify compliance to NCISD, and obtain similar certifications from their subcontractors. Before or immediately after employing or securing the services of a person who is a “covered employee” (as defined below) the Contractor/Subcontractor shall send or ensure that the employee sends to DPS all information that is required by DPS for obtaining the person’s national criminal history record information, which may include (but is not limited to) a complete set of the person’s fingerprints and a recent electronic digital image photograph of the person, as required by DPS. DPS shall obtain the person’s national criminal history record information and report the results through the criminal history clearinghouse as provided by Texas Government Code 411.0845. For more information or to set up an account, Contractor/Subcontractor should contact the Texas Department of Public Safety’s Crime Records Service at 512.424.2474. Contractor/Subcontractor shall obtain all criminal history record information that relates to all covered employees through the criminal history clearinghouse as provided by Texas Government Code 411.0845. In addition, Contractor/Subcontractor shall require that each of its subcontracting entities obtains all criminal history record information that relates to its covered employees, if the subcontracting entity is also a “qualified school contractor.” Contractor/Subcontractor shall: (1) provide NCISD with a fitness determination (as set forth below) as to each covered employee, based on all criminal history record information obtained; and (2) certify to NCISD that Contractor/Subcontractor has received all criminal history record information relating to a person who is employed by or under a current offer of employment by Contractor/Subcontractor.
- (2) **NCISD:** All Contractors/Subcontractors who are not “qualified school contractors” (in other words, all Contractors/Subcontractors who do not provide “care or care placement services” or are not based in Texas) are required to follow the instructions listed below, so that NCISD may obtain their covered employees’ criminal history record information, as applicable. Contractor/Subcontractor shall also require that any of its subcontracting entities that are not “qualified school contractors” follow the instructions listed below, so that NCISD may obtain their covered employees’ criminal history record information. **Contractor/Subcontractor is responsible for the payment of all fingerprinting costs. Should NCISD pay any costs of fingerprinting Contractor/Subcontractor employees, Contractor agrees to reimburse NCISD for such costs; in the event Contractor fails to reimburse NCISD for the costs of fingerprinting Contractor/Subcontractor employees,**

Contractor agrees that NCISD may deduct such costs from any payment due and owing by NCISD to Contractor.

Definitions:

- Covered employees: Employees of a Contractor/Subcontractor who have or will have continuing duties related to the service to be performed at a school district and have or will have direct contact with students. NCISD will be the final arbiter of what constitutes *continuing duties* and *direct contact* with students.
- Continuing duties related to contracted services: Work duties that are performed pursuant to a contract to provide services to a school entity on a regular, repeated basis rather than infrequently or one-time only. *See* 19 Tex. Admin. Code §153.1101(2).
- Direct contact with students: 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. 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. 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. *See* 19 Tex. Admin. Code § 153.1101(7).
- Public Works Contractor: An entity that contracts directly or subcontracts with an entity that contracts with a school district to provide construction services to the school district.
- Exception for Certain Public Works Contractors' Employees and Applicants: The criminal history record information requirements outlined above do not apply to an employee or applicant for employment of a public works contractor (as defined above) if: (1) the public work does not involve the construction, alteration, or repair of an instructional facility as defined by Texas Education Code Section 46.001; (2) the employee's duties will be completed not later than the seventh (7th) day before a new instructional facility will be used for instruction; or (3) for an existing instructional facility, the work area contains sanitary facilities and is separated from all areas used by students by a secure barrier fence at least six (6) feet high, and the Contractor adopts, informs employees of, and enforces a policy prohibiting employees and any subcontractor's employees from interacting with students or entering areas used by students.

Disqualifying criminal history:

- (1) a conviction or other criminal history information designated by NCISD; or (2) a felony or misdemeanor offense that would prevent a person from being employed under Texas Education Code § 22.085(a), that is: (a) conviction of a felony offense under Title 5, Texas Penal Code if at the time of the offense, the victim was under 18; (b) conviction of or placement on deferred adjudication community supervision for an offense for which a defendant is required to register as a sex offender under Chapter 62, Texas Code of Criminal Procedure; or (c) conviction of an offense under federal law or the laws of another state that is equivalent to (a) or (b).

Types of Criminal History Record Information:

- National criminal history record information from the Texas Department of Public Safety criminal

history clearinghouse. NCISD and/or Contractor/Subcontractor may obtain from any law enforcement or criminal justice agency all criminal history record information that relates to a covered employee.

On behalf of __ (“Contractor/Subcontractor”), I, the undersigned authorized signatory for Contractor/Subcontractor, certify to New Caney Independent School District (“NCISD”) (and, in the case of a Subcontractor, certify to Contractor and NCISD) that [**check one**]:

☐ **OPTION A: Contractor/Subcontractor certifies that none of the employees of Contractor/Subcontractor are covered employees, as defined above.** For each covered employee who is employed by or under a current offer of employment by Contractor/Subcontractor, Contractor/Subcontractor certifies to NCISD that it will timely complete the “Contractor Criminal History Background Check Certification” form and submit such to NCISD. If this box is checked, I further certify that Contractor/Subcontractor has taken precautions or imposed conditions to ensure that its employees will not become *covered employees*. Contractor/Subcontractor will ensure that these precautions or conditions continue to exist throughout the time that the contracted services are provided. If NCISD, in its sole discretion, determines that employees of Contractor/Subcontractor are *covered employees*, as defined above, Contractor/Subcontractor will provide NCISD with the name, date of birth, and any other requested information of such covered employees so that NCISD may obtain criminal history record information on the covered employees, upon request by NCISD.

Or

☐ **OPTION B: Contractor/Subcontractor certifies that some or all of the employees of Contractor/Subcontractor are covered employees, but the criminal history record information requirements do not apply to its employees or applicants for employment because:**

- (1) Contractor/Subcontractor is a public works contractor (an entity that contracts directly or subcontracts with an entity that contracts with a school district to provide construction services to the school district); **and**
- (2) the public work does not involve the construction, alteration, or repair of an instructional facility as defined by Texas Education Code Section 46.001; the employee’s duties will be completed not later than the seventh (7th) day before a new instructional facility will be used for instruction; **or** for an existing instructional facility, the work area contains sanitary facilities and is separated from all areas used by students by a secure barrier fence at least six (6) feet high, and the Contractor adopts, informs employees of, and enforces a policy prohibiting employees and any subcontractor’s employees from interacting with students or entering areas used by students.

If this option is selected, Contractor/Subcontractor further certifies to NCISD that:

- (a) Contractor/Subcontractor shall ensure that the conditions or precautions that resulted in the determination that the criminal history record information requirements do not apply to its employees or applicants for employment continue to exist throughout the time that the contracted services are provided;
- (b) For each covered employee who is employed by or under a current offer of employment by Contractor/Subcontractor, Contractor/Subcontractor will timely complete the “Contractor Criminal History Background Check Certification” form and submit such to NCISD; and
- (c) If NCISD, in its sole discretion, determines that the conditions in paragraph (1) and/or (2) above are not satisfied as to Contractor/Subcontractor, Contractor/Subcontractor will provide NCISD with the name, date of birth, and any other requested information of its covered employees so

that NCISD may obtain criminal history record information on the covered employees, upon request by NCISD.

Or

OPTION C: Contractor/Subcontractor certifies that some or all of the employees of Contractor/Subcontractor are covered employees, and Contractor/ Subcontractor is a “qualified school contractor.” For each covered employee who is employed by or under a current offer of employment by Contractor/Subcontractor, Contractor/Subcontractor certifies to NCISD that it will timely complete the “Contractor Criminal History Background Check Certification” form and submit such to NCISD. If this option is selected, I further certify that:

- (1) Contractor/Subcontractor certifies to NCISD that Contractor/Subcontractor has received all criminal history record information relating to a person who is employed by or under a current offer of employment by Contractor/Subcontractor. Contractor/Subcontractor provides NCISD with the following fitness determination as to each covered employee, based on all criminal history record information obtained: None of the covered employees has a disqualifying criminal history.
- (2) If Contractor/Subcontractor at any time receives information that a covered employee subsequently has a reported disqualifying criminal history, Contractor/Subcontractor will immediately remove the covered employee from contract duties and notify NCISD in writing within 3 business days.
- (3) Upon request by NCISD, Contractor/Subcontractor will provide NCISD with the name, date of birth, and any other requested information of covered employees so that NCISD may obtain criminal history record information on the covered employees.

Or

OPTION D: Contractor/Subcontractor certifies that some or all of the employees of Contractor/Subcontractor are covered employees, and Contractor/Subcontractor is not a “qualified school contractor.” If this option is selected, I further certify that:

- (1) For each covered employee who is employed by or under a current offer of employment by Contractor/Subcontractor, Contractor/Subcontractor certifies to NCISD that will timely complete the “Contractor Criminal History Background Check Certification” form and submit such to NCISD, providing the following information regarding each covered employee as required by DPS in order to provide criminal history record information, so that NCISD may obtain the covered employees’ criminal history record information: (a) Full name (first, middle, and last); (b) Date of birth; (c) Sex; (d) Social Security number; (e) number assigned to any form of unexpired identification card issued by Texas or another state, the District of Columbia, or a U.S. territory that includes the person’s photograph; (f) if the employee has ever been fingerprinted by a public school district in Texas (and if so, the name of the school district); and (g) the person’s written consent to the release of his or her criminal history record information.
- (2) Contractor/Subcontractor shall provide NCISD’s “Texas Fingerprint Service Code Form” document to all covered employees and ensure that they schedule fingerprinting appointments in a timely manner. Contractor/Subcontractor shall be solely responsible to send or ensure that each covered employee sends to DPS all information that may be required by DPS for obtaining national criminal history record information, which may include, but is not limited to, a complete set of the person’s fingerprints and a recent electronic digital image photograph of the person. Any covered employee whose criminal history record information is not received by NCISD at least ten (10) NCISD business days prior to the start of the services

to be performed by Contractor/Subcontractor at NCISD is subject to exclusion from service, in NCISD's sole discretion, until his or her criminal history record information can be obtained and reviewed by NCISD. **Contractor/Subcontractor is responsible for the payment of all fingerprinting costs.** Because Contractor/Subcontractor is not a "qualified school contractor," it will not be permitted to view the criminal history record information obtained by NCISD.

- (3) DPS shall obtain the person's national criminal history record information and report the results through the criminal history clearinghouse as provided by Texas Government Code 411.0845. Contractor/Subcontractor agrees that NCISD will obtain all criminal history record information that relates to a covered employee through the criminal history clearinghouse as provided by Texas Government Code 411.0845. Contractor/Subcontractor agrees that NCISD will review each covered employee's criminal history record information, together with the employee's qualifications, background, and experience, based on information gathered by NCISD through the procurement and/or contracting processes, to determine, in NCISD's sole discretion, whether any covered employee(s) should be prohibited from serving at NCISD. NCISD will notify Contractor/Subcontractor of its determination.
- (4) If NCISD at any time receives information that a covered employee subsequently has a reported disqualifying criminal history or should be prohibited from serving at NCISD, in NCISD's sole discretion, for any other reason, including, but not limited to, the employee's qualifications, background, and experience, based on information gathered by NCISD through the procurement and/or contracting processes, NCISD will notify Contractor/Subcontractor of its determination. Contractor/Subcontractor will immediately remove the covered employee from contract duties.

Upon contract award and/or initiation of PO/contract from NCISD, the winning proposer/Contractor shall complete NCISD's "Contractor Criminal History Background Check Certification" form, providing the following information regarding each covered employee as required by DPS in order to provide criminal history record information, so that NCISD may obtain the covered employees' criminal history record information: (a) Full name (first, middle, and last); (b) Date of birth; (c) Sex; (d) Social Security number; (e) number assigned to any form of unexpired identification card issued by Texas or another state, the District of Columbia, or a U.S. territory that includes the person's photograph; (f) if the employee has ever been fingerprinted by a public school district in Texas (and if so, the name of the school district); and (g) the person's written consent to the release of his or her criminal history record information. Contractor/Subcontractor shall be solely responsible to send or ensure that each covered employee sends to DPS all information that may be required by DPS for obtaining national criminal history record information, which may include, but is not limited to, a complete set of the person's fingerprints and a recent electronic digital image photograph of the person.

If, during the term of the contract with NCISD, Contractor/Subcontractor employs additional covered employees or assigns new covered employees to perform services at NCISD, Contractor shall immediately notify NCISD and provide NCISD with all of the information listed in the preceding paragraph as to each additional covered employee, so that NCISD may obtain the additional covered employees' criminal history record information. If, during the term of the contract with NCISD, Contractor/Subcontractor ceases to employ a covered employee in connection with an NCISD contract, whose information was previously provided to NCISD, Contractor/Subcontractor shall immediately notify NCISD of the same and provide NCISD with each former covered employee's (a) Full name (first, middle, and last); (b) Date of birth; (c) Sex; (d) Social Security number; and (e) number assigned to any form of unexpired identification card

issued by Texas or another state, the District of Columbia, or a U.S. territory that includes the person's photograph, so that NCISD may unsubscribe from that individual's criminal history record.

If NCISD, in its sole discretion, objects to the assignment of a covered employee for any reason, including, but not limited to, on the basis of the covered employee's criminal history record information and/or insufficient qualifications, lack of experience, and the like, based on information gathered by NCISD through the procurement and/or contracting processes, Contractor/Subcontractor agrees to discontinue using that covered employee to provide services at NCISD.

I also certify to NCISD (and, in the case of a Subcontractor, certify to Contractor and NCISD) on behalf of Contractor/Subcontractor that Contractor/Subcontractor has required its subcontractors to comply with Texas Education Code, Chapter 22 and obtained certifications from its subcontractors of such compliance. Noncompliance or misrepresentation regarding this certification may be grounds for contract termination.

Signature

Title

Date

***Exhibit C – AIA Documents
A101-2017, Exhibit A Insurance and Bonds; and
A201-2017, all as amended by New Caney ISD***

DRAFT 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 «TBD» day of «TBD» in the year «2025»
(In words, indicate day, month and year.)

BETWEEN the Owner:
(Name, legal status, address and other information)

«New Caney Independent School District
22784 Hwy 59 S
Building "E"
Porter, Texas 77365 »« »

and the Contractor:
(Name, legal status, address and other information)

«TBD» «« »
« »
« »
« »

for the following Project:
(Name, location and detailed description)

«New Caney ISD Administration Building »

The Architect:
(Name, legal status, address and other information)

«Glaus, Pyle, Schomer, Burns & DeHaven, Inc. dba GPD Group
2121 Sage Road #240
Houston, Texas 77056 »« »

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.

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.

ELECTRONIC COPYING of any portion of this AIA® Document to another electronic file is prohibited and constitutes a violation of copyright laws as set forth in the footer of this document.

TABLE OF ARTICLES

- 1 THE CONTRACT DOCUMENTS
- 2 THE WORK OF THIS CONTRACT
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- 7 TERMINATION OR SUSPENSION
- 8 MISCELLANEOUS PROVISIONS
- 9 ENUMERATION OF CONTRACT DOCUMENTS

EXHIBIT A INSURANCE AND BONDS

ARTICLE 1 THE CONTRACT DOCUMENTS

§ 1.1 The Contract Documents consist of this Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), all sections of the Project Manual, including Drawings, Specifications, and Addenda issued prior to execution of this Agreement, other documents listed in this Agreement, and written Modifications signed by both parties that are 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. As used in the Contract Documents, the terms "AIA Document A201 – 2017", "General Conditions", "General Conditions of the Contract for Construction" or "A201-2017" shall refer to the General Conditions document that pertains to the Project, as modified or amended by the Owner for the Project. This Agreement represents the entire and integrated agreement between the Owner and the Contractor and supersedes prior negotiations, representations, or agreements, either written or oral. An enumeration of the Contract Documents and their order of precedence, other than a Modification, appear in Article 9.

§ 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 or amend a contract, to approve and execute a Change Order valued at or above \$50,000 or Construction Change Directive that would increase the Contract Sum more than \$50,000, or to agree to an extension to the date of Substantial or Final Completion.

§ 1.3 The Board designates the authorized representatives identified in Paragraph 8.3 to act on its behalf in other respects.

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.)

[☒] Established as follows:

(Insert a date or a means to determine the date of commencement of the Work.)

«The date of commencement shall be the day that the Contractor receives a Notice to Proceed from the Owner, which may precede the date of execution of this Agreement. If a Building Permit is not available or other approvals are not available for the entire Project, the Contractor must commence work on those portions of the Project that do

not require a Building Permit or other approvals on receipt of a Notice to Proceed. Work at the Project site shall not begin until Owner has received all required payment and performance bonds and insurance. »

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 and Final 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.)

[☒] By the following date: «October 24, 2026»

§ 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 or Final Completion as provided in this Section 3.3, liquidated damages, if any, shall be assessed as set forth in Section 4.5.

§ 3.3.4 Subject to adjustments of the Contract Time as provided in the Contract Documents, Final Completion shall be nine (9) calendar days after the date of Substantial Completion.

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 «TBD» (\$ «TBD»), 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
«TBD»	

§ 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
«Owner Contingency Allowance»	\$0.00

§ 4.3.1 The Contract Sum contains an Owner's Contingency / Owner Betterment Allowance. This contingency is for the sole use of the Owner to be used for changes in the scope of the Work and for the betterment of the Project. Owner's authorized representative may approve any expenditure from Owner's Contingency without further Board approval. If the Owner's Contingency is not expended or not fully expended, then any unused portion shall belong to the Owner and shall be credited to the Owner in calculating final payment.

§ 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)
« TBD »		

§ 4.5 Liquidated damages.

§ 4.5.1 The Work to be performed under this Agreement shall be substantially completed by the date set forth in the Agreement, or by such dates thereafter as may be established in any written extensions granted under Article 8 of the General Conditions. The parties hereto agree that time is of the essence of this Contract and in all phases of the Work, and that actual and direct damages would be suffered by the Owner if the Contractor does not substantially or finally complete all Work called for in the Contract Document by the specified dates. Such actual and direct damages are, and will continue to be, impracticable and extremely difficult to determine. Execution of this Agreement under these specifications shall constitute the agreement by Owner and Contractor that the amounts stated herein are the minimum value of the costs and actual and direct damages caused by failure of Contractor to complete the Work within the allotted or agreed extended times of Substantial or Final Completion, that such sums are liquidated direct damages and as all not be constructed to be as a penalty, and that such sums may be deducted from payments due Contractor if such delay occurs. It is therefore expressly agreed, as a part of the consideration inducing the Owner to execute this Contract, that the Owner may deduct from any payment(s) due to the Contractor a sum equal to One Thousand Dollars (\$1,000.00) for each and every Calendar Day beyond the date set forth in the Agreement for Substantial Completion or Final Completion of the Work included in the Contract Documents. It is expressly understood that said sum per day is agreed upon as a real, justified, and fair estimate of the pecuniary damages which will be sustained by the Owner in the event that the Work is not substantially or finally 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, but not limited to, additional compensation for personnel, attorneys fees, architectural fees, engineering fees, program management fees, inspection fees, storage costs, food service costs, transportation costs, utilities costs, costs of temporary facilities, loss of interest on money, and other miscellaneous increased costs, all of which are difficult of exact ascertainment. Failure to complete the Work within the designated or agreed extended dates of Substantial or Final Completion, shall be construed as a breach of this Agreement.

§ 4.5.2 Such damages shall be in addition to, and not in lieu of, any other rights or remedies Owner may have against Contractor for failure to timely achieve Final Completion, and damages for failure to achieve Substantial Completion and failure to achieve Final Completion shall run concurrently. If the Work is not finally completed by the time stated in the Agreement, or as extended, no payments for Work completed beyond that time shall be made until the Project reaches Final Completion.»

§ 4.6 Other:

(Insert provisions for bonus or other incentives, if any, that might result in a change to the Contract Sum.)

«n/a »

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.

§ 5.1.3 Refer to AIA A201, as modified by the Owner for the project, for Payments.

§ 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, less any unused Owner's contingency, 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, but shall contain as a minimum, individual line items for each section of the table of contents of the Project Manual

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separated by material costs and labor costs. Additionally, General Conditions costs shall be separated into individual line items. Each Application for Payment shall also include a list, with backup data, of how each payment shall be spent, including a list detailing which subcontractors and suppliers will be paid out of funds paid by the Owner and the amount of such payments to subcontractors and suppliers. Additionally, beginning with the second application for payment, proof of each payment to Contractor's subcontractors and suppliers for payment within 61-days after payment. The Application for Payment shall be submitted on a schedule of values basis. 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, as modified by the Owner for the Project, General Conditions of the Contract for Construction, and subject to other provisions of the Contract Documents, the amount of each progress payment shall be provided using the AIA G702 and G703 format and 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, as modified by the Owner for the Project;
- .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 as modified by the Owner for the Project; and
- .5 Retainage withheld pursuant to Section 5.1.7.

§ 5.1.6.3 If Owner is entitled to deduct liquidated damages, or any other damages or amounts provided in the Contract Documents, including clean-up fees, then Owner shall be entitled to deduct such liquidated damages, amounts and fees at any time.

§ 5.1.6.4 If Contractor fails or refuses to complete the Work, or has unsettled claims with Owner, any payment to Contractor shall be subject to deduction for such amounts as the Architect and Program Manager, if applicable, shall determine as the cost for completing incomplete Work and the value of unsettled claims.

§ 5.1.6.5 Payments shall be made on account of materials and equipment (a) incorporated in the Work, (b) suitably stored at the Project site, or (c) 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 The surety must agree, in writing, to each request for payment; and
- .4 The Contractor must bear the cost of the Owner's and Architect's expenses related to visiting the off-site storage area.

Payment for materials and/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 and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance (naming the Owner as additional 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

§ 5.1.7 Retainage

§ 5.1.7.1 For each progress payment made prior to Final Completion of the Work, the Owner may withhold the following amount, as retainage, from the payment otherwise due:

(Insert a percentage or amount to be withheld as retainage from each Application for Payment. The amount of retainage may be limited by governing law.)

«Five percent (5%) »

§ 5.1.7.1.1 The following items are not subject to retainage:

(Insert any items not subject to the withholding of retainage, such as general conditions, insurance, etc.)

«None. »

§ 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.)

«No reduction allowed »

§ 5.1.7.3 Except as set forth in this Section 5.1.7.3, upon Final 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 Final Completion shall not include retainage as follows:

(Insert any other conditions for release of retainage upon Final Completion.)

«n/a »

§ 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 payable in accordance with Article 9 of AIA Document A201-2017, as modified by the Owner for the Project.

§ 5.1.9 Except with the Owner's prior written approval or as otherwise provided in in Section 9.3.2 of the AIA Document A201-2017, the Contractor shall not make advance payments to suppliers for materials or equipment which have not been delivered and stored at the site. If the Contractor wishes to bill for materials or equipment which cannot be stored on site, the Contractor shall, along with the request for approval, provide evidence of purchase, evidence of delivery in good order without damage, and a certificate of insurance specifically covering the material identified by way of serial numbers, bill of lading, and copy of signature of receipt of materials and photography showing material. The Contractor shall also require, at the Owner's request, proof that the facility at which the materials or equipment is stored is bonded. Security and protection from theft and damage remains on the Contractor as the first line of accountability and financial responsibility. Delays due to issues arising from stored materials shall not be considered as reasonable justification to release the Contractor from meeting the schedule unless the Owner agrees to such delay in writing in advance of any delay.

§ 5.2 Final Payment

§ 5.2.1 Final payment, constituting the entire unpaid balance of the Contract Sum, minus disputed sums, authorized deductions, and liquidated damages, shall be made by the Owner to the Contractor after

- .1 the Contractor has fully performed the Contract except for the Contractor's responsibility to correct nonconforming Work as provided in Article 12 of AIA Document A201-2017, as modified by the Owner for the project, and to satisfy other requirements, if any, which extend beyond final payment;
- .2 the Contractor has provided all documents required by Section 3.5 et seq. and 9.10.2 of AIA Document A201-2017; and
- .3 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 45 days after Owner's Board's vote or other required approval pursuant to applicable Owner policy. Undisputed amounts unpaid after the date on which payment is due shall bear interest pursuant to Texas Government Code Section 2251.025.

§ 5.3 Interest

Undisputed payments due and unpaid under the Contract shall bear interest at the rate established by Texas Government Code Chapter 2251.

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, as modified by the Owner for the Project, unless the parties appoint below another individual, not a party to this Agreement, to serve as the Initial Decision Maker.

(If the parties mutually agree, insert the name, address and other contact information of the Initial Decision Maker, if other than the Architect.)

§ 6.2 Binding Dispute Resolution

For any Claim or dispute between the parties, the method of binding dispute resolution shall be as follows:
(Check the appropriate box.)

☒ [«X»] Litigation in a court of competent jurisdiction

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, as amended by the Owner for the Project.

§ 7.1.1 If the Contract is terminated for the Owner's convenience in accordance with Article 14 of AIA Document A201-2017, as amended by the Owner for the Project, 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.)

«As described in AIA Document A201-2017, as amended by the Owner for the Project. »

§ 7.2 The Work may be suspended by the Owner as provided in Article 14 of AIA Document A201-2017, as amended by the Owner for the Project.

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 Designated representative:

(Name, address, email address, and other information)

The Owner's Board of Trustees, by majority vote at a duly noticed and lawfully called public meeting, is the only representative of Owner, a Texas independent school district organized under the laws of the State of Texas, having the power to enter into a contract, to execute a change order requiring an increase in an amount of \$50,000 or more, to the Contract Sum, or to agree to an extension to the contractual completion date, unless this authority is lawfully delegated. The Board may designate in writing an authorized representative (or representatives), as appropriate, to act on its behalf during the course of construction. Such authorized representative shall have authority to act on behalf of the Owner concerning decisions that do not require a majority vote of the Board of Trustees and shall have the authority to bind the Owner only to the extent expressly authorized or delegated by the Board of Trustees. The authorized representative shall have no implied authority. Such authorized representative shall also bring recommendations to the Board of Trustees on any matter requiring Board approval. In the event that changes in the

scope of the Work are required before the Board's next regularly scheduled meeting or in order to facilitate and expedite the timely completion of the Work, the Board's authorized representative shall have authority to approve construction changes that do not exceed \$50,000.00 in increased costs. Any such change shall be confirmed in writing between the Contractor and the Board's authorized representative and notice of such approved changes shall be given to the Board at its next regularly scheduled meeting. The Board shall act as soon as reasonably possible to avoid unnecessary delays in the construction completion date. Except as expressly authorized by the Owner or the Contract Documents, the Architect does not have the authority to bind the Owner. The term "Owner" means the Owner or the Owner's authorized representative.

§ 8.3 The Owner's authorized representative:

«Superintendent of Schools »

§ 8.3 The Contractor's representative:

(Name, address, email address, and other information)

« TBD »

« »

« »

§ 8.4 The Contractor's representative shall be changed without ten days' prior notice to the other party.

§ 8.5 Insurance and Bonds

§ 8.5.1 The Contractor shall purchase and maintain insurance as set forth in 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 All notices required to be given under the Contract must be in writing. Any notice required or permitted to be given under the Contract shall be deemed delivered, whether or not actually received, three days after it is deposited in the U.S. Mail, when sent by certified mail, return receipt requested, postage prepaid, and correctly addressed to the party at the address provided in this Agreement. Notice given in any other manner shall be deemed delivered when actually received. Either party may change its address for notice by giving notice of the change of address in accordance with this provision. The Architect must be copied on notices sent to the Owner.

§ 8.7 Other provisions:

§ 8.7.1 The subject of this Contract is a public school facility which is governed by School Facilities Standards promulgated by the State Board of Education and said project must be constructed in compliance with these Standards. Upon request, Owner, its authorized agent, its Architect, and/or its Engineer shall make available information related to the School Facilities Standards necessary for compliance with said Standards.

§ 8.7.2 The Owner is an organization exempt from Texas taxes. Owner shall not be responsible for sales, consumer, use, and similar taxes on labor, materials, equipment, systems, and other items purchased for the project which Owner would ordinarily be exempt.

§ 8.7.3 All provisions in the Contract Documents that mandate arbitration are expressly deleted and rendered null and void.

§ 8.7.4 Subcontracts, purchase orders and rental agreements entered into by the Contractor shall contain provisions permitting assignment to the Owner upon default by Contractor under the Contract Documents. If the Owner accepts such assignment, the Owner shall be responsible for the payment of amounts which would have been reimbursable to Contractor under this Agreement and for which payment has not already been made to the Contractor. Contractor shall be responsible for the payment of any other amounts payable under the Contract. If the Owner elects not to accept the assignment of any subcontract, purchase order or rental agreement which would have constituted a Cost of the Work had this agreement not been terminated, the Contractor shall terminate such subcontract, purchase order or rental agreement.

§ 8.7.5 Unless the context of this Agreement otherwise clearly requires, references to the plural include the singular, the term "including" is not limiting and the terms "hereof," "herein," "hereunder" and similar terms in the Contract Documents refer to the Contract Documents as a whole and not to any particular provision thereof, unless stated otherwise. Additionally, the parties hereto acknowledge that they have carefully reviewed this Agreement and have been advised by counsel of their choosing with respect thereto, and that they understand its contents and agree that this Agreement shall not be construed more strongly against any part hereto regardless of who is responsible for its preparation.

§ 8.7.6 In the event of any suit or action arising out of or in connection with any of the Contract Documents, the prevailing party in such proceedings shall be entitled to recover reasonable attorney fees and court costs.

§ 8.7.7 Any provision in the Contract Documents to the contrary notwithstanding, if any of the facilities to be constructed or modified under this Agreement or the Contract require the issuance of a Certificate of Occupancy or other regulatory approval, then Substantial Completion of any such facilities shall not be deemed to have been attained for those facilities prior to the date on which an unconditional Certificate of Occupancy or other regulatory approval is obtained.

§ 8.7.8 If the building will be used or occupied by the Owner or members of the public, the Contractor shall be responsible for maintaining safe routes of travel from sidewalks and parking areas to the building and shall reroute access as necessary to maintain safe access during construction at no additional cost beyond the agreed contract amount.

§ 8.7.9 By signing this Agreement or providing or causing to be provided a certificate of coverage, the Contractor is certifying to the Owner 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. Contractor is also representing that it will require all subcontractors to provide workers' compensation coverage on all employees who will provide services on the Project for the duration of the Project and to provide written certifications of such coverage to the Contractor. The Contractor will provide the certifications to Owner. Providing false or misleading information may subject the Contractor to administrative penalties, criminal penalties, civil penalties, or other civil actions. The Contractor's failure to comply with any of these provisions is a breach of contract by the Contractor which entitles the Owner to declare the contract void if the Contractor does not remedy the breach within ten days after receipt of notice of breach from the Owner.

§ 8.7.10 The Contractor shall, as a condition precedent to allowing any subcontractor to proceed with any work on the Project, either require that the subcontractor provide proof of the existence of workers' compensation coverage for its employees, or, at the Contractor's sole discretion, provide for coverage of the subcontractor's employees under the Contractor's workers' compensation insurance coverage. The Contractor shall maintain records of all required certificates of insurance provided by the subcontractors, and shall forward copies to the Owner and the Architect.

§ 8.7.11 Warranty. The Contractor shall be responsible for the coordination of warranty work, if any during the first year after Substantial Completion of the Entire Work.

§ 8.7.12 No provision of this Agreement shall waive any immunity or defense. No provision of this Agreement is a waiver of any immunity or a consent to suit.

§ 8.7.13 The Owner's competitive procurement solicitation documents/packet and the response of the Contractor to same are incorporated herein by reference as if copied verbatim. The Contractor agrees to comply with all requirements incorporated or included in the competitive procurement solicitation documents/packet by the Owner

§ 8.7.14 The Contractor shall record the progress of the Project. On a monthly basis, or as otherwise agreed to by the Owner, the Contractor shall submit written progress reports to the Owner and Architect, showing percentages of completion and other information required by the Owner. The Contractor shall also keep, and make available to the Owner and Architect, a daily log containing a record for each day of weather, portions of the Work in progress and accomplished, Subcontractors working on the site, number of workers on site, identification of equipment on site, problems that might affect progress of the work, accidents, injuries, and other information required by the Owner.

The log shall be available to the Owner and Architect at any time during work hours and shall be presented for discussion at the project progress meetings.

§ 8.7.15 If (a) Contractor is not a sole proprietorship; (b) Contractor has ten (10) or more full-time employees; and (c) this Agreement has a value of \$100,000 or more, the following certification shall apply; otherwise, this certification is not required. Pursuant to Chapter 2270 of the Texas Government Code, the Contractor hereby certifies and verifies that neither the Contractor, nor any affiliate, subsidiary, or parent company of the Contractor, if any (the "Contractor Companies"), boycotts Israel, and the Architect agrees that the 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 refusing to deal with, terminating business activities with, 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, but does not include an action made for ordinary business purposes.

§ 8.7.16 Contractor verifies and affirms that it is not a foreign terrorist organization as identified on the list prepared and maintained by the Texas Comptroller of Public Accounts. If Contractor misrepresents its inclusion on the list, then such omission or misrepresentation shall void this Agreement.

§ 8.7.17 If Contractor is not a governmental body and (a) this Agreement has a stated expenditure of at least \$1 million in public funds for the purchase of goods or services by Owner; or (b) this Agreement results in the expenditure of at least \$1 million in public funds for the purchase of goods or services by Owner in a fiscal year of Owner, the following certification shall apply; otherwise, this certification is not required. As required by Tex. Gov't Code § 552.374(b), the following statement is included in the RFP and the Agreement (unless the Agreement is (1) related to the purchase or underwriting of a public security; (2) is or may be used as collateral on a loan; or (3) proceeds from which are used to pay debt service of a public security of loan): "The requirements of Subchapter J, Chapter 552, Government Code, may apply to this RFP and Agreement and the Contractor agrees that the Contract can be terminated if the Contractor knowingly or intentionally fails to comply with a requirement of that subchapter." Pursuant to Subchapter J, Chapter 552, Texas Government Code, the Contractor hereby certifies and agrees to (1) preserve all contracting information related to this Agreement as provided by the records retention requirements applicable to Owner for the duration of the Agreement; (2) promptly provide to Owner any contracting information related to the Agreement that is in the custody or possession of the Contractor on request of Owner; and (3) on completion of the Agreement, either (a) provide at no cost to Owner all contracting information related to the Agreement that is in the custody or possession of Contractor, or (b) preserve the contracting information related to the Agreement as provided by the records retention requirements applicable to Owner.

§ 8.7.18 If (a) Contractor is not a sole proprietorship; (b) Contractor has ten (10) or more full-time employees; and (c) this Agreement has a value of \$100,000 or more that is to be paid wholly or partly from public funds, the following certification shall apply; otherwise, this certification is not required. Pursuant to TEX. GOV'T CODE Ch. 2274 of SB 13 (87th session), Contractor hereby certifies and verifies that Contractor, or any wholly owned subsidiary, majority-owned subsidiary, parent company, or affiliate of these entities or business associations, if any, does not boycott energy companies and will not boycott energy companies during the term of the Contract. For purposes of this Agreement, the term "company" shall mean an organization, association, corporation, partnership, joint venture, limited partnership, limited liability partnership, or limited liability company, that exists to make a profit. The term "boycott energy company" shall mean "without an ordinary business purpose, refusing to deal with, terminating business activities with, or otherwise taking any action intended to penalize, inflict economic harm on, or limit commercial relations with a company because the company (a) engages in the exploration, production, utilization, transportation, sale, or manufacturing of fossil fuel-based energy and does not commit or pledge to meet environmental standards beyond applicable federal and state law, or (b) does business with a company described by paragraph (a)." See TEX. GOV'T CODE § 809.001(1).

§ 8.7.19 If (a) Contractor is not a sole proprietorship; (b) Contractor has at least ten (10) full-time employees; (c) this Agreement has a value of at least \$100,000 that is paid wholly or partly from public funds; (d) the Contract is not excepted under TEX. GOV'T CODE § 2274.003 of SB 19 (87th leg.); and (e) Owner has determined that Contractor is not a sole-source provider or Owner has not received any bids from a company that is able to provide this written verification, the following certification shall apply; otherwise, this certification is not required. Pursuant to TEX. GOV'T CODE Ch. 2274 of SB 19 (87th session), Contractor hereby certifies and verifies that Contractor, or association, corporation, partnership, joint venture, limited partnership, limited liability partnership, or limited liability company, including a wholly owned subsidiary, majority-owned subsidiary parent company, or affiliate of

these entities or associations, that exists to make a profit, does not have a practice, policy, guidance, or directive that discriminates against a firearm entity or firearm trade association and will not discriminate during the term of this contract against a firearm entity or firearm trade association. For purposes of this Agreement, "discriminate against a firearm entity or firearm trade association" shall mean, with respect to the entity or association, to: "(1) refuse to engage in the trade of any goods or services with the entity or association based solely on its status as a firearm entity or firearm trade association; (2) refrain from continuing an existing business relationship with the entity or association based solely on its status as a firearm entity or firearm trade association; or (3) terminate an existing business relationship with the entity or association based solely on its status as a firearm entity or firearm trade association. See TEX. GOV'T CODE § 2274.001(3) of SB 19. "Discrimination against a firearm entity or firearm trade association" does not include: "(1) the established policies of a merchant, retail seller, or platform that restrict or prohibit the listing or selling of ammunition, firearms, or firearm accessories; and (2) a company's refusal to engage in the trade of any goods or services, decision to refrain from continuing an existing business relationship, or decision to terminate an existing business relationship to comply with federal, state, or local law, policy, or regulations or a directive by a regulatory agency, or for any traditional business reason that is specific to the customer or potential customer and not based solely on an entity's or association's status as a firearm entity or firearm trade association." See TEX. GOV'T CODE § 2274.001(3) of SB 19.

§ 8.7.20 Owner is prohibited from entering into a contract or other agreement relating to critical infrastructure that would grant to Contractor direct or remote access to or control of critical infrastructure in this state, excluding access specifically allowed by Owner for product warranty and support purposes. Contractor certifies that neither it nor its parent company nor any affiliate of Contractor or its parent company, is (1) owned by or the majority of stock or other ownership interest of the company is held or controlled by individuals who are citizens of China, Iran, North Korea, Russia, or a designated country; (2) a company or other entity, including governmental entity, that is owned or controlled by citizens of or is directly controlled by the government of China, Iran, North Korea, Russia, or a designated country; or (3) headquartered in China, Iran, North Korea, Russia, or a designated country. For purposes of this Contract, "critical infrastructure" means "a communication infrastructure system, cybersecurity system, electric grid, hazardous waste treatment system, or water treatment facility." See TEX. GOV'T CODE § 2274.0101(2) of SB 1226 (87th leg.). Contractor verifies and certifies that Contractor will not grant direct or remote access to or control of critical infrastructure, except for product warranty and support purposes, to prohibited individuals, companies, or entities, including governmental entities, owned, controlled, or headquartered in China, Iran, North Korea, Russia, or a designated country, as determined by the Governor.

§ 8.7.21 Program Manager shall have, and is hereby granted by Owner, full and complete power, authority, and discretion to act for, and in the name, place, and stead of, Owner in carrying out and discharging the responsibilities and obligations of Program Manager under the Agreement between the Owner and Program Manager; provided, however, that Program Manager shall have no right or authority, express or implied, to commit or otherwise obligate Owner in any manner whatsoever except to the extent specifically provided in the Agreement between the Owner and the Program Manager or specifically authorized in writing by Owner. In no event shall Program Manager be authorized to execute any documents, agreements, or other instruments on behalf of Owner without written approval by Owner. In no event shall Program Manager have the authority to modify completion dates of the Project Schedule without written approval by Owner. Program Manager shall have the authority to modify interim milestones dates not affecting the completion dates specified in the Agreements between the parties. In no event shall Program Manager have the authority to modify contract value of the Project without written approval by Owner. Program Manager shall have the authority to modify budgets, contingencies, allowances and similar accounting tasks not affecting the contract value specified in the Agreements between the parties. In no event shall Program Manager have the authority to relax or to bind the Owner to codes and standards imposed by the Authorities Having Jurisdiction, unless authorized in writing by the Owner.

§ 8.7.22 The Contractor shall utilize online project management software in the manner required by Owner.

§ 8.8 Governing Law and Venue

§ 8.8.1 Section 13.1 of the General Conditions document pertaining to the Project, as modified by the Owner, shall apply to the Agreement, the Contract, and the Contract documents in all respects. No provision of this Agreement is a waiver of any immunity, defense, or a consent to suit.

§ 8.8.2 Venue

To the maximum extent permitted by applicable law, the parties expressly agree that the exclusive venue and place of trial for any action brought under or in connection with or in any way related to the Work, the Project, the

Agreement, the Contract, or any of the Contract Documents shall be in the state district courts of Montgomery County, Texas, and the parties hereby waive any and all objections to the agreed-upon venue as stated herein. The Contract, including but not limited to the Agreement and all other Contract Documents, is performable entirely in Montgomery County, Texas.

§ 8.9 Severability

If any provision or part of the Contract Documents is held to be illegal, invalid, or unenforceable under any present or future law or regulation, such provision shall be fully severable and the Contract Documents shall be construed and enforced as if such illegal, invalid or unenforceable provision had never comprised a part of the Contract Documents. The remaining provisions of the Contract Documents shall remain in full force and effect and shall not be affected by the illegal, invalid, or unenforceable provision or by its severance.

§ 8.10 Information and Services Required of the Owner

§ 8.10.1 Pursuant to the requirements of the Texas Business and Commerce Code section 56.054(e)(3), the Owner represents that funds are available and have been authorized for the full contract amount of the work.

ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

§ 9.1 This Agreement is comprised of the following documents; in the event of any inconsistency or conflict between or among the documents that comprise this Agreement, the order of precedence shall be:

- .1 AIA Document A101™-2017, Standard Form of Agreement Between Owner and Contractor, as modified by Owner for the Project
- .2 Exhibit A, Insurance and Bonds
- .3 AIA Document A201™-2017, General Conditions of the Contract for Construction, as modified by the Owner for the project
- .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
« TBD »		

.6 Specifications

Section	Title	Date	Pages
« TBD »			

.7 Addenda, if any:

Number	Date	Pages
« TBD »		

Portions of Addenda relating to bidding or competitive purchasing requirements are not part of the Contract Documents unless the bidding or competitive purchasing requirements are also enumerated in this Article 9.

.8 Other Exhibits: None.

(Check all boxes that apply and include appropriate information identifying the exhibit where required.)

.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.)

- .1 Owner's competitive procurement solicitation documents, including Owner's required certifications/Vendor Packet.
- .2 The Project Manual for the Project, including all sections to same, whether issued or created prior to or after the execution of this Agreement.
- .3 Statutory Payment and Performance Bonds.
- .4 Certificates of Insurance required of the Contractor.
- .5 All documents listed or described in Section 1.1.1 of AIA Document A201-2017, as amended by the Owner.
- .6 Scale/Schedule of Prevailing Wages (attached as Exhibit A to the AIA Document A201-2017, General Conditions of the Contract for Construction, as modified by the Owner for the Project) and incorporated herein as if fully set forth.
- .7 Any modifications to this Agreement or to the Contract or any Contract Documents approved by the Parties.
- .8 Any documents stated in this Agreement as being a part of or incorporated into this Agreement or the Contract
- .9 Portion(s) of Contractor's responses and proposals to Owner's competitive procurement solicitation documents that were accepted by Owner.

This Agreement entered into as of the day and year first written above.

« »

OWNER (Signature)

«Matthew Calvert
Superintendent
New Caney Independent School District »« »
(Printed name and title)

(Date)

« »

CONTRACTOR (Signature)

«TBD »« »

(Printed name and title)

(Date)

DRAFT AIA® Document A101™ – 2017

Exhibit A

Insurance and Bonds

This Insurance and Bonds Exhibit is part of the Agreement, between the Owner and the Contractor, dated the «TBD» day of «TBD» in the year «2025»

for the following **PROJECT**:
(Name and location or address)

«New Caney ISD Administration Building »

THE OWNER:

(Name, legal status and address)

«New Caney Independent School District
22784 Hwy 59 S
Building "E"
Porter, Texas 77365 »

THE CONTRACTOR:

(Name, legal status and address)

« TBD »

TABLE OF ARTICLES

- A.1 GENERAL
- A.2 OWNER'S INSURANCE
- A.3 CONTRACTOR'S INSURANCE AND BONDS
- A.4 SPECIAL TERMS AND CONDITIONS

ARTICLE A.1 GENERAL

The Owner and Contractor shall purchase and maintain insurance, and provide bonds, as set forth in this Exhibit. As used in this Exhibit, the term General Conditions refers to AIA Document A201™-2017, General Conditions of the Contract for Construction, as amended. Nothing contained in this Exhibit shall limit or waive Contractor's legal or contractual responsibilities to Owner or others.

ARTICLE A.2 OWNER'S INSURANCE

§ A.2.1 General

Prior to commencement of the Work, the Owner shall secure the insurance, and provide evidence of the coverage, required under this Article A.2.

§ A.2.2 Liability Insurance

§ A.2.2.1 The Owner shall be responsible for purchasing and maintaining the Owner's usual general liability insurance.

§ A.2.2.2 The Owner shall be responsible for purchasing and maintaining property and casualty insurance no later than the date on which Owner begins to occupy or use any

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.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

This document is intended to be used in conjunction with AIA Document A201™-2017, General Conditions of the Contract for Construction. Article 11 of A201™-2017 contains additional insurance provisions.

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completed or partially-completed portions of the Work. If Owner occupies or uses any completed or partially-completed portion of the Work on any stage, then such occupancy or use must be consented to by the insurer and authorized by public authorities having jurisdiction over the Work, pursuant to Paragraphs (partial occupancy or use - 201) and A.2.3.4. To the extent of overlap between Owner's property insurance and Contractor's builder's risk insurance, Contractor's builder's risk shall be primary and non-contributory.

§ A.2.2.3 The Architect shall be responsible for purchasing and maintaining the Architect's liability and worker's compensation insurance as provided in the AIA Document B102- 2017, as amended.

ARTICLE A.3 CONTRACTOR'S INSURANCE AND BONDS

§ A.3.1 General

§ A.3.1.0 The Contractor and the Contractor's Subcontractors shall purchase and maintain such insurance as will protect them and the Owner from claims which may arise out of, or result from, the Contractor's operations under the Contract whether such operations be by Contractor or by any Subcontractor, or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable, including the following:

§ A.3.1.0.1 Claims under state and federal employee benefit acts that are applicable to the Work to be performed, including private entities performing work at the site, and exempt from the coverage on account of number of employees or occupation, which entities shall maintain voluntary compensation coverage at the same limits specified for mandatory coverage for the duration of the Project (see Sections A.3.2.5 and A.3.1.12);

§ A.3.1.0.2 Claims for damages because of bodily injury, occupational sickness or disease, or death of the Contractor's employees;

§ A.3.1.0.3 Claims for damages because of bodily injury, sickness or disease, or death of any person other than the Contractor's employees;

§ A.3.1.0.4 Claims for damages insured by usual personal injury liability coverage;

§ A.3.1.0.5 Claims for damages, other than to the Work itself, because of injury to or destruction of tangible property, including loss of use resulting therefrom;

§ A.3.1.0.6 Claims for damages because of bodily injury, death of a person, or property damage arising out of ownership, maintenance, or use of a motor vehicle;

§ A.3.1.0.7 Claims for bodily injury or property damage arising out of completed operations;

§ A.3.1.0.8 Claims involving contractual liability insurance applicable to the Contractor's obligations under the Contract Documents, including under Section 3.18 indemnification); and

§ A.3.1.0.9 Claims for damages to the Work itself, through builder's risk insurance, pursuant to Section A.3.2.13.

§ A.3.1.1 Certificates of Insurance. The Contractor shall provide original certificates of insurance acceptable to the Owner evidencing compliance with the requirements in this Article A.3 at the following times: (1) prior to commencement of the Work; (2) upon renewal or replacement of each required policy of insurance; and (3) upon the Owner's written request. The Contractor (and each Subcontractor) shall maintain the insurance coverages specified herein at all times during the term of the Contract or such later date specified herein. An additional certificate evidencing continuation of any insurance coverages that are required to remain in force after final payment, including coverage for completed operations, shall be submitted with the final Application for Payment and thereafter upon renewal or replacement of such coverage until the expiration of the periods required by Section A.3.2.1 and Section A.3.3.1. The certificates will show the Owner, its trustees, officers, employees, agents, and representatives as an additional insured or named insured when such coverages are required under the Contract Documents. All certificates required hereunder shall be in form and content satisfactory to Owner and shall include copies of all required insurance policies, declarations, and endorsements, containing all generally applicable conditions, definitions, and exclusions related to the Project.

§ A.3.1.1.1 Certificates must include a provision stating that coverages afforded under the policies will not be terminated, materially modified, or allowed to expire, and that its limits will not be reduced, until at least 30 days' prior written notice has been given to the Owner;

§ A.3.1.1.2 Certificates must be written by an insurance company or companies satisfactory to owner and licensed to do business in the State of Texas by the Texas Department of Insurance, with a rating of not less

than A-X in the latest available A.M. Best Key Rating Guide, Property-Casualty, and that permits waivers of subrogation; and

§ A.3.1.1.3 Certificates must be evidenced on an original ACORD Certificate of Insurance 25-S (7/90), AIA Document G715 current edition, each signed and with an original signature of the Authorized Representative, naming Owner as a certificate holder and attaching all endorsements required herein. Policy exclusions and restrictions should be clearly explained on the Certificate or in an attached letter from the Issuing Agency. Blank areas on the Certificate should have "not covered" written across the printed areas when coverage is not provided.

§ A.3.1.2 **Deductibles.** The Contractor shall disclose to the Owner any deductible applicable to any insurance required to be provided by the Contractor, and the Contractor shall be responsible for losses within the deductible. If the Owner is damaged by the failure of the Contractor to maintain such insurance and to so notify the Owner then the Contractor shall bear all reasonable costs properly attributable thereto.

§ A.3.1.3 **Additional Insured Obligations.** All insurance required herein shall name the Owner, its officers, employees, representatives and agents, as an additional insured, except Contractor's Worker's Compensation insurance. To the fullest extent permitted by law, the Contractor shall cause the commercial general liability coverage to include (1) the Owner, its trustees officers, employees, agents, and representatives, the Architect, the Program Manager, and the Architect's and/or Program Manager's consultants as additional insureds for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's operations; and (2) the Owner, its trustees officers, employees, agents, and representatives as an additional insured for claims caused in whole or in part by the Contractor's negligent acts or omissions for which loss occurs during completed operations. All insurance required herein shall be, by endorsement, primary and non-contributory insurance with respect to the Owner, its trustees officers, employees, agents, and representatives and shall apply to both ongoing and completed operations. Owner insurance shall be excess, secondary, and non-contributing. The Commercial General Liability coverage provided by Contractor shall be endorsed to provide such primary and non-contributing liability. If the additional insured has other insurance which is applicable to the loss, such other insurance shall be on an excess or contingent basis. To the extent commercially available, the additional insured coverage shall be no less than that provided by Insurance Services Office, Inc. (ISO) forms CG 20 10 07 04, CG 20 37 07 04, and, with respect to the Architect and the Architect's consultants, CG 20 32 07 04, unless otherwise required by Owner.

§ A.3.1.4 No Work will be commenced and no equipment or materials can be shipped until all requirements of this Article have been satisfied, satisfactory evidence of insurance has been provided, and all insurance is in full force and effect. Contractor shall notify Owner and Architect in writing of any proposed nonconformity with these requirements, and shall notify Owner and Architect in writing of any insurance changes which occur during the terms required under the Contract Documents. Any deviation from these requirements can only be approved by Owner's Board of Trustees, unless otherwise delegated. Any nonconformity may be grounds for termination or modification of the Contract. To the extent that Contractor is unable to procure the insurance designated herein because the insurance is not reasonably available or is cost-prohibitive, then Contractor shall provide written notice to Owner's Board of Trustees. Said lack of insurance may then be grounds for termination or modification of the Contract.

§ A.3.1.5 All insurance shall be written on an occurrence basis, if available, and shall contain a waiver of subrogation in favor of Owner on all claims arising out of the Project. The policies shall provide such waivers of subrogation by endorsement or otherwise. The Contractor waives all rights of subrogation against Owner, its employees, officers, trustees, and agents, for damages caused by fire or other perils to the extent covered by insurance pursuant to Article A.3, except such rights as they may have to proceeds of such insurance held by the Owner as a fiduciary or as an insured. Contractor, as appropriate, shall require of separate Contractors, Subcontractors, and Sub-subcontractors, agents, and employees of any of them, by appropriate written agreements, similar waivers, each in favor of the Owner. The policies of insurance purchased and maintained by each person or entity agreeing to waive claims pursuant to this Section A.3.1.5 shall not prohibit this waiver of subrogation. A waiver of subrogation shall be effective as to a person or entity even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, or did not pay the insurance premium directly or indirectly; and whether or not the person or entity had an insurable interest in the property damaged.

§ A.3.1.6 Any failure of Contractor to comply with the reporting provisions of the policies shall not affect the coverage provided to the Owner, its officers, employees, representatives or agents.

§ A.3.1.7 All workers on the Project must be covered by the required insurance policies of the Contractor or a Subcontractor.

§ A.3.1.8 Contractor and its subcontractors shall not commence the shipment of equipment or materials or commence the Work at the site until all of the insurance coverage required of Contractor and its subcontractors are in force and the necessary certificates and statements pursuant to Article A.3 have been received by Owner and the Architect has issued a written notice to proceed.

§ A.3.1.9 As an alternative and at Owner's sole option and expense, Owner may elect to furnish or to arrange for Contractor any part or all of the insurance required by this Article A.3. If Owner so elects, it shall notify, in writing, Contractor and issue a Change Order therefor, but no adjustment to the scheduled completion date or the Contract Sum shall be allowed.

§ A.3.1.10 The Contractor shall furnish Owner all information concerning reduction of coverage on account of revised limits or claims paid under the General Aggregate, or both, amendments, renewals, notices, cancellations, and additional endorsements as required under the Contract Documents or as they are provided to Contractor, whichever is earlier.

§ A.3.1.11 The insurance required by Article A.3 shall be written for not less than the limits specified in the Contract Documents or the limits required by law, whichever coverage is greater. The stipulated limits of liability aggregate coverages shall be for this Project.

§ A.3.1.12 Contractor's insurance shall apply separately to each insured against whom claim is made or suit is brought, except with respect to the limits of the insurer's liability.

§ A.3.1.13 In the event of partial or full occupancy by the Owner prior to Substantial Completion of the Project, the Contractor shall notify the property insurance carrier and obtain a "Use and Occupancy" waiver to prevent cancellation, lapse, reduction, or other invalidation of such insurance by occupancy. Certificates of endorsements for this waiver shall be furnished by the Owner and the Architect.

§ A.3.1.14 The Owner as fiduciary shall have power to adjust and settle a loss with property insurers. If after such loss no other special agreement is made and unless the Owner terminates the Contract for convenience, replacement of damaged property shall be performed by the Contractor under the insurance proceeds after notification of a Change in the Work in accordance with Article 7 of the General Conditions. The Contractor shall, as soon as the claim under the policy is settled, proceed with all due diligence with the rebuilding or reparation and shall not be entitled to any payment in respect thereto other than the said moneys received from insurance, but an extension of time for completion shall be allowed by the Architect for a just and reasonable period. All monies received under any such policies are to be paid to the Contractor by installments on the certificates of the Architect and to be applied in or towards the rebuilding or reparation of the work destroyed or injured. The Contractor shall pay all subcontractors their just shares of insurance proceeds received by the Contractor, and by appropriate agreements shall require subcontractors to make payment to their sub-subcontractors in similar manner.

§ A.3.1.15 If the Contractor fails to purchase and maintain the required insurance, with all of the coverages and in the amounts described in the Contract Documents, the Contractor shall inform the Owner in writing prior to commencement of the Work. Upon receipt of notice from the Contractor, the Owner, in its sole discretion, may delay commencement of the Work and may obtain insurance that will protect the interests of the Owner, its trustees, officers, employees, agents, and representatives in the Work. When the failure to provide coverage has been cured or resolved, the Contract Sum and Contract Time shall be equitably adjusted to minimize the effect of any such failure on the Owner. In the event the Contractor fails to procure coverage, the Contractor waives all rights against the Owner, its trustees, officers, employees, agents, and representatives to the extent the loss would have been covered by the insurance to have been procured by the Contractor. The cost of the insurance shall be charged to the Contractor by a Change Order. If the Contractor does not provide written notice, and the Owner is damaged by the failure or neglect of the Contractor to purchase or maintain the required insurance, the Contractor shall reimburse the Owner for all reasonable costs and damages attributable thereto. Contractor, as appropriate, shall require of

separate Contractors, Subcontractors, and Sub-subcontractors, agents, and employees of any of them, by appropriate written agreements, similar obligations and liabilities, each in favor of the Owner.

§ A.3.2 Contractor's Required Insurance Coverage

§ A.3.2.1 The Contractor shall purchase and maintain the following types and limits of insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Contractor shall maintain the required insurance without interruption from the date of commencement of the Work until the expiration of the period for correction of Work as set forth in Section 12.2.2 of the General Conditions, unless a different duration is stated below:

(If the Contractor is required to maintain insurance for a duration other than the expiration of the period for correction of Work, state the duration.)

§ A.3.2.2 Commercial General Liability

§ A.3.2.2.1

Commercial General Liability insurance for the Project written on an occurrence form with:

§ A.3.2.2.1.1 Policy limits of not less than:

§ A.3.2.2.1.1.1 Each Occurrence

One Million Dollars (\$1,000,000) each occurrence
Two Million Dollars (\$2,000,000) aggregate (a designated Construction Project general aggregate limit shall be provided)

§ A.3.2.2.1.1.2 Medical Expense (per person)

Ten Thousand Dollars (\$10,000) each occurrence
(included with the per occurrence limits for Bodily Injury and Property Damage limits)

§ A.3.2.2.1.1.3 Products & Completed Operations

Two Million Dollars (\$2,000,000) aggregate
(to be maintained for a period of two years after Final Payment; Contractor shall continue to provide evidence of such coverage to Owner on an annual basis during this period and Owner shall be named by endorsement as an Additional Insured for such coverage)

§ A.3.2.2.1.1.4 Personal and Advertising Injury

One Million Dollars (\$1,000,000) each person

§ A.3.2.2.1.1.5 Fire, Lightning, or Explosion

One Million Dollars (\$1,000,000)

§ A.3.2.2.1.2 Coverages including the following:

§ A.3.2.2.1.2.1 Occurrence Basis

§ A.3.2.2.1.2.2 Premises Operations

§ A.3.2.2.1.2.3 Contractual Liability Coverage (including insurance sufficient to cover Contractor's contractual indemnities)

§ A.3.2.2.1.2.4 Explosion, collapse, and underground (X, C, and U) coverage

§ A.3.2.2.1.2.5 Products/Completed Operations coverage for Contractor, its Subcontractors, and Owner

§ A.3.2.2.1.2.6 Broad Form Property Damage

§ A.3.2.2.1.2.7 Independent Contractors

§ A.3.2.2.1.2.8 General Aggregate Per Project Endorsement

§ A.3.2.2.1.3 All of the coverages which may be included in coverages A, B and C contained in the Standard Texas Form Commercial General Liability Policy, without deletion. Such policy must be issued upon an "occurrence," as distinguished from a "claims made," basis and shall be continued for a period of one (1) year after the completion of the Services for the Project.

§ A.3.2.2.2 The Contractor's Commercial General Liability policy under this Section A.3.2.2 shall not contain an exclusion or restriction of coverage for the following:

- .1 Claims by one insured against another insured, if the exclusion or restriction is based solely on the fact that the claimant is an insured, and there would otherwise be coverage for the claim.
- .2 Claims for property damage to the Contractor's Work arising out of the products-completed operations hazard where the damaged Work or the Work out of which the damage arises was performed by a Subcontractor.
- .3 Claims for bodily injury other than to employees of the insured.
- .4 Claims for indemnity under Section 3.18 of the General Conditions arising out of injury to employees of the insured.
- .5 Claims or loss excluded under a prior work endorsement or other similar exclusionary language.
- .6 Claims or loss due to physical damage under a prior injury endorsement or similar exclusionary language.
- .7 Claims related to residential, multi-family, or other habitational projects, if the Work is to be performed on such a project.
- .8 Claims related to roofing, if the Work involves roofing.
- .9 Claims related to exterior insulation finish systems (EIFS), synthetic stucco or similar exterior coatings or surfaces, if the Work involves such coatings or surfaces.
- .10 Claims related to earth subsidence or movement, where the Work involves such hazards.
- .11 Claims related to explosion, collapse and underground hazards, where the Work involves such hazards.

§ A.3.2.3 Comprehensive Automobile Liability Insurance covering vehicles owned, hired, and non-owned vehicles used, by or on behalf of the Contractor, with minimum combined single limit of not less than « One Million Dollars» (\$ « 1,000,000.00 ») per occurrence or \$500,000.00 Bodily Injury (per person), \$1,000,000.00 Bodily Injury (per accident), and \$500,000.00 Property Damage (per accident), for bodily injury, death of any person, and property damage arising out of the ownership, maintenance and use of those motor vehicles along with any other statutorily required automobile coverage. Owner and its trustees, officers, representatives, agents, and employees shall be endorsed as Additional Insureds, ATIMA (As Their Interests May Appear).

§ A.3.2.4 Excess (Umbrella) Liability Insurance of one times the Contract amount for all contracts with the following minimum and maximum: not less than Five Million Dollars (\$5,000,000) Each Occurrence and Five Million Dollars (\$5,000,000) Aggregate, with Aggregate Per Project Endorsement, and maximum limit of Twenty-Five Million Dollars (\$25,000,000). The Umbrella shall provide coverage over the Workers' Compensation, General Liability and Comprehensive Automobile Liability Insurance Coverages. The Owner, the Architect and all Consultants listed on the Title Page of the Project Manual shall be listed as Additional Insureds on the Contractor's policy associated with the Project. Provisions shall be included for Waiver of Subrogation against the Owner and Architect and its Consultants.

§ A.3.2.5 Workers' Compensation not less than statutory limits mandated by state and federal laws with All States endorsement. All liability arising out of Contractor's employment of workers and anyone for whom Contractor shall be liable for Worker's Compensation Claims. Worker's compensation is required and no alternative form of insurance shall be permitted. Waiver of Subrogation in favor of Owner and Program Manager required.

§ A.3.2.5.1 A copy of a certificate of insurance, a certificate of authority to self-insure issued by the Texas Workers' Compensation 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 services on a Project is required for the duration of the Project. 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.

§ A.3.2.5.2 Persons providing services on the Project ("Subcontractor" in Texas Labor Code 406.096) include 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 contracted directly with the Contractor and 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, or employees of any entity that furnishes persons to provide services on the Project.

§ A.3.2.5.3 Services include, without limitation, providing, hauling, or delivering equipment or materials, or providing labor, transportation, or other service related to a Project. Services do not include activities unrelated to the Project, such as food/beverage vendors, office supply deliveries, and delivery of portable toilets.

§ A.3.2.5.4 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.

§ A.3.2.5.5 The Contractor must provide a certificate of coverage to the governmental entity prior to being awarded the contract.

§ A.3.2.5.6 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.

§ A.3.2.5.7 The Contractor shall obtain from each person providing services on a Project, and provide to the governmental entity:

§ A.3.2.5.7.1 A certificate of coverage, prior to that person beginning work on the Project, so the governmental entity will have on file certificates of coverage showing coverage for all persons providing services on the Project; and

§ A.3.2.5.7.2 No later than seven (7) 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.

§ A.3.2.5.8 The Contractor shall retain all required certificates of coverage for the duration of the Project and for one (1) year thereafter.

§ A.3.2.5.9 The Contractor shall notify the governmental entity in writing by certified mail or personal delivery, within ten (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.

§ A.3.2.5.10 The Contractor shall post on each Project site a notice, in the text, form, and manner prescribed by the Texas Workers' Compensation Commission, 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 of coverage.

§ A.3.2.5.11 The Contractor shall contractually require each person with whom it contracts to provide services on a Project, to:

§ A.3.2.5.11.1 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 401.011(44) for all of its employees providing services on the Project for the duration of the Project;

§ A.3.2.5.11.2 Provide to 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;

§ A.3.2.5.11.3 Provide the Contractor, prior to the end of the coverage period, 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;

§ A.3.2.5.11.4 Obtain from each other person with whom it contracts, and provide to the Contractor:

§ A.3.2.5.11.4.1 A certificate of coverage, prior to the other person beginning work on the Project; and

§ A.3.2.5.11.4.2 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;

§ A.3.2.5.11.5 Retain all required certificates of coverage on file for the duration of the Project and for one (1) year thereafter;

§ A.3.2.5.11.6 Notify the governmental entity in writing by certified mail or personal delivery, within ten (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

§ A.3.2.5.11.7 Contractually require each person with whom it contracts to perform as required by items a-f, with the certificates of coverage to be provided to the person for whom they are providing services.

§ A.3.2.5.12 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 civil actions.

§ A.3.2.5.13 The Contractor's failure to comply with any of these provisions is a breach of contract by the Contractor that entitles the governmental entity to declare the contract void if the Contractor does not remedy the breach within ten (10) days after receipt of notice of breach from the governmental entity.

§ A.3.2.5.14 The coverage requirement recited above does not apply to sole proprietors, partners, and corporate officers who are excluded from coverage in an insurance policy or certificate of authority to self-insure that is delivered, issued for delivery, or renewed on or after January 1, 1996. 28 TAC 110.110(i)

§ A.3.2.6 Employers' Liability with policy limits not less than statutory limits mandated by state and federal laws, including, at a minimum, « One Million Dollars » (\$ « 1,000,000 ») Bodily Injury with Accident - each accident, « One Million Dollars » (\$ « 1,000,000 ») Bodily Injury by Disease - each employee, and « One Million Dollars » (\$ « 1,000,000 ») Bodily Injury by Disease - policy limit. A waiver of subrogation shall be granted in favor of the Owner.

§ A.3.2.7 Jones Act, and the Longshore & Harbor Workers' Compensation Act, as required, if the Work involves hazards arising from work on or near navigable waterways, including vessels and docks.

§ A.3.2.8 If the Contractor is required to furnish professional services as part of the Work, the Contractor shall procure Professional Liability insurance covering performance of the professional services, with policy limits of not less than « » (\$ « ») per claim and « » (\$ « ») in the aggregate.

§ A.3.2.9 If the Work involves the transport, dissemination, use, or release of pollutants, the Contractor shall procure Pollution Liability insurance, with policy limits of not less than « » (\$ « ») per claim and « » (\$ « ») in the aggregate.

§ A.3.2.10 Coverage under Sections A.3.2.8 and A.3.2.9 may be procured through a Combined Professional Liability and Pollution Liability insurance policy, with combined policy limits of not less than « » (\$ « ») per claim and « » (\$ « ») in the aggregate.

§ A.3.2.11 Insurance for maritime liability risks associated with the operation of a vessel, if the Work requires such activities, with policy limits of not less than « » (\$ « ») per claim and « » (\$ « ») in the aggregate.

§ A.3.2.12 Insurance for the use or operation of manned or unmanned aircraft, if the Work requires such activities, with policy limits of not less than « » (\$ « ») per claim and « » (\$ « ») in the aggregate.

§ A.3.2.13 Contractor shall, at its expense, obtain and, during the progress of the Work, maintain full builder's risk "all-risks" or equivalent insurance policy, including boiler and machinery insurance, on said Work in the amount of the initial Contract Sum (or, if the Project is a Construction Manager at Risk project, Guaranteed Maximum Price), plus value of subsequent Contract Modifications and labor performed and cost of materials and equipment supplied or installed by others, comprising total value for the entire Project at the site on a replacement cost basis.

§ A.3.2.13.1 For any claim made against the builder's risk insurance, the deductible shall not exceed \$2,500 for a Contract Sum (or Guaranteed Maximum Price if the Project is a Construction Manager at Risk project) of less than \$4 million. For a Contract Sum (or Guaranteed Maximum Price if the Project is a Construction Manager at Risk project) of \$4 million or more, the deductible shall not exceed \$5,000.

§ A.3.2.13.2 Coverage shall insure against the perils of fire (with extended coverage) and physical loss or damage, including, without limitation or duplication of coverage, lightning, collapse, earthquake, flood, wind storm, hurricane, hail, explosion, riot, civil commotion, smoke, aircraft, land vehicles, theft, vandalism, malicious mischief, falsework, testing and start-up, temporary structures, debris removal including demolition occasioned by enforcement of any applicable legal requirements, ensuing loss or resulting damage from error, omission, or deficiency in construction methods, design, specifications, workmanship, or materials, and all other perils, and shall include all work incorporated in the building and all materials for the same in or about the premises, including materials stored on-site, off-site and in transit, and shall cover reasonable compensation for Architect's and Contractor's services and expenses required as a result of such insured loss, including claim preparation expenses.

§ A.3.2.13.3 If the Work involves remodeling an existing structure or constructing an addition to an existing structure, the Contractor shall purchase and maintain, until the expiration of the period for correction of Work as set forth in Section 12.2.2 of the General Conditions, "all-risks" property insurance, on a replacement cost basis, protecting the existing structure against direct physical loss or damage from the causes of loss identified in Section A.3.2.13.2, notwithstanding the undertaking of the Work. The Contractor shall be responsible for all co-insurance penalties.

§ A.3.2.13.4 Form of policy to be used shall be "Completed Value Builder's Risk". Both the Owner and the Contractor shall be a named insured under the policy or policies, and the insurance shall also include the interests of Contractor, subcontractors, and sub-subcontractors. Contractor shall furnish certified copies of the required policy or policies, with receipts for premiums paid for such insurance, to the Owner and the Architect.

§ A.3.2.13.5 Contractor shall be responsible for maintaining said builder's risk insurance until the date of Final Completion and shall continue such insurance following Final Completion or, if necessary, replace such insurance policy with property insurance written for the total value of the Project that shall remain in effect until expiration of the period for correction of the Work set forth in Section 12.2.2 of the General Conditions.

§ A.3.2.13.6 If this policy excludes Employee Theft or Dishonesty coverage, including Third Parties, Contractor shall obtain separate coverage sufficient to protect Owner's interest and in an amount agreeable to Owner.

§ A.3.3 Contractor's Other Insurance Coverage

§ A.3.3.1 Insurance selected and described in this Section A.3.3 shall be purchased by Contractor (and each Subcontractor, as applicable) from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Contractor (and each Subcontractor, as applicable) shall maintain the required insurance without interruption from the date of commencement of the Work until the expiration of the period for correction of Work as set forth in Section 12.2.2 of the General Conditions, unless a different duration is stated below:

(If the Contractor is required to maintain any of the types of insurance selected below for a duration other than the expiration of the period for correction of Work, state the duration.)

§ A.3.3.2 The Contractor shall purchase and maintain the following types and limits of insurance in accordance with Section A.3.3.1.

(Select the types of insurance the Contractor is required to purchase and maintain by placing an X in the box(es) next to the description(s) of selected insurance. Where policy limits are provided, include the policy limit in the appropriate fill point.)

[« »] § A.3.3.2.2 Railroad Protective Liability Insurance, with policy limits of not less than « » (\$ « ») per

claim and (\$) in the aggregate, for Work within fifty (50) feet of railroad property.

[☐] **§ A.3.3.2.3 Asbestos Abatement Liability Insurance**, with policy limits of not less than (\$) per claim and (\$) in the aggregate, for liability arising from the encapsulation, removal, handling, storage, transportation, and disposal of asbestos-containing materials.

[☐] **§ A.3.3.2.4 Insurance for physical damage to property while it is in storage and in transit to the construction site on an "all-risks" completed value form.**

[☐] **§ A.3.3.2.5 Property insurance on an "all-risks" completed value form, covering property owned by the Contractor and used on the Project, including scaffolding and other equipment.**

[☐] **§ A.3.3.2.6 Other Insurance**

(List below any other insurance coverage to be provided by the Contractor and any applicable limits.)

Coverage

Limits

§ A.3.4 Performance Bond and Payment Bond

The Contractor shall provide surety bonds, from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located, as follows:

(Specify type and penal sum of bonds.)

Type

Payment Bond

Performance Bond

Penal Sum (\$0.00)

100% of the Contract Sum/Guaranteed Maximum Price

100% of the Contract Sum/Guaranteed Maximum Price

Payment and Performance Bonds shall be in a form approved by the Owner.

§ A.3.4.1 Each bond shall be of a penal sum equal to 100% of the Contract Sum, or Guaranteed Maximum Price if the Project is a Construction Manager at Risk project, whichever is applicable; provided, however, no limitation herein shall limit Contractor's liability under the Contract Documents. 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 full force throughout the contractual correction period of the Agreement. Except as provided below, such bonds shall be delivered to the Owner and the Architect prior to commencement of the Work. All bonds will be reviewed by the Architect for compliance with the Contract Documents. In the event that the Architect has any questions concerning the sufficiency of the bonds, the bonds will be referred to the Owner or the Owner's Representative with Architect's recommendation. The Work will not be started until the bonds and issuing companies have been accepted as satisfactory by the Owner. (If a fixed contract amount or Guaranteed Maximum Price has not been determined at the time the contract is awarded, then the penal sums of the payment and performance bonds delivered to the Owner must each be in an amount equal to the Project budget, as specified in the request for qualifications or request for sealed proposals. The Construction Manager at Risk shall deliver the bonds not later than the tenth day after the date the Construction Manager at Risk executes the Contract, unless the Construction Manager at Risk furnished a bid bond or other financial security acceptable to the District to ensure that the Construction Manager will furnish the required payment and performance bonds when the Guaranteed Maximum Price is established.)

§ A.3.4.2 All bonds shall fully comply with Texas Insurance Code Section 3503.001 et seq. and Texas Government Code Chapter 2253, or their successors, and shall be issued by a surety company acceptable to the Owner and licensed, listed and authorized to issue bonds in the State of Texas by the Texas Department of Insurance, with appropriate underwriting limitation, on the U.S. Treasury Department Circular No. 570 (Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies). The surety company shall have a rating of not less than "A-X" according to the latest posted ratings on the A.M. Best website,

www.ambest.com. The surety company shall provide, if requested, information on bonding capacity and other projects under coverage and shall provide proof to establish adequate financial capacity for this Project. Should the bond amount be in excess of ten percent (10%) of the surety company's capital and surplus, then the surety company issuing the bond shall certify that the surety company has acquired reinsurance, in a form and amount acceptable to the Owner, to reinsure the portion of the risk that exceeds ten percent (10%) of the surety company's capital and surplus with one or more reinsurers who are duly authorized and admitted to do business in Texas and that the amount reinsured by a reinsurer does not exceed ten percent (10%) of the reinsurer's capital and surplus. Contractor shall immediately notify the Owner and Architect in writing if there is any change in: the rating; insolvency or receivership in any State; bankruptcy; right to do business in the State; or status of Contractor's sureties at any time until Final Completion.

§ A.3.4.3 All bonds shall be originals. The Contractor shall require the attorney-in-fact who executes the required Bonds on behalf of the Surety to affix thereto a certified and current copy of the power-of-attorney. The name, address, and telephone number of a contact person for the bonding company shall be provided.

§ A.3.4.4 Bonds shall guarantee the faithful performance of all of the covenants, stipulations, and agreements of the Contract. Bonds shall be signed by an agent, resident in the State of Texas. If at any time during the continuance of the Contract, the Owner determines that the Contractor is unable to complete the Work in accordance with the Contract Documents, any of the Contractor's bonds become insufficient, the surety becomes insolvent, or the surety's rating drops below the required level, then the Owner shall have the right to require from the Contractor additional and sufficient sureties or other security acceptable to the Owner, which the Contractor shall furnish to the satisfaction of the Owner within ten (10) days after notice to do so. These contractual remedies are in addition to all remedies available by law. In default thereof, all payment or money due to the Contractor may be withheld until the Contractor provides additional surety or security.

Claims must be sent to the Contractor and his Surety, in accordance with Texas Government Code, Chapter 2253. 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.

ARTICLE A.4 SPECIAL TERMS AND CONDITIONS

Special terms and conditions that modify this Insurance and Bonds Exhibit, if any, are as follows:

«None. »

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General Conditions of the Contract for Construction

for the following PROJECT:
(Name and location or address)

«New Caney ISD Administration Building »

THE OWNER:
(Name, legal status and address)

«New Caney Independent School District
22784 Hwy 59 S
Building "E"
Porter, Texas 77365 »« »

THE ARCHITECT:
(Name, legal status and address)

«Glaus, Pyle, Schomer, Burns & DeHaven, Inc. dba GPD Group
2121 Sage Road #240
Houston, Texas 77056 »« »

THE PROGRAM MANAGER:
(Name, legal status and address)

«n/a »

The Owner may retain Program Manager(s) to carry out some of the functions of the administration of the Owner's construction program. The Contractor, Architect, and Program Manager (when applicable) shall cooperate with each other in the performance of their respective functions. The management and reporting systems used by the Owner and/or Program Manager, including the assignment of the Program Manager, may be changed by Owner during the Project.

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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.

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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), 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 or the Owner. All sections of the Project Manual shall be a part of the Contract Documents. The solicitation documents used by the Owner, including advertisement or Requests for bids or Proposals, Instructions to Bidders, other information furnished by the Owner in anticipation of receiving bids or proposals, and Addenda relating to such solicitation documents, except to the extent that the proposal has been modified by the terms of the Contract shall be a part of the Contract Documents. Any reference to any Contract Documents shall mean the document as amended and/or supplemented for this Project.

§ 1.1.2 The Contract

The Contract Documents form the Contract for Construction (the "Contract") and are as fully a part of the Contract as if attached hereto 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. After execution of the original Contract Documents, 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.

§ 1.1.2.1 To be effective, all Contract Documents requiring signatures must be signed first by the Contractor and then by the Owner's authorized representative, after approval by Owner's Board of Trustees, unless otherwise delegated. If an approved Contract Document requiring signature has not been signed, then the missing signature shall be provided within a reasonable period of time. Failure to sign an approved Contract Document after notice and a reasonable opportunity to sign shall be considered a material breach of the Contract. Contractor's signing of the Agreement shall be considered as signing all Contract Documents identified therein.

§ 1.1.2.2 After execution of the original Contract Documents, the Contract may thereafter be amended or modified only by a written Modification signed by Contractor, approved by Owner's Board of Trustees, unless otherwise delegated, and signed by an authorized representative of Owner's Board of Trustees. As a material consideration for the making of the Contract, Modifications to the Contract shall not be construed against the maker of said Modifications.

§ 1.1.2.3 In the event of conflict, the order of precedence of the Contract Documents shall be as listed in the Agreement. Terms and conditions contained in the Agreement shall take precedence over terms and conditions contained in the General Conditions, and the terms and conditions in the General Conditions shall take precedence over all other terms and conditions contained in the other Contract Documents, except for Exhibit A, "Insurance and Bonds," attached to the Agreement, which shall take precedence over the General Conditions. An enumeration of the Contract Documents and their order of precedence, other than a Modification, appear in Article 9 of the AIA A101, as modified by the Owner for the Project.

§ 1.1.2.4 Any reference to the Agreement, General Conditions, or any other Contract Document shall mean the document as amended and/or supplemented for this Project.

§ 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. The Work includes all of Contractor's responsibilities as to all labor, parts, supplies, skill, supervision, transportation services, storage requirements, and other facilities and things necessary, proper or incidental to the carrying out and completion of the terms of the Contract Documents and all other items of cost or value needed to produce, construct, and fully complete the public Work identified by the Contract Documents. The Contract

Documents include all Construction Documents, such as Drawings and Specifications that establish in detail the quality levels of materials and systems required for the Project. The Construction Documents shall reflect all agreements between Owner and Architect concerning Owner's budgetary constraints, programmatic needs, and expectations as to quality, functionality of systems, maintenance costs, and usable life of equipment and facilities. Said Construction Documents shall reflect the Owner's educational program and educational specifications, the State educational adequacy, safety, and security standards in 19 TAC Section 61.1040, and any other standards to which the Architect is subject pursuant to applicable law or contract. The Architect shall provide Construction Documents which are sufficient for Owner to complete construction of the Project.

§ 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, wherever located and whenever issued, 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 or documents, including those in electronic form, prepared by the Architect and the Architect's consultants and shall set forth in detail the requirements for construction of the Project.

§ 1.1.8 Initial Decision Maker

The Initial Decision Maker is the person identified in the Agreement to render initial decisions or recommendations 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.

§ 1.1.9 Project Manual

The Project Manual is a volume assembled for the Work which includes the bidding or proposal requirements, sample forms, Conditions of the Contract and Specifications.

§ 1.1.10 Project Manual Addenda

Project Manual Addenda are written, or graphic instruments issued prior to the execution of the Contract, which modify or interpret the bidding or proposal documents, including Drawings and Specifications, by additions, deletions, clarifications, or corrections. Addenda will become part of the Contract Documents when the Agreement is executed. The Contractor and Subcontractors shall include all addenda items on their copies of the Drawings and Specifications.

§ 1.1.11 The terms "bids" or "bidding" shall include any kind of competitive purchasing/procurement under Texas Government Code Chapter 2269.

§ 1.1.12 Abbreviations

AIA:	American Institute of Architects
AIEE:	American Institute of Electrical Engineers
ACI:	American Concrete Institute
ASHERA:	Asbestos Hazardous Emergency Response Act
AISI:	American Iron and Steel Institute
AISC:	American Institute of Steel Construction
ANSI:	American National Standards Institute
ASA:	American Standards Association

ASTM:	American Society of Testing Materials
AWSC:	American Welding Society Code
CERCLA:	Comprehensive Environmental Response, Compensation, and Liability Act
EPA:	Environmental Protection Agency
FS:	Federal Specification
NEC:	National Electrical Code
NIC:	Not in Contract (indicates work not to be done by this Contractor under this Agreement)
OSHA:	Occupational Safety and Health Administration
SPR:	Simplified Practice Recommendation
TAS:	Texas Accessibility Standards
UL:	Underwriters Laboratories, Inc.

§ 1.1.13 Miscellaneous Other Words

§ 1.1.13.1 Calendar Days: The days of the Gregorian calendar. 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.

§ 1.1.13.2 Holidays: The days officially recognized by the construction industry in this area as a holiday; 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.

§ 1.1.13.3 Regular Work Days: All calendar days except holidays and Sundays. Requests for extensions of time shall be requested on the basis of Regular Work Days

§ 1.1.13.4 Anticipated Adverse Weather Days: An allowance of Regular Work Days established as probable days lost due to weather delays; said allowance to be included in the Contractor's Completion Time.

§ 1.1.13.5 Adverse Weather Days: Regular Work Days when rain, flooding, snow, unusually high winds, excessively wet grounds, or similar circumstances prevent progress on Critical Path portions of the Work. The Contractor will be entitled to an extension of the Contract Time for the net additional time, if any, which results from deducting the amount of Anticipated Adverse Weather Days from the total amount of approved Adverse Weather Days.

§ 1.1.13.5.1 Further, Adverse Weather is defined as the occurrence of one or more of the following conditions within a twenty-four (24) hour day that prevents construction activity exposed to weather conditions or access to the site:

1. Precipitation (rain, snow, or ice) in excess of twenty-five one hundredths of an inch (0.25") liquid measure, hereafter referred to as Standard Baseline.
2. Temperatures that do not rise above that required for the day's construction activity, if such temperature requirement is specified or accepted as standard industry practice.
3. Sustained wind in excess of twenty-five (25) m.p.h.
4. "dry-out" or "mud" days resulting from precipitation that occur beyond the standard baseline; only if there is a hindrance to site access or sitework and Contractor has taken all reasonable accommodations to avoid such hindrance; and, at a rate no greater than 1 make-up day for each day or consecutive days of precipitation beyond the Anticipated Adverse Weather Days that total 1.0 inch or more, liquid measure.
5. Adverse weather prevents work on the project for fifty percent (50%) or more of the Contractor's scheduled work day and critical path construction activities were included in the day's schedule, including a weekend day or holiday if Contractor has scheduled construction activity that day.

§ 1.1.13.6 Net Days: Actual Adverse Weather Days experienced to date less Anticipated Adverse Weather Days anticipated to date. Actual Instruction Days experienced to date less Anticipated Instruction Days anticipated to date.

§ 1.1.13.7 Instruction Days: Regular Work Days when the Owner operations prevent progress on Critical Path portions of the Work. The Contractor will be entitled to an extension of the Contract Time for the net additional time, if any, which results from deducting the amount of Anticipated Instruction Days from the total amount of

approved Instruction Days.

§ 1.1.13.8 The term "business day" is a day the Owner's Administration Building is scheduled to be open for normal business purposes, unless closed by the Owner's Superintendent of Schools or designee for inclement weather or other reason. Days on which the Administration Building is normally closed are Thanksgiving Break, Winter Break, Spring Break, and Summer Break, as well as other federal, state or local days specified in the calendar approved by the Owner's Board of Trustees on an annual basis. A business day does not include a day on which the Owner's Administration Building is open only for the purposes of conducting candidate filing, early voting, elections, or other special events.

§ 1.1.13.9 The term "Direct Labor Cost" means the actual and verifiable salaries and wages (basic, premium and incentive) paid to personnel, but does not include indirect payroll related costs or fringe benefits (Labor Cost Burden).

§ 1.1.13.10 The term "Labor Cost Burden" means the actual and verifiable cost of customary and statutory benefits including, but not limited to, social security contributions, unemployment, excise and payroll taxes, workers' compensation, health and retirement benefits, bonuses, sick leave, vacation and holiday pay applicable thereto. Labor Cost Burden excludes all forms of general liability policy premiums and deductibles, safety training, tuition cost reimbursement, small tool expense, and union dues. The Owner reserves the right to request evidence of Labor Cost Burden at any time from Contractor and Subcontractors.

§ 1.1.14 The term "Compensable Change" means circumstances involving the performance of Extra Work:

- 1 that are the result of
 - (1) Differing Site Conditions,
 - (2) amendments or additions to Applicable Laws, which amendments or additions are enacted after the execution of the Agreement,
 - (3) a Change requested by Owner in accordance with the conditions of authorization applicable to Compensable Changes set forth in Article 7, below, or
 - (4) other circumstances involving a Change in the Work for which Contractor is given under the Contract Documents a specific and express right to a Change Order to the Contract Price;
- 2 that are not caused, in whole or in part, by an act or omission of Contractor or a Subcontractor, of any Tier, constituting negligence, willful misconduct, or violation of an Applicable Law, or by a failure of Contractor or a Subcontractor, of any Tier, to comply with the Contract Documents;
- 3 for which a Change Order is neither prohibited by nor waived under the terms of the Contract Documents; and
- 4 that if performed would require Contractor to incur additional and unforeseeable Allowable Costs that would not have been required to be incurred in the absence of such circumstances.

§ 1.1.15 The term "Compensable Delay" means a Delay to the critical path of activities affecting Contractor's ability to achieve Substantial Completion of the entirety of the Work within the Contract Time:

- 1 that is the result of
 - (a) a Compensable Change,
 - (b) the willful negligence of Owner, Architect, a Owner Consultant or a Separate Contractor,
 - (c) a breach by Owner of an obligation under the Contract Documents, or
 - (d) other circumstances involving Delay for which Contractor is given under the Contract Documents a specific and express right to a Change Order adjusting the Contract Price;
- 2 that is not caused, in whole or in part, by an act or omission of Contractor or a Subcontractor, of any Tier, constituting negligence, willful misconduct, or a violation of an Applicable Law, or a failure by Contractor or any Subcontractor, of any Tier, to comply with the Contract Documents; and
- 3 for which a Change Order to the Contract Time is neither prohibited by nor waived under the terms of the Contract Documents.

§ 1.1.16 The term "Excusable Delay" means a Delay, other than a Compensable Delay, to Contractor's ability to achieve Substantial Completion or Final Completion of the Work within the Contract Time that is: (1) not caused, in whole or in part, by an act or omission of Contractor or a Subcontractor, of any Tier, constituting negligence, willful misconduct, a violation of an Applicable Law or a failure by Contractor or any Subcontractor, of any Tier, to comply with the Contract Documents; (2) unforeseeable, unavoidable and beyond the control of Contractor and the Subcontractors, of every Tier; and (3) the result of a Force Majeure Event. Without limitation to the foregoing,

neither the bankruptcy, insolvency nor financial inability of Contractor or a Subcontractor, of any Tier, nor any failure by a Subcontractor, of any Tier, to perform any obligation imposed by contract or Applicable Laws shall constitute a ground for Excusable Delay.

§ 1.1.17 The term "Unexcused Delay" means any Delay that is not a Compensable Delay or Excusable Delay or that constitutes a Compensable Delay or Excusable Delay for which Contractor is not entitled to a Change Order to the Contract Time, including, without limitation, the following: (1) Delay caused by an act or omission of Contractor or a Subcontractor, of any Tier, constituting negligence, willful misconduct, a violation of an Applicable Law or a failure by Contractor or any Subcontractor, of any Tier, to comply with the Contract Documents; (2) Delay for which Contractor has failed to provide a timely and complete Notice of Delay or Request for Extension; or (3) Delay associated with any circumstances where the costs or risk associated with such circumstances are designated in the Contract Documents as being at Contractor's risk or Contractor's Own Expense.

§ 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 During the course of the Work, should any conflict be found in or between the Contract Documents, the Contractor shall be deemed to have estimated the Work on the basis of the greater quantity or better quality, or the most stringent requirement, unless the Contractor obtained a decision in writing from the Architect as to what shall govern before the submission of the Contractor's proposal. The Architect, in case of such conflict, may interpret or construe the documents so as to obtain the most substantial and complete performance of the Work consistent with the Contract Documents and reasonably inferable therefrom, in the best interest of Owner, and the Architect's decision shall be final. The terms and conditions of this clause shall not relieve any party of any other obligation under the Contract Documents.

§ 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 Relation of Specifications and Drawings

General Requirements in the Specifications govern the execution of all Specifications. Summary paragraphs present a brief indication of the Work, but do not limit the Work as later detailed. The Drawings and Specifications are correlative and have equal authority and priority. 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. If Drawings and Specifications are not in concurrence regarding quantity or quality, Contractor shall request interpretation from the Architect. For purposes of construction, the Architect shall determine in writing 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.

§ 1.2.4.1 Drawings are in part diagrammatic, and do not necessarily show complete details of construction, materials, or their performance, or installation, and do not necessarily show how construction details or other items of work or fixtures or equipment may affect any particular installation. These shall be ascertained by the Contractor from the Architect and correlated to bring the parts together to a complete whole.

§ 1.2.4.2 All dimensions shall be verified by field measurements and all work laid out to permit pipes, valves, ductwork, lights, panels, other items of construction, to be located as closely as possible to locations shown. All items shall be checked before installation to determine that they can be concealed properly, if appropriate, and that they clear any structural components, supports for other items, and cabinets and equipment or other mechanical, electrical or architectural items having fixed locations.

§ 1.2.4.3 Work shall be laid out to assure ready accessibility to valves, fittings, and other items requiring servicing, adjustment or checking.

§ 1.2.4.4 Actual physical dimensions of specified stock items shall govern over dimensions shown for work to receive stock items. Custom items or modified stock items shall be fabricated to dimensions shown, or to fit into other dimensioned work.

§ 1.2.4.5 If Work is required in a manner which makes it impossible to produce the specified quality of Work, or should errors, omissions, or discrepancies exist in the Contract Documents, the Contractor shall request in writing an interpretation before proceeding with Work. If Contractor fails to make such a written request, no excuse or claim will thereafter be entertained for failure to carry out Work in a satisfactory manner as specified by Contract Documents. Should conflict occur in or between Drawings and Specifications which should reasonably have been ascertained by the Contractor, Contractor is deemed to have estimated and included in the Contract Sum the more expensive way of doing the Work.

§ 1.2.5 Materials, Equipment and Processes

The mechanical, electrical, and plumbing drawings show the general arrangement and extent of the Work. Exact location and arrangement of the various parts shall be determined with the approval of the Architect after equipment has been selected and as the Work progresses.

§ 1.2.5.1 All Work shall, insofar as possible, be installed in such a manner as will not interfere with architectural or structural portions of the building. Should changes become necessary because of a failure of the Contractor to comply with the bidding instructions concerning equipment requiring area not shown on the Construction Documents, the Contractor shall be fully responsible for completing any required modifications or eliminating any interferences. The Contractor shall be required to submit material data and drawings on all equipment, which may vary from the Drawings and Project Manual, and any interferences must be eliminated before Work proceeds.

§ 1.2.5.2 Where in the Project Manual, Specifications, and Drawings, certain products, manufacturer's trade names, or catalog numbers are given, it is done for the express purpose of establishing a standard of function, dimension, appearance, and quality of design, in harmony with the Work, and is not intended for the purpose of limiting competition. Where particular items are specified, products of those named manufacturers are required unless Contractor submits for consideration proposed substitutions of materials, equipment or processes from those set out in the Contract Documents. Submittals of proposed substitutions should contain sufficient information to allow the Architect and Owner to determine if the proposed substitution is in fact equal to or better than the requirements in the Contract Documents. Contractor shall bear all risk caused by submitting substitutions, including all costs. The Owner may approve substitutions only when the substitution is clearly provided by the Contract to be equal in performance characteristics to the requirements of the Contract Documents, equally compatible with the existing installations, and complementary to the architectural design for the Work. Certain specified construction and equipment details may not be regularly included as part of the named manufacturer's standard catalog equipment but shall be obtained by the Contractor from the manufacturer as required for the proper evaluation and/or functioning of the equipment. Reasonable minor variations in equipment are expected and will be acceptable, if approved in advance by the Architect and Owner; however, indicated and specified performance and material requirements are the minimum. The Owner and the Architect reserve the right to determine the equality of equipment and materials that deviate from any of the indicated and specified requirements. Materials or equipment shall not be substituted unless the Architect has specifically accepted such substitution for use on this Project in writing.

§ 1.2.5.3 Diagrammatic indications of piping, ducts, conduit, and other similar items are subject to adjustment to obtain required grading, passage over, under or around obstructions, to avoid exposure to finished areas, or unsightly, obstructing conditions. Contractor shall be responsible for coordination of these adjustments and recommending alternate solutions whenever design details affect construction feasibility, costs, or schedules. All manufactured articles, materials, and equipment shall be incorporated into the Work in accordance with the manufacturer's written or printed directions and instructions unless otherwise indicated in the Contract Documents.

§ 1.2.6 Standards and Requirements

When the Work is governed by reference to standards, building codes, manufacturers' instructions, or other documents, unless otherwise specified, the current edition as of the date of execution of the Agreement shall apply. Requirements of public authorities apply as minimum requirements only and do not supersede more stringent specified requirements.

§ 1.2.7 Errors in Construction Documents

The Owner and Contractor agree that the Contract Documents may not be free from errors, inconsistencies, or omissions. The Contractor stipulates and agrees that the Owner has no duty to discover any errors, inconsistencies, or omissions in the Drawings, Plans, Specifications and other Construction Documents, and has no duty to notify Contractor of same. Owner makes no warranty as to the completeness, adequacy, and accuracy of any Drawings, Plans, Specifications or other Construction Documents, either express or implied. Execution of the Contract by the Contractor is a representation that the Contractor has thoroughly reviewed and become familiar with the Contract Documents and that the Contractor is not aware of any errors, inconsistencies, or omissions in the Contract Documents which would delay the Contractor in the performance of the Contract Work. The Contractor shall not be entitled to any damages or increase in the Contract Sum due to delays or disruptions to the Work.

§ 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 All ownership rights, whether common law, statutory, or other reserved rights, including copyright ownership, of the Instruments of Service/Construction Documents, are controlled by the Agreement between the Owner and the Architect. The Contractor, Subcontractors, Sub-subcontractors, and suppliers shall not own or claim a copyright in the Instruments of Service or Construction Documents. The Owner holds perpetual right to use all of the Instruments of Service / Construction Documents for this Project. 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 any 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 copyright holder. All copies of the Instruments of Service and Construction Documents, except the Contractor's record set, shall be returned or suitably accounted for to the copyright holder upon completion of the Work.

§ 1.6 Notice

§ 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 shall be deemed to have been duly served if delivered to the individual for which it was intended in person, by registered or certified mail, return receipt requested, by courier service providing proof of delivery, or by electronic transmission (facsimile or email), with electronic confirmation of receipt, if a method for electronic transmission is set forth in the Agreement. For notices delivered by electronic transmission and received after 5:00 p.m. on a day on which the recipient's offices are open, or on a weekend, Holiday, or other day on which the recipient's offices are closed, notice shall be deemed to have been duly served on the next day on which the recipient's offices are open.

§ 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, return receipt requested, or by courier providing proof of delivery.

§ 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, including, in the Owner's sole discretion, using 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. Notwithstanding any provision herein to the contrary, if the parties agree to an exchange of electronic data/CAD files, such transfer shall be in accordance with the following requirements: the seals and signatures shall be removed from any Drawings or Project Manual and the following statement substituted: The record copy of this Drawing or Project Manual is on file at the Architect's office. This electronic document is released for the purposes of reference, coordination and/or facility management under the authority of Texas Registration Number Architect License No. (insert License #). Any modification of this Drawing or Project Manual shall be in compliance with the Texas Board of Architectural Examiner's rules.

§ 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 Section 1.7, above, or any use of Contract Documents or any other information or documentation in digital form inconsistent with those protocols set forth in Section 1.7, above, shall be at the using or relying party's sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building information model, and each of their agents and employees.

§ 1.9 Parties to Consult

§ 1.9.1 Representatives of the Owner, Contractor, and Architect shall meet periodically at mutually agreed upon intervals for the purpose of establishing procedures to facilitate cooperation, communication and timely responses among the participants. By participating in this arrangement, the parties do not intend to create additional contractual obligations or modify the legal relationships which may otherwise exist.

§ 1.9.2 Contractor acknowledges that the Contract Sum reflects Owner's absolute budgetary limit for the Costs of the Work. Should the Contractor become aware of circumstances with respect to the Work that, if not addressed or remedied would lead to a cost overrun, it shall immediately notify Owner and Architect of the existence of such circumstances and its recommendation for addressing the circumstances, including any possible elimination or offset of the cost overrun. If at any time circumstances arise that might result in the Contract Sum being exceeded, the Owner, Contractor and Architect shall consult and revise the Drawings and Project Manual (including, but not limited to consideration of substitutions of materials) in such fashion as to cause the Work as revised to be accomplished for the Contract Sum; provided that no such revision shall result in a material diminishment of the square footage of the instructional facilities.

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 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, including, but not limited to, a Change Order or Construction Change Directive modifying the Contract Sum or an extension to the date of Substantial or Final Completion. The Board of Trustees may designate in writing one or more persons to represent the Owner and act on its behalf for such matters, as well as day-to-day operations under the Contract, in accordance with the current policy of the Board of Trustees; however, such representatives shall have the authority to bind the Owner only to the extent expressly authorized by the Owner and shall have no implied authority. Neither Architect nor Contractor may rely upon the direction of an employee of Owner who has not been designated as set forth herein, and Owner shall not be responsible, financially or otherwise, for actions taken by the Architect or Contractor in reliance upon direction from unauthorized persons. Except as otherwise provided in Section 4.2.1, the Architect does not have the authority to bind the Owner with respect to matters requiring Owner's approval or authorization. The Owner has contracted with the Architect who will carry out the functions of administration of the Project and the initial arbiter of Claims as identified in Section 15.2.

§ 2.1.2 The presence of the Owner, the Owner's representative(s) or Architect at the Work site does not imply acceptance or approval of the Work.

§ 2.1.3 The Owner may require that the Contractor use and/or respond to certain Owner-furnished forms or inquiries during the course of the Project. From time to time, there may be future revisions, changes, additions or deletions to these forms. The fact that the Owner modifies and increases reasonable reporting requirements shall not serve as the basis for a claim for additional time or compensation by the Contractor.

§ 2.2 Intentionally 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. Contractor shall pay for all permit fees and inspection fees required for performance of the Work other than inspection and testing fees which the Owner contracts for separately with a third party, and Certificates of Occupancy fees. All of such fees shall be considered Cost of the Work unless the Contractor is required to pay for them without reimbursement due to the Contractor's fault under other provisions of the Contract Documents.

§ 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 whose status under the Contract Documents shall be that of the Architect. Owner shall notify Contractor if a new Architect has been employed by Owner.

§ 2.3.4 If requested in writing to do so by the Contractor prior to the start of the Work, the Owner may, at the Owner's sole discretion, furnish surveys known to the Owner describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. Owner does not guarantee the accuracy of surveys provided, including the locations of utility lines, cables, pipes, or pipelines, or the presence or absence of easements. The Contractor shall not be entitled to rely on the accuracy of information furnished by the Owner and shall exercise proper diligence and take appropriate precautions relating to the safe performance of the Work. THE OWNER DOES NOT IN ANY WAY REPRESENT, WARRANT OR GUARANTY TO CONTRACTOR OR TO ANY OTHER PERSON THE RELIABILITY, CONSTRUCTABILITY, COMPLETENESS, OR ACCURACY OF ANY SURVEYS, REPORTS, STUDIES, TESTS, ARCHITECTURAL OR ENGINEERING PLANS, OR SIMILAR INFORMATION PROVIDED BY OWNER IN CONNECTION WITH THIS CONTRACT, NOR DOES THE OWNER REPRESENT, WARRANT OR GUARANTY THAT SUCH INFORMATION IS FREE FROM DEFECTS, ERRORS OR DEFICIENCIES, AND ALL SUCH REPRESENTATIONS, WARRANTIES AND GUARANTIES ARE HEREBY EXPRESSLY DENIED AND DISCLAIMED. The Owner shall not be liable to the Contractor or any other person for breach of warranty or misrepresentation in the event of any errors or deficiencies in such information provided to the Contractor by the Owner. The Owner's provision of a survey will not relieve the Contractor from its obligations to examine the site or exercise proper precautions relating to the safe performance of the Work.

§ 2.3.5 Information or services required of the Owner by the Contract Documents shall be furnished by the Owner within a reasonable time following actual receipt of a written request. Absent such timely request by Contractor,

any Claim based upon lack of such information or services shall be waived. The Owner shall not be required to expend any funds to obtain such information unless Owner agrees to do so.

§ 2.3.6 Unless otherwise provided in the Contract Documents, the Owner shall furnish to the Contractor one .pdf copy of the Contract Documents for purposes of making reproductions pursuant to Section 1.5.2. The cost of reproductions will be borne by the Contractor.

§ 2.4 Owner's Right to Stop the Work

If the Contractor fails to correct non-conforming or defective Work as required by Section 12.2, or fails to complete the Work on time as required by the Contract or is in default of any of its material obligations hereunder, the Owner, by a written order signed by an agent specifically so empowered by the Owner, may order 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 any duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity. This right shall be in addition to, and not in restriction of, the Owner's rights under Section 12.2.

§ 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 within a three-day period after receipt of 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 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 Owner or 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 actual cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's and other consultants' additional services and expenses made necessary by such default, neglect, or failure. If current and future payments are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner within thirty (30) days after receipt of written notice from the Owner therefor. 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.

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. If the Work is performed under a Construction Manager at Risk delivery method, the term "Contractor" shall include the Construction Manager or its authorized representative.

§ 3.1.2 The Contractor shall perform the Work in accordance with the Contract Documents and in a good and workmanlike manner except to the extent the Contract Documents expressly specify a higher degree of finish or workmanship. Workmanship shall be of a quality to produce first class results. This shall mean that all material shall be installed in a true and straight alignment, level and plumb, patterns shall be uniform, and jointing of materials shall be flush and level unless otherwise directed in writing by the Architect. All labor shall be performed in the best manner by laborers, workers, and mechanics skilled in their respective trades.

§ 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 in the Architect's administration of the Contract, activities of the Owner (or Owner's Program Manager, if applicable), or by tests, inspections or approvals required or performed by persons or entities other than the Contractor.

§ 3.1.4 By submission of a proposal, the Contractor represents and warrants the following to the Owner (in addition to the other representations and warranties contained in the Contract Documents), as an inducement to the Owner to execute this Contract, which representations and warranties shall survive the execution and delivery of the Contract and the Final Completion of the Work: (1) that the Contractor is financially solvent, able to pay its debts as they mature, and possessed of sufficient working capital to complete the Work and perform its obligations under the Contract Documents; (2) that the Contractor is able to furnish the plant, tools, materials, supplies, equipment, and

labor required to timely complete the Work and perform its obligations hereunder and that the Contractor is sufficiently experienced and competent to do so; (3) that the Contractor is authorized to do business in the State where the Project is located and properly licensed by all necessary governmental, public, and quasi-public authorities having jurisdiction over the Contractor, the Work, or the site of the Project; and (4) that the execution of the Contract and its performance thereof are within the Contractor's duly-authorized powers.

§ 3.1.5 Pursuant to Texas Education Code Section 44.034, Contractor must give advance written notice to the Owner if the Contractor or an owner or operator of the Contractor has been convicted of a felony. The Owner may terminate the Contract if the Owner determines that the Contractor failed to give such notice or misrepresented the conduct resulting in the conviction. This paragraph requiring advance notice does not apply to a publicly-held corporation.

§ 3.1.6 Contractor, its Subcontractors, Sub-subcontractors, suppliers, and other vendors shall bear responsibility for compliance with all applicable state and federal laws, regulations, guidelines, and ordinances applicable to the Work, including but not limited to, laws concerned with labor, equal employment opportunity, safety, minimum wages, and prevailing wage rates. Contractor further recognizes that the Owner and Architect do not owe the Contractor or any Subcontractor, Sub-subcontractor, supplier, or other vendor any duty to supervise or direct its work so as to protect such party from the consequences of its own conduct. Without limiting the foregoing, the Owner reserves the right to utilize one or more of its employees to function in the capacity of the Owner's inspector, whose primary function will be daily inspections, checking pay requests, construction timelines, and storage of supplies and materials.

§ 3.1.7 The Contractor shall disclose the existence and extent of any financial interests, whether direct or indirect, such Contractor may have in any Subcontractor, Sub-subcontractor, supplier, and other vendor which the Contractor may propose for the Project.

§ 3.1.8 It is understood and agreed that the relationship of Contractor to Owner shall be that of an independent contractor. Nothing contained the Contract or inferable therefrom shall be deemed or construed to: (1) make Contractor the agent, servant or employee of the Owner; or (2) create any partnership, joint venture, or other association between Owner and Contractor. Any direction or instruction by Owner in respect of 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 as described herein.

§ 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. Contractor also represents by its execution of the Contract; that the Contractor has thoroughly reviewed all of the Contract Documents and that based on such review and to the best knowledge of Contractor as a contractor, not as a design professional, that said Contract Documents are sufficient to enable the Contractor to determine the Contract Sum and that the Contract Documents are sufficient to enable it to perform the Work described in the Contract Documents, and otherwise to fulfill all its obligations hereunder in accordance with the terms of the Contract. The Contractor further acknowledges and declares that it has visited and examined the site (but only as to visible surface conditions or conditions ascertainable from the results of any subsurface tests required or provided in connection with this Project; or other reports and documents available to the Contractor) and reasonably examined the physical, legal and other conditions affecting the Work including, without limitation, all soil, subsurface, water, survey and engineering reports and studies delivered to or obtained by Contractor and the conditions described in this Section 3.2.1. In connection therewith, Contractor, by execution of the Contract will be representing and warranting to Owner that it has, by careful examination, satisfied itself as to the conditions and limitations under which the Work is to be performed, including, without limitation, (1) the location, layout and nature of the Project site and surrounding areas, (2) generally prevailing climatic and weather conditions, (3) anticipated labor supply and costs, (4) availability and cost of materials, tools and equipment and (5) other similar issues. In arriving at the Contract Sum, the Contractor has, as an experienced and prudent manager and contractor, exercised its reasonable judgment and expertise to include the impact of such circumstances upon the Contract Sum.

1. Claims for additional compensation or time because of the failure of the Contractor to familiarize itself with visible surface conditions at the site or other conditions under which the Work is to be performed will not be allowed.

- 2 The Owner assumes no responsibility or liability for the physical condition or safety of the Project site or any improvements located on the Project Site. The Contractor shall be solely responsible for providing a safe place for the performance of the Work. The Owner shall not be required to make any adjustment in the Contract Sum, Guaranteed Maximum Price, if applicable, or Contract Time in connection with any failure by the Contractor or any Subcontractor to comply with the requirements of this Section 3.2.
- 3 The Contractor represents that the Subcontractors, manufacturers and suppliers engaged or to be engaged by it are and will be familiar with the requirements for performance by them of their obligations. All contracts with subcontractors and suppliers shall be in writing and shall reflect the terms of this Contract which directly or indirectly affect subcontractors or suppliers, including Owner's right to withhold payment, retainage requirements, and Owner's rights and liability on termination of this Contract. The Contractor shall require compliance with the terms and provisions of the Contract Documents applicable to them, including, without limitation, the requirement for subcontractors to comply with the prevailing wage rates established in the Contract, to maintain worker's compensation coverage on employees, and to provide certification of such coverage to Contractor.

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.3.4, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor. In addition, as part of the Contractor's preconstruction services, in reviewing the Contract Documents, the Contractor shall endeavor to detect any errors, omissions, or inconsistencies in the design and other documents which affect the performance or constructability of the Work. The Contractor shall promptly report to the Architect and the Owner 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. 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. If, in the opinion of the Architect or the Owner, the Contractor does not make a reasonable effort to comply with the above requirements or such information was available to the Contractor from a careful study and comparison of the Contract Documents, field conditions, Owner-provided information, Contractor-prepared coordination drawings, or prior Project correspondence or documentation, and this causes the Architect or its Consultants to expend additional time in the discharge of the duties imposed by the Contract Documents, then the Contractor shall bear the cost of compensation for the Architect's and its consultants' additional services and expenses made necessary by the Contractor's failure and the Owner shall be entitled to deduct such amounts from the Contract Sum. The Architect will give the Contractor prior notice of intent to bill for additional services and expenses before additional services are performed or additional expenses are incurred.

- 1 The exactness of grades, elevations, dimensions, or locations given on any Drawings issued by the Architect, or the work installed by other contractors, is not guaranteed by the Owner. The Contractor shall, therefore, satisfy itself as to the accuracy of all grades, elevations, dimensions, and locations. In all cases of interconnection of its Work with existing or other work, it shall verify at the site all dimensions relating to such existing or other work. Any errors due to the Contractor's failure to so verify all such grades, elevations, dimensions, or locations shall be promptly rectified by the Contractor without any additional cost to the Owner.

§ 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 and the Owner any nonconformity in the Contract Documents with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities that is discovered by or made known to the Contractor as a request for information in such form as the Architect or Owner may require. The Owner 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.

§ 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 notify the Owner prior to incurring such additional cost or expending such additional time, or if Contractor cannot reasonably provide notice prior to incurring costs or expending additional time, then as soon thereafter as reasonably possible, but not later than 10 Calendar Days, and may 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 including any extra efforts as required to bring the project back into alignment with the original schedule. 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 and limitations of the Contractor's ability to satisfactorily perform the Work or to honor an applicable warranty, and limitations of or interference with the Owner's intended use, caused by products or systems specified except when: (1) such errors, inconsistencies, omissions, differences, nonconformities, or limitations are the fault of Contractor, in whole or in part, (2) the Contractor failed to discover such errors, inconsistencies, omissions, differences, or nonconformities due to its failure to properly perform the obligations of Section 3.2.2 or 3.2.3, (3) the Contractor recognized such errors, inconsistencies, omissions, differences, nonconformities, or limitations and failed to report them to the Architect and the Owner, or (4) the Contractor should have detected such errors, inconsistencies, omissions, differences, nonconformities, or limitations as part of Contractor's performance of its obligations under the Contract Documents, including the performance of Contractor's preconstruction services.

§ 3.2.5 Notwithstanding the delivery of a survey or other documents by the Owner, prior to performing any Work, Contractor shall, if applicable, independently determine the location of 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 the Work in such a manner so as to avoid damaging any such lines, cables, pipes, and pipelines. Contractor shall be responsible for any damage done to such utility lines, cables, pipes and pipelines during its Work, and shall be responsible for any loss, damage, or extra expense resulting from such damage. Repairs shall be made immediately to restore all service. Any delay for such break shall be attributable to Contractor. In addition, Contractor shall, if applicable, review the appropriate AHERA and hazardous materials surveys for the particular site(s) involved in the Project, and shall notify all Subcontractors and Sub-subcontractors of the necessity to review said surveys. Contractor shall perform the Work in such a manner as to avoid damaging, exposing, or dislodging any asbestos-containing materials that are clearly identified and located in AHERA and other hazardous material surveys. Before performing any portion of the Work, the Contractor shall fully investigate all physical aspects of the Project site and verify all dimensions, measurements, property lines, grades and elevations, existing improvements, and general suitability of existing conditions at the Project site. If applicable, Contractor shall comply with U.S. Environmental Protection Agency rules concerning renovating, repairing or painting work in schools built prior to 1978 involving lead-based paint.

§ 3.2.6 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 an applicable warranty, or will result in a limitation of or interference with the Owner's intended use, then the Contractor shall promptly notify the Architect and Owner in writing, providing substantiation for its position.

§ 3.2.7 The Contractor shall arrange meetings prior to commencement of the Work of all major Subcontractors to allow the Subcontractors to demonstrate an understanding of the Contract Documents to the Architect and to allow the Subcontractors to ask for interpretations, when necessary. 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, drainage 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.

§ 3.3 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 that 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 propose alternative means, methods, techniques, sequences, or procedures. Contractor shall not proceed with that portion of the Work without further written instructions from the Architect. If the Contractor is then instructed to proceed without acceptance of changes proposed by the Contractor, the Contractor shall not be responsible for any resulting loss or damage to the extent that the acceptance of Contractor's proposed alternative means, methods, techniques, sequences, or procedures would have avoided such loss or damage.

§ 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.

§ 3.3.2.1 Contractor shall, before any duties are performed on Owner's property where students are present (and with respect to additional employees/applicants hired or assigned to perform services on Owner's property during the term of the Contract with Owner, before or immediately after employing or securing the services of such additional employee/applicant), and at least annually thereafter, comply with all requirements relating to criminal history information required by Texas Education Code Chapter 22, unless Owner, in its sole discretion, determines in writing that an exception applies under Section 22.0834(a-1) of the Texas Education Code regarding certain employees/applicants of public works contractors, subject to Contractor's and all Subcontractors' compliance with Section 22.0834 of the Texas Education Code. Before beginning any Work on the Project, Contractor will provide written certifications and fitness determinations and all information requested by Owner to the Owner (including, without limitation, all covered employees' written consent to the release of their criminal history record information to Owner, so that the Owner may obtain criminal history record information on such individuals). In addition, Contractor shall certify to Owner that Contractor has complied with all applicable statutory requirements as of that date. 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 Owner. Upon request by Owner, Contractor will provide, in writing, updated certifications and fitness determinations and the names and any other requested information regarding individuals to whom Chapter 22 applies (including, without limitation, such individuals' written consent to the release of their criminal history record information to Owner), so that the Owner may obtain criminal history record information on such individuals. Contractor shall be solely responsible to send or ensure that each covered employee sends to the Texas Department of Public Safety (DPS) all information that may be required by DPS for obtaining national criminal history record information, which may include, but is not limited to, a complete set of the person's fingerprints and a recent electronic digital image photograph of the person. Contractor shall assume all expenses associated with obtaining criminal history record information. It shall be the responsibility of the Contractor and the entities with which the Contractor contracts to ensure compliance with this provision.

§ 3.3.2.1.1 Subcontractors or any Subcontracting entity, as defined by Texas Education Code Chapter 22, shall be required by the terms of their contract with Contractor or any other contracting entity (as defined in Texas Education Code Chapter 22), and by Texas law, to comply with all requirements relating to criminal history record information on their employees, agents, or applicants, to give required certifications and fitness determinations and provide all information requested by Owner to Owner and the contracting entities (including, without limitation, such individuals' written consent to the release of their criminal history record information to Owner, so that the Owner may obtain criminal history record information on such individuals), and to obtain required certifications/fitness determinations/compliance from the subcontracting entity's subcontractors. Subcontractors shall be solely responsible to send or ensure that each covered employee sends to DPS all information that may be required by DPS for obtaining national criminal history record information, which may include, but is not limited to, a complete set of the person's fingerprints and a recent electronic digital image photograph of the person.

§ 3.3.2.1.2 Contractor/Subcontractor will not assign any "covered employees" with a "disqualifying criminal history," as those terms are defined below, to work on the Project. If Contractor/Subcontractor at any time receives information that a covered employee has a reported disqualifying criminal history, then Contractor/Subcontractor will immediately remove the covered employee from the Project and notify the Owner in writing within three (3) business days. If Owner at any time, in its sole discretion, objects to the assignment of a covered employee for any reason, including, but not limited to, on the basis of the covered employee's criminal history record information and/or insufficient qualifications, lack of experience, and the like, based on information gathered by Owner through

the procurement and/or contracting processes, Contractor/Subcontractor agrees to discontinue using that covered employee to provide services on Owner's Project. If Contractor/Subcontractor has (1) taken precautions or imposed conditions to ensure that the employees of Contractor or any Subcontractor will not become covered employees, or (2) certified to Owner conditions or precautions resulting in the determination that the criminal history record information requirements do not apply to its employees or applicants for employment (pursuant to the exception for certain employees/applicants of public works contractors under Texas Education Code Section 22.0834(a-1)), Contractor/Subcontractor shall ensure that the precautions or conditions continue to exist throughout the time that the contracted services are provided.

§ 3.3.2.1.3 For the purposes of this Section 3.3.2.1, "covered employees" means employees, agents or Subcontractors of Contractor or a Subcontractor who have or will have continuing duties related to the service to be performed on Owner's Project and have or will have direct contact with Owner's students. "Disqualifying criminal history" means: (1) a conviction or other criminal history information designated by Owner; or (2) a felony or misdemeanor offense that would prevent a person from being employed under Texas Education Code § 22.085(a), that is: (a) conviction of a felony offense under Title 5, Texas Penal Code if at the time of the offense, the victim was under 18; (b) conviction of or placement on deferred adjudication community supervision for an offense for which a defendant is required to register as a sex offender under Chapter 62, Texas Code of Criminal Procedure; or (c) conviction of an offense under federal law or the laws of another state that is equivalent to (a) or (b). Owner shall be solely responsible for making the final determination of what constitutes direct contact with Owner's students and what constitutes a disqualifying criminal history.

§ 3.3.2.2 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 Contractor's 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 or possessing weapons, speaking profane and/or offensive language, or engaging in any inappropriate interactions of any nature whatsoever with Owner's students or employees, including talking, touching, staring or otherwise contributing to a hostile or offensive environment for Owner's students or employees. 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 or the general public. Sexual harassment is strictly forbidden. Any employee of the Contractor or a Subcontractor who is found to have engaged in any such conduct shall be subject to appropriate disciplinary action by the Contractor or Subcontractor, including immediate removal from the job site.

§ 3.3.2.3 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, including wearing shirts at all times, and "badging" of Contractor's employees, Subcontractors, and all other persons carrying out the Work on the job site for identification. Contractor shall ensure that all construction workers, whether Contractor's own forces or the forces of Contractor's Subcontractors, wear identification tags on the front of their persons during all times that they are on Owner's property. Such identification tags shall contain a current photograph and the worker's name in a typeface large enough to be seen from a reasonable distance. Contractor shall furnish to Owner (and update, as appropriate) photo identification of all workers and employees.

§ 3.3.2.4 Contractor shall require all construction workers, whether Contractor's own forces or the forces of Contractor's Subcontractors, to park their personal motor vehicles on Owner's property only in the parking places designated by the Owner's campus principal or other facility administrator. Any vehicles not parked in the appropriate locations shall be towed at the vehicle owner's sole expense.

§ 3.3.2.5 Contractor shall follow, and shall require all employees, agents and subcontractors to follow, the tree ordinance of the municipality in which the Project is located. In addition, if not covered by the municipal tree ordinance, Contractor shall barricade and protect all trees on the Project, which shall be included in the Cost of the Work.

§ 3.3.2.6 Contractor shall institute a theft deterrence program designed to restrict construction worker access to properties of Owner that are currently in use, to maintain supervision of Contractor's and Contractor's Subcontractor's forces, and to reimburse the Owner or those persons suffering a theft loss which results from

Contractor's forces or Contractor's Subcontractor's forces' actions, omissions, or failure to secure the Work or connecting or adjacent property. All such programs shall be paid as General Conditions.

§ 3.3.2.7 Any individual found by Owner to have violated the standards of conduct or restrictions set forth in Section 3.3.2 is subject to immediate removal from the job site and, in Owner's sole discretion, permanent removal from the Project or all construction on any of Owner's property. Repeated removal of Contractor's or Contractor's Subcontractor's forces, or one serious infraction, shall constitute a material breach of the Contract justifying the immediate termination by Owner pursuant to Article 14. THE CONTRACTOR HEREBY RELEASES, INDEMNIFIES AND HOLDS HARMLESS THE OWNER FROM AND AGAINST CONTRACTOR'S AND ANY SUBCONTRACTOR'S FORCES' NON-COMPLIANCE WITH THE STANDARDS OF CONDUCT OR RESTRICTIONS SET FORTH IN SECTION 3.3.2, NON-COMPLIANCE WITH CRIMINAL LAW, AND NON-COMPLIANCE WITH IMMIGRATION LAW OR REGULATIONS. Contractor shall place similar language in its subcontract agreements, requiring its Subcontractors and Sub-subcontractors to be responsible for their own forces, and Contractor shall cooperate with the Owner to ensure Subcontractor and Sub-subcontractor compliance.

§ 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. Copies of inspection reports, photographs or other related records shall be made available to the Owner for review if requested. Reports and documentation shall be formatted and developed in a logical format indicating dates, time of day, findings and the person performing the inspection.

§ 3.3.4 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 the 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.

§ 3.3.5 The Contractor has the responsibility to ensure that all materials suppliers and Subcontractors, Sub-subcontractors, suppliers, and their agents, and employees adhere to the Contract Documents, and that they order materials on time, taking into account the current market and delivery conditions and that they provide materials on time. The Contractor shall properly and efficiently coordinate the timing, scheduling, and routing of its Work with that of all trades, Subcontractors, and others on the Project including deliveries, storage, installations and construction utilities. The Contractor shall be responsible for the space requirements, locations, and routing of all materials and equipment required under the Agreement or other Contract Documents. In areas and locations where the proper and most effective space requirements, locations, and routing cannot be made as indicated, the Contractor shall meet with all others involved, before installation, to plan the most effective and efficient method of overall installation.

§ 3.3.6 Contractor acknowledges that the Work may be performed in connection with a facility which may be currently occupied and in use. It is imperative that Contractor's operations and the performance of the Work not interfere with, interrupt, disturb, or disrupt Owner's normal operations or facilities. Contractor agrees to and shall comply with all rules, regulations and requirements of the Owner and the facility on which the Work is to be performed, and shall take all steps necessary to protect and guard the safety of the employees, students and invitees of Owner. Contractor shall exercise the utmost skill and judgment to ensure that continuing construction activity will not interfere with the use, occupancy and quiet enjoyment of facilities in use on the site. Contractor recognizes that the ongoing activities in proximity with its construction activities shall result in the need for prompt and effective coordination of its services with those involved in the ongoing utilization of the premises. Such coordination and adequate site access shall be the responsibility of Contractor. When Work occurs in existing facilities, Contractor understands and accepts the cost and schedule impacts associated with work in existing facilities and the potential delays and disruptions to the progress of the Work and has considered such delays and disruptions in the Contract Sum. The Contractor shall perform all the Work in such a manner as to cause minimum interference with the operations of the Owner and other Contractors and Subcontractors on the site, and shall take, and cause the Contractor's and its Subcontractor's employees, agents, licensees and permittees to take all necessary precautions to protect the Work and the site and all persons and property thereon from damage or injury. Contractor shall not

request access to the Project, or request the presence of the Owner or presence of Owner's Consultants during non-working times unless the Contractor has demonstrated full-time, fully staffed performance of the Work during Regular Work Days. Owner shall not be obligated to comply with properly submitted requests.

§ 3.3.7 Representatives of the Owner, Contractor, and Architect shall meet periodically at mutually agreed upon intervals, for the purpose of establishing procedures to facilitate cooperation, communication, and timely responses among the participants. By participating in this arrangement, the parties do not intend to create additional contractual obligations or modify the legal relationships which may otherwise exist.

§ 3.3.8 The Owner may require that the Contractor use and/or respond to certain Owner-furnished forms or inquiries during the course of the Project. From time to time, there may be future revisions, changes, additions or deletions to these forms. The fact that the Owner modifies and increases reasonable reporting requirements shall not serve as the basis for a claim for additional time or compensation by the Contractor.

§ 3.3.9 In the event Contractor shall fall behind schedule at any time, for any reason, Owner shall be entitled to direct acceleration or resequencing of the Work to bring the Work back on schedule. Contractor shall be entitled to compensation for such acceleration only (a) to the extent necessitated by excusable and compensable delays, and (b) to the extent of premium pay and additional equipment cost actually incurred by Contractor. In the event Contractor determines that the Scheduled Completion Date cannot be met by resequencing the Work, then Contractor shall immediately provide to the Owner, and in any event within seven (7) days after the date of receipt of any request by Owner for resequencing or acceleration, a plan to complete the Work in the shortest possible time. No approval by the Owner of any plan for resequencing or acceleration of the Work submitted by Contractor pursuant to this paragraph shall constitute a waiver by Owner of any damages or losses which Owner may suffer by reason of such resequencing or the failure of Contractor to meet the Scheduled Completion Date.

§ 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.

§ 3.4.1.1 The Contractor and any Subcontractor or Sub-subcontractor on the Project shall properly classify, as an employee or an independent contractor, in accordance with the Fair Labor Standards Act, its implementing regulations, and Texas Labor Code Section 214.008, any individual the Contractor, Subcontractor, or Sub-subcontractor directly retains and compensates for services performed in connection with the Contract. Any Contractor, Subcontractor, or Sub-subcontractor who fails to properly classify such an individual may be subject to the penalties of Texas Labor Code Sec. 214.008(c).

§ 3.4.1.2 Attention is called to the Government Code, Chapter 2258, Prevailing Wage Rates. Among other things, this Article provides that it shall be mandatory upon the Contractor, and upon any Subcontractor and Sub-Subcontractor under the Contractor, to pay all laborers, workers, and mechanics employed or utilized by them in the execution of the Contract not less than the prevailing rates of per diem wages for work of a similar character in the locality at the time of construction.

§ 3.4.1.3 In accordance therewith Texas Government Code Section 2258 et seq.; Texas Labor Code Section 62.051 et seq, the Owner has established a scale of prevailing wages which is incorporated in the Contract Documents, and not less than this established scale must be paid on the Project. Any workers not included in the schedule shall be properly classified and paid not less than the rate of wages prevailing in the locality of the Work at the time of construction. Wages listed are minimum rates only, and payment greater than the prevailing wage is not prohibited. No claims for additional compensation above the Contract Sum shall be considered by the Owner because of payments of wage rates in excess of the applicable rates provided herein. If no schedule of prevailing wage rates is included in the Contract Documents, then the parties shall, at a minimum, use the wage rates determined by the U.S. Department of Labor for projects located in the County in which the Project is located in accordance with the Davis-Bacon Act, 40 USC 3141-3148, which can be accessed on the internet at <https://sam.gov/content/wage>, determinations, or the wage rates determined by any local contractor association, whichever is higher.

§ 3.4.1.4 The Contractor and each Subcontractor and Sub-Subcontractor shall keep a record showing the name and occupation of each worker employed by the Contractor, Subcontractor, or Sub-subcontractor in the construction of

the Work and the actual per diem wages paid to each worker. Owner reserves the right to receive and review payroll records, payment records, and earning statements of employees of Contractor, and of Contractor's Subcontractors and Sub-subcontractors. These records shall be maintained and made accessible for no less than three (3) years following the date of Final Completion.

§ 3.4.1.5 A Contractor or Subcontractor or Sub-Subcontractor who violates the requirements of Sections 3.4.1.2 or 3.4.1.3 shall pay to Owner the sum of Sixty Dollars and No/100 (\$60.00) for each laborer, worker, or mechanic employed for each calendar day or part of the day that the laborer, worker, or mechanic is paid less than the wage rate stipulated in the scale of prevailing wages applicable to the Project, as required by Texas Government Code Section 2258.023(b).

§ 3.4.1.6 In the event of a complaint of a breach of the requirements in Sections 3.1.6 or 3.4.1, et seq, the Owner shall have the right to make a determination as provided by law, and to retain any amount due under the Contract pending a final determination of the violation. Owner may conduct, at its discretion, wage-related interviews of any worker at the sites of the Work without prior warning to the Contractor or Subcontractor or Sub-Subcontractor.

§ 3.4.1.7 In the event of a strike or stoppage of Work resulting from a dispute involving or affecting the labor employed by the Contractor or any of its Subcontractors or Sub-subcontractors, Owner may, at its option and without any notice required by the Contract, terminate the Contract for default unless the Contractor remedies the strike of Work or Work stoppage or other disruption within twenty (20) calendar days after the dispute arises.

§ 3.4.1.8 The Contractor shall require all Subcontractors and Sub-Subcontractors to comply with the provisions of this Section 3.4.1 and its subparts.

§ 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 prior written consent of the Owner, after evaluation by the Architect and in accordance with a Change Order or Construction Change Directive. Any such substitution request shall be made to the Architect within fifteen (15) days after execution of the Contract.

- .1** Substitutions and alternates may be rejected without explanation and will be considered only under one or more of the following conditions: (i) the proposal is required for compliance with interpretation of code requirements or insurance regulations then existing; (ii) specified products are unavailable through no fault of the Contractor; (iii) and when, in the judgment of the Owner or the Architect, a substitution would be substantially in the Owner's best interests in terms of cost, time, or other considerations.
- .2** The Contractor must submit to the Architect and the Owner (i) a full explanation of the proposed substitution and submittal of all supporting data, including technical information, catalog cuts, warranties, test results, installation instructions, operating procedures, and other like information necessary for a complete evaluation for the substitution; (ii) a written explanation of the reasons the substitution is necessary, including the benefits to the Owner and the Work in the event the substitution is acceptable; (iii) the adjustment, if any, in the Contract Sum; (iv) the adjustment, if any, in the Contract Time and the construction schedule; and (v) an affidavit stating the (a) proposed substitution conforms to and meets all requirements of the pertinent Specifications and the requirements shown on the Drawings, and (b) the Contractor accepts the warranty and correction obligations and will coordinate the installation of the accepted substitute, making such changes as may be required for the Work to be completed in all respects as if originally specified by the Architect. Proposals for substitutions shall be submitted in triplicate to the Architect and the Owner in sufficient time to allow the Architect and the Owner no less than twenty-one (21) Business Days for review, unless a shorter time is agreed upon in writing. No substitutions will be considered or allowed without the Contractor's submittals of complete substantiating data and information as stated herein.
- .3** Whether or not the Owner or the Architect accepts any proposed substitution, the Contractor shall reimburse the Owner for any fees charged by the Architect or other consultants for evaluating each proposed substitute.

§ 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 qualified by training and experience and skilled in tasks assigned to them. The Contractor shall only employ or use labor in connection with the Work capable of working harmoniously with all trades, crafts, and any other individuals associated with the Project. The Contractor shall furnish Owner, on request, resumes of the Contractor's key personnel involved in the day-to-day Work on the Project, as well as a list of all engineers, consultants, subcontractors and suppliers involved in construction. At the written request of the Owner or Architect, the Contractor shall not use in the performance of the Work any engineer, consultant, or employee of the Contractor, Subcontractor or Sub-subcontractor reasonably deemed by Owner to be incompetent, careless, unqualified to perform the Work assigned to him, insubordinate, in violation of any provision in the Contract Documents, or otherwise unsatisfactory to Owner. Contractor shall engage sufficient workers on the Project at all times for the proper coordination and performance of the Work in the time periods required by the Contract. This provision is applicable to Subcontractors, Sub-subcontractors and their employees.

§ 3.4.4 Identification of Employees. Contractor shall require all construction workers, whether Contractor's own forces, or the forces of Contractor's subcontractors, to wear identification tags on the front of their persons during all times that they are on Owner's property. Such identification tags shall have identification of the construction worker by number or other identifying medium in a typeface large enough to be seen from eight feet away if requested to do so.

§ 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 the Work the Contract Documents require or permit. The Contractor further warrants that the Work will be performed and completed in a good and workmanlike manner, continuously and diligently in accordance with the Contract Documents, all applicable building codes, and generally accepted standards of engineering and construction practice for construction of projects similar to the Project, except to the extent the Contract Documents expressly specify a higher degree of finish or workmanship, in which case the standard shall be the higher standard. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse by parties other than Contractor, alterations to the Work not executed by the Contractor, improper or insufficient maintenance (unless such maintenance is Contractor's responsibility), improper operation by parties other than the Contractor, or normal wear and tear and normal usage, but such exclusions shall only apply after Owner has taken occupancy of the portion of the Project at issue. If required by the Architect or the Owner, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment. Warranties shall become effective on a date established by the Owner and Architect in accordance with the Contract Documents. Notwithstanding anything in the Contract Documents to the contrary, Owner and Contractor expressly agree that the warranties stated herein shall mean the individual warranties associated with each particular Work or designated portion thereof within the Project, and each such individual warranty shall run from the date of Substantial Completion of the entire Work (unless otherwise expressly provided in the applicable Contract Documents for that particular Work). Such warranty shall be maintained notwithstanding that certain systems may be activated prior to Substantial Completion as required for the satisfactory completion of the Project. Contractor's warranties herein shall be interpreted to require Contractor to replace defective materials and equipment and re-execute defective Work which is disclosed to the Contractor by the Owner within a period of one (1) year after Substantial Completion of the entire Work or designated portion thereof or, if latent defect, within one (1) year after discovery thereof by Owner. The Contractor shall perform all work reasonably required, to correct Work with errors, omissions, defects or deviations from what is required by the Contract Documents, at no cost to Owner. The warranties set out in this subparagraph are not exclusive of any other warranties, remedies or guarantees set out in other places in the Contract Documents or implied under applicable law, but are in addition to and not in limitation of any other such warranties, remedies, or guarantees.

§ 3.5.2 The Contractor agrees to assign to the Owner at the time of Final Completion of the Work, such assignment to be effective no later than Final Completion, any and all third-party warranties relating to materials, equipment, machinery, components, and labor used in the Work and further agrees to perform the Work in such manner so as to preserve any and all such third-party warranties. Contractor shall take no action or fail to act in any way which results in the termination or expiration of any such third-party warranties or which otherwise results in prejudice to the rights of Owner under such warranties. Contractor's warranties shall in no way limit or abridge the warranties of the manufacturers and suppliers of equipment and systems which are to comprise a portion of the Work and all such

warranties shall be in form and substance as required by the Contract Documents. Contractor agrees to provide all notices required for the effectiveness of such warranties and shall include provisions in the contracts with Subcontractors and Sub-subcontractors and other 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.

§ 3.5.3 The warranty(ies) provided in Section 3.5 and its subparts, including but not limited to Section 3.5.1, shall be interpreted to require Contractor to address failure, errors, omissions, defects, deviations, or other nonconformities of materials, products, or workmanship, defective materials and equipment and re-execute defective Work which is disclosed to the Contractor by the Owner or discovered by the Owner within a period of one (1) year after Substantial Completion of the entire Work or, if latent defect, within one (1) year after discovery thereof by Owner. Upon written notice from the Owner of any defects covered by warranty, the Contractor shall promptly remedy any such defects. If Contractor does not respond to Owner's written notice, either by beginning corrective work or notifying Owner in writing stating when work will begin, within ten (10) days of receipt of the notice or such shorter time as required in the Contract Documents, the Owner may take measures to correct the defects and Contractor will be obligated to reimburse the Owner's costs. Any measures taken by Owner to correct defects due to Contractor's failure to timely respond to Owner's written notice shall not operate to void or otherwise alter any warranties issued by, for, or through the Contractor. 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 will extend beyond the applicable warranty period until the warranty defect is remedied and accepted by the Owner. The provisions of this subparagraph shall be in addition to, and not in lieu of, any other rights and remedies available to Owner. The Owner will determine and assign the warranty priority as follows:

§ 3.5.3.1 Priority 1 - A complete shutdown situation. Owner is unable to operate. Safety or loss of building contents anticipated. Unless shorter response durations exist in the Contract Documents, the Contractor shall provide warranty repair service within 8-hours' notice for warranty notice for the following:

1. Cooler and freezer equipment;
2. Chiller and pumps;
3. Boiler and pump;
4. Lift station;
5. Generator;
6. Elevator;
7. Roof leaks
8. Fire alarm and fire sprinkler malfunction

§ 3.5.3.2 Priority 2 - A major component of Owner ability to operate is affected. Some aspects of the operation can continue but issue is a major problem. Unless shorter response durations exist in the Contract Documents, the Contractor shall provide warranty repair service within 24-hours' notice.

§ 3.5.3.3 Priority 3 - Owner operation is unaffected, but the issue is affecting efficient operation by one or more people. Unless shorter response durations exist in the Contract Documents, the Contractor shall provide warranty repair service within 5-working days' notice.

§ 3.5.3.4 Priority 4 - The issue is an inconvenience or annoying but there are clear workarounds or alternates. Unless shorter response durations exist in the Contract Documents, the Contractor shall provide warranty repair service within 10-working days' notice.

§ 3.5.4 The Contractor shall issue in writing to the Owner as a condition precedent to final payment a "General Warranty" reflecting the terms and conditions of Sections 3.5.1, 3.5.2, and 3.5.3 for all Work under the Contract Documents. This General Warranty shall be assignable.

§ 3.5.5 Except when a longer warranty time is called for in the Contract Documents or is otherwise provided by law, the General Warranty shall be for twelve (12) months from the date of Substantial Completion of the entire Work and shall be in form and content otherwise satisfactory to the Owner. Contractor shall maintain a complete and accurate schedule of the date(s) of Substantial Completion, date(s) upon which the one-year warranty will expire, and date(s) of Final Completion. Contractor agrees to provide notice of the warranty expiration date to Owner and Architect at least one month prior to the expiration of the one-year warranty period. Prior to termination of the one year warranty period, Contractor shall accompany the Owner and Architect on re-inspection of the Work/building and be responsible for correcting any deficiencies not caused by the Owner or by the use of the

building which are observed or reported during the re-inspection. Additionally, for a period beginning at Substantial Completion of any phase of the Work and extending twelve (12) months beyond Final Completion of any phase of the Work, upon request of the Owner, the Contractor shall, not less than once a month, attend a meeting with the Owner to review the facility operations and performance to identify defects, warranty issues, and proposed corrections; and to make appropriate written recommendations to the Owner. 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 three (3) 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. If Contractor fails to provide notice of the expiration of the one-year warranty period at least one month prior to the expiration date, Contractor's warranty obligations described in this paragraph shall continue until such inspection is conducted and any deficiencies found in the inspection are corrected.

§ 3.5.6 Warranties shall become effective on a date established by the Owner and Architect in accordance with the Contract Documents. This date shall be the Date of Substantial Completion of the entire Work, unless otherwise provided in any Certificate of Partial Substantial Completion approved by the parties, except for work to be completed or corrected after the date of Substantial Completion and prior to final payment. Warranties for work to be completed or corrected after the date of Substantial Completion and prior to final payment shall become effective on the later of the date the work is completed or corrected and accepted by the Owner and Architect or the date of final payment.

§ 3.5.7 In the event an item under warranty fails, the Contractor shall extend the original warranty period by a length of time equal to the elapsed time which occurs from the notification in writing by the Owner or a warranty claim until acknowledgement by the Owner that the claim has been resolved.

§ 3.5.8 The warranties of Contractor in this Section 3.5 and its subparts shall in no way limit or abridge the warranties of the suppliers or manufacturers of equipment or 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 not engage in any act or conduct, whether by commission or omission that results in the termination or expiration of such third party warranties or which otherwise operates to prejudice the rights of Owner under such warranties.

§ 3.5.9 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 standards; 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 standards; or (3) such further reasonable proof as is required by the Architect. Contractor shall also certify that the Project has been constructed in general conformance with the Architect's or Engineer's plans, specifications, and Construction Documents, as modified from time to time pursuant to the terms of the Contract Documents. Contractor shall complete all applicable certifications required by 19 Texas Administrative Code Section 61.1036-1040.

§ 3.6 Taxes

Contractor shall pay all applicable local, county and state taxes, income tax, compensation tax, social security and withholding payments as required by law. Owner is an exempt entity under the tax laws of the State of Texas, and Contractor shall not include in the Contract Sum or any Modification any amount for any taxes from which the Owner is exempt by virtue of its status as a governmental entity and/or as a Texas independent school district. The Owner represents that this Project is eligible for exemption from the State Sales Tax on tangible personal property and material incorporated in the Project, provided that the Contractor fulfills the requirements of the Limited Sale, Excise and Use Tax Rules and Regulations. For the purpose of establishing exemption, it is understood and agreed that the Contractor may be required to segregate materials and labor costs at the time a Contract is awarded. Contractor will accept a Certificate of Exemption from the Owner. Contractor shall obtain Certificates of Resale from its suppliers. Failure of Contractor or any Subcontractor or Sub-subcontractor to obtain Certificates of Resale from their suppliers shall make the Contractor, Subcontractor, or Sub-subcontractor responsible for absorbing the tax, without compensation from Owner. CONTRACTOR HEREBY RELEASES, INDEMNIFIES AND HOLDS HARMLESS OWNER FROM ANY AND ALL CLAIMS AND DEMANDS MADE AS A RESULT OF THE FAILURE OF CONTRACTOR OR ANY SUBCONTRACTOR OR SUB-SUBCONTRACTOR TO COMPLY WITH THE PROVISIONS OF ANY OR ALL SUCH LAWS AND REGULATIONS.

§ 3.7 Permits, Fees, Notices and Compliance with Laws

§ 3.7.1 After the Architect has filed the plans and specifications with the Texas Department of Licensing and Regulation, the Architect shall notify Contractor that Contractor may make and submit the applications for the building permit. 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. The Contractor shall procure (as required by the Contract Documents) all certificates of inspection, use; occupancy, permits and licenses, pay all charges, deposits and fees and give all notices necessary and incidental to the due and lawful prosecution of the Work. Certificates of inspection, use and occupancy shall be delivered to the Architect upon completion of the Work in sufficient time for occupation of the Project in accordance with the approved schedule for the Work. The costs of such procurement, payment and delivery are included within the Contract Sum, and constitute Costs of the Work unless otherwise provided by the Contract Documents.

§ 3.7.1.1 The Contractor shall be responsible for timely notification to and coordination with all utility companies regarding the provision of services to the Project. The Contractor shall immediately inform the Architect when the Owner's participation is required, and the Architect will notify the Owner. Connections for temporary and permanent utilities, utility district/company inspections, tap charges, water meter charges, and any other similar fees assessed by jurisdictional authorities having control over the Project, as well as payment for temporary utilities services required for the Work, whether the Work is new construction or renovation of an existing facility, are the direct responsibility of the Contractor, without reimbursement from Owner, unless otherwise agreed in writing. If the Work is new construction, then payment for temporary and permanent utility services shall be the direct responsibility of the Contractor, without reimbursement from Owner, until the later of completion of commissioning or Substantial Completion.

§ 3.7.1.2 After consultation with the Owner, the Contractor shall obtain all permits and approvals for itself and the Owner, and pay all fees and expenses, if any, associated with National Pollutant Discharge Elimination System (NPDES) regulations administered by the Environmental Protection Agency (EPA) and local authorities, if applicable, that require completion of documentation and/or acquisition of a "Land Disturbing Activities Permit" for the Project. Also after consultation with the Owner, the Contractor shall obtain all permits and approvals, and pay all fees and expenses, if any, associated with Storm Water Pollution Prevention and Pollution Control Plan (SWPPP) regulations administered by the Texas Commission on Environmental Quality (TCEQ) and local authorities. Contractor shall coordinate processing all forms and fees with the Owner. Contractor's obligations under this Section may or may not require it to obtain or perform engineering services during the pre-construction phase to prepare proper drainage for the construction site. Any drainage alterations made by Contractor during the construction process, which require the issuance of a permit, shall be at Contractor's sole cost. Reimbursable expenses shall not include any fines or penalties assessed against the Contractor, Contractor's Subcontractors or Sub-subcontractors, the Project, or the Owner

§ 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. In addition, Contractor shall authorize posting of any notices concerning the Workers Compensation insurance carried by other parties involved in the Project, including without limitation, Architect, at the same location where Contractor posts notices regarding Workers Compensation. If applicable, the Contractor shall procure and obtain all bonds required of the Owner or the Contractor by the municipality in which the Project is located or by any other public or private body with jurisdiction over the Project. In connection with such bonds, the Contractor shall prepare all applications, supply all necessary back-up material and furnish the surety with any required personal undertakings. The Contractor shall also obtain and pay all charges for all approvals for street closings, traffic control, parking meter removal and other similar matters as may be necessary or appropriate from time to time for the performance of the Work.

§ 3.7.3 If the Contractor performs Work when Contractor knows or reasonably should have known it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, the Contract Documents, or lawful orders of public authorities, the Contractor shall assume all 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 within forty-eight (48) hours after first observance of the conditions. Contractor agrees that this is a reasonable notice requirement. The Architect will promptly investigate such conditions and, if the Architect determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend to the Owner 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. The Owner will then consider the facts and the reports of the Architect and the Owner will make the final determination of action. If the Contractor disputes the Owner's determination, the Contractor 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 in writing. 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.

§ 3.8 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. The inclusion of any Allowance or Contingency is solely for the benefit of the Owner. Expenditure of any Allowance or Contingency may only be made with prior written approval of the Owner and according to the procedures of Article 7. Owner's authorized representative may approve any expenditure from Allowances without further Board approval. If the Allowances or Contingency are not expended or not fully expended, then any unused portion shall belong to the Owner and shall be credited to the Owner in calculating Final Payment.

§ 3.8.2 Calculation of costs or credits for Allowances shall be as described in article 7.1.4.

§ 3.8.3 Materials and equipment under an Allowance shall be selected by the Owner with reasonable promptness.

§ 3.8.4 When performing Work under Allowances, Contractor shall solicit and receive not less than three written proposals, unless the requirement to obtain proposals is waived by the Owner in advance, and shall provide the Work as directed by the Architect, upon Owner's written approval, on the basis of the best value to the Owner.

§ 3.9 Superintendent and Project Manager

§ 3.9.1 The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site at all times during performance of the Work. In addition, the Contractor may employ a project manager and necessary assistants who may supervise several Project sites. The list of all supervisory personnel, including the project manager and superintendent, that the Contractor intends to use on the Project and a chain-of-command organizational chart shall be submitted to the Owner and Architect. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor. Important communications shall be similarly confirmed in writing. Other communications shall be similarly confirmed on written request in each case. Questions about plan interpretation or directions shall be submitted to the Architect in the form of a written request for information and the Architect shall respond to such request for information in a reasonable and timely fashion. Contractor's selection of project manager or superintendent(s) shall be approved by Owner. The Contractor shall not engage supervisory personnel or utilize an organization and chain-of-command other than as approved by Owner and Architect, and Contractor shall not replace the project manager or superintendent(s) without Owner's consent or until a replacement project manager or superintendent(s) has been selected in accordance with this Section. The Owner may reject or require removal of any job superintendent, project manager or employee of the Contractor, Subcontractor or Sub-Subcontractor involved in the Project.

§ 3.9.2 Contractor's superintendent shall be present full-time on the site as soon as possible after commencement of the Work, and shall remain assigned to the Work, throughout the course of the Work until items requiring completion or correction, identified at Substantial Completion pursuant to Section 9.8, have been completed or corrected. From Substantial Completion until Final Completion, the superintendent shall be on the site to ensure that Final Completion occurs within the number of days required by the Agreement.

§ 3.9.3 Contractor's project manager, while not required to be present full-time at the site, shall remain assigned to the Work, and be available on an as-needed basis throughout the course of the Work until items requiring completion or correction, identified at Substantial Completion pursuant to Section 9.8, have been completed or corrected in accordance with the Construction Documents.

§ 3.9.4 Owner shall be notified not less than 24 hours before any time that superintendent will not be present at the site for any reason except periodic illness. If the reason is due to illness, then Owner shall be notified at the beginning of that day. Owner shall be notified of the identity of the acting superintendent. In the event the superintendent is absent from the site and notice has not been provided nor has an acting superintendent been assigned to the Work, then an amount equal to the superintendent's daily rate shall be deducted from the amount owed to the Contractor under General Conditions for such day.

§ 3.10 Contractor's Construction and Submittal Schedules

§ 3.10.1 The Contractor, promptly after being awarded the Contract, but in no case prior to the first application for payment, shall submit for the Owner's and Architect's review and approval a Contractor's construction schedule for the Work. The schedule shall be transmitted in the form of Microsoft Project in the native file format. 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 and Final Completion; (2) an apportionment of the Work by construction activity; (3) the time required for completion of each portion of the Work; (4) predecessors and successors; (5) phases; (6) baseline start and stop dates; (7) actual start and stop dates; (8) current start and stop dates; (9) delays; (10) critical path; (11) submittals; (12) extensions of the Contract Time authorized by Change Orders, (13) anticipated Adverse Weather Days, (14) Anticipated Instructional Days, and (15) Owner activities. The schedule shall provide for the orderly progression of the Work to completion and 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 and, upon such revision, shall be submitted to Architect and Owner for their review and approval. In no case will the schedule be updated less frequently than each application for payment. The Contractor's schedule may be considered when evaluating a request for additional time.

- .1 If any updated schedule exceeds the time limits set forth in the Contract Documents for completion of the Work, the Contractor shall include with the updated schedule a statement of the reasons for the anticipated delay in completion of the Work and the Contractor's planned course of action for completing the Work within the time limits, inclusive of previously accepted time extensions, set forth in the Contract Documents. If the Contractor asserts that the failure of the Owner or the Architect to provide information to the Contractor is the reason for anticipated delay in completion, the Contractor shall also specify what information is required from the Owner or Architect.

§ 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 and Owner'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 to prioritize submittals in a manner that aligns with the critical path, key milestone and activities of the Project, (2) indicate compliance with the requirement that the Contractor attain at least 80% completion of the submittals (by quantity) by the time the Contract Sum to date has attained 20% total completed and stored to date, and (3) allow the Architect and Owner 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, and the Owner may withhold progress payments until the conditions of this Article are satisfied. 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. 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

§ 3.10.3 The Contractor shall perform the Work in general accordance with the most recent schedules submitted to and approved by the Owner and Architect. Submission of any schedule under this Contract constitutes a representation by the Contractor that: (1) the schedule represents the sequence in which the Contractor intends to prosecute the remaining Work; (2) the schedule represents the actual sequence and durations used to prosecute the completed Work; (3) that to the best of its knowledge and belief the Contractor is able to complete the remaining Work in the sequence and time indicated; and, (4) that the Contractor intends to complete the remaining Work in the sequence and time indicated.

§ 3.10.4 The Contractor shall hold weekly progress meetings at the Project site, or at such other time and frequency as are acceptable to the Owner.

§ 3.10.5 If reasonably required by Owner, Contractor shall also prepare and furnish project cash flow projections, manning data for critical activities, and schedules for the purchase and delivery of all critical equipment and material, together with periodic updating thereof.

§ 3.10.6 The Contractor shall recommend to the Owner and to the Architect a schedule for procurement of long-lead time items which will constitute part of the Work as required to meet the project schedule.

§ 3.10.7 In addition to the requirements of the Contract Documents, the Contractor's submittal schedule shall include submittals required for Substantial and Final Completion, as described by the Contract Documents, including but not limited to (1) individual specification section-required warranties, (2) certificates, (3) statements, (4) third-party tests.

§ 3.10.8 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 the calendar year. Those needs are reflected in scheduled 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 and the importance of meeting milestones and completion dates is not exclusive.

§ 3.11 Documents and Samples at the Site

§ 3.11.1 The Contractor shall make available, at the Project site, one record copy of the Contract Documents, including Drawings, Specifications, Addenda, Change Orders, Construction Change Directives, and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, including concealed mechanical, electrical and plumbing items inside of the facility and underground utilities at the site, and one record copy of the approved Shop Drawings, field test records, inspection certificates or records, manufacturers' certificates, Product Data, Samples, and similar required submittals. These shall be in electronic form or paper copy, available to the Architect and Owner at all times. At the completion of the Project, all such documents and records shall be delivered to the Architect, with all changes made during construction, in an editable CAD format agreed to at the beginning of the Project along with (3) full sets of hard copy drawings and one digital copy in PDF format, for submittal to the Owner upon completion of the Work as a record of the Work as constructed, and shall be signed by the Contractor certifying to Owner thereby that they show complete and "as-built" conditions, stating sizes, kinds of materials, vital piping, conduit locations, and similar matters. These documents are to be considered part of the Work beyond the General Conditions. Other than Project identification, the documents shall not bear any professional seal or information or any reference to those firms providing professional services to the Owner, except for historical or reference purposes. This shall be completed and up to date within (30) working days from Substantial Completion and shall be a condition precedent to Final Payment.

§ 3.11.2 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 their respective agents.

§ 3.11.3 In addition to any other requirement in the Contract Documents and prior to installation, at Owner's or Architect's request, Contractor shall furnish or cause a Subcontractor or Sub-subcontractor to furnish, for the Owner's 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.

§ 3.12 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.

§ 3.12.4.1 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 10 business days for the Architect or his Consultants' review and submittals shall be sequenced logically in accordance with the schedule, required fabrication and installation time. For submittals delivered by electronic transmission and received after 5:00 p.m. on a day on which the recipient's offices are open, or on a weekend, Holiday, or other day on which the recipient's offices are closed, submittals shall be deemed to have been duly served on the next day on which the recipient's offices are open.

§ 3.12.4.2 The Contractor shall be prepared to submit color Samples on any key items (such as quarry tile, vinyl wall covering, etc.) within fifteen (15) days of the award of Subcontract(s). All color Samples required for the Work shall be received by the Architect no later than sixty (60) days of the date of the approval of the Contract Sum. Once samples of all key items are received, the Architect will finalize color selections.

§ 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve, and submit to the Architect and Owner, Shop Drawings, Product Data, Samples, and similar submittals required by the Contract Documents, in accordance with the submittal schedule approved by the Architect and Owner or, in the absence of an approved submittal schedule, as required under the Contract Documents. At a minimum, Contractor shall submit all submittals 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.

§ 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. If, in the opinion of the Architect or Owner, the Shop Drawings are (a) incomplete, (b) indicate an inadequate understanding of the Work covered by the Shop Drawings, or (c) indicate a lack of study and review by the Contractor prior to submittal to the Architect, the Shop Drawings will be returned, unchecked, to the Contractor for correction of these deficiencies and subsequent resubmittal. The Architect's review of Contractor's submittals shall be limited to examination of an initial submittal and one (1) re-submittal. The Architect's review of additional submittals will be made only with the consent of the Owner after notification by the Architect. The Owner shall be entitled to reimbursement from the Contractor of amounts paid to the Architect for evaluation of such additional re-submittals.

§ 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 by the Architect and/or Owner.

§ 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 or Owner's approval of Shop Drawings, Product Data, Samples, or similar submittals, unless the Contractor has specifically notified the Architect and Owner of such deviation at the time of submittal and (1) the Architect has given written approval of 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 or Owner's approval thereof except for any such errors or omissions which are within the Architect's statutory or contractual design responsibility..

§ 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 of a resubmission shall not apply to such revisions.

§ 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; however, the Contractor represents and warrants that all Shop Drawings shall be prepared by persons and entities possessing expertise and experience in the trade for which the Shop Drawings are prepared and, if required by the Architect or applicable law, by a licensed architect or engineer.

§ 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 cause such services or certifications to be provided by an appropriately licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings, and other submittals prepared by such professional. Shop Drawings, and other submittals related to the Work, designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy and accuracy of the services, certifications, and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor the performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review and approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents.

§ 3.12.10.2 If the Contract Documents require the Contractor's design professional to certify that the Work has been performed in accordance with the design criteria, the Contractor shall furnish such certifications to the Architect at the time and in the form specified by the Architect.

§ 3.12.10.3 A registered architect must prepare plans and specifications for all the Work, as governed by the Texas Occupations Code Chapter 1051; and a registered engineer must prepare plans, specifications and estimates for all Work governed by Texas Occupations Code Chapter 1001. In the event that Contractor retains a licensed design professional under the terms of this section, Contractor shall require that the licensed design professional carry commercial general liability and errors and omissions insurance coverage in the same amounts and forms as required of the Architect on this Project. In the event that the licensed design professional retained by the Contractor will be conducting on-site services or observations, the licensed design professional shall also carry worker's compensation insurance and comprehensive automobile liability in the same amounts and forms as required of the Architect on this Project.

§ 3.12.11 The Contractor shall provide composite drawings within four (4) weeks of corresponding submittals approval showing how all piping, ductwork, lights, conduit and 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 1/4" per foot minimum scale and shall include invert elevations, elevation views and sections required to meet the intended purpose. Trades

required to participate include, but are not necessarily limited to structural, mechanical, plumbing, fire sprinkler, electrical, data and special systems.

§ 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.

§ 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 whom the Contractor is responsible shall not erect any sign on the Project site without the prior 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 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 any area and buildings adjacent to the site or the Work. Prior to the start of any Work which may impact or otherwise affect beneficial use or occupancy of an existing facility, the Contractor shall provide a work plan for such Work that identifies and controls any interruption for approval by the Owner. Work in this situation shall not proceed until an agreed plan of Work is approved in writing by the Owner.

§ 3.13.5 Without prior written 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.

§ 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; provided, however, that any such cutting, fitting or patching can only be performed if the cutting, fitting or patching results in Work that is in accordance with the Contract Documents. 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. Structural members shall not be cut and air duct shapes, piping sizes and related system designed elements shall not be changed or modified except with written permission of the Architect. 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 After installation of the Work, Contractor shall carefully fit around, close up, repair, patch and paint such Work to match adjoining surfaces by use of proper tools and new materials using workers skilled in the required trades. All patching must include replacement or repair of any fire rated assembly to its full rating as required by current codes and standards at the point of Work or as may be required by the building official.

§ 3.15 Cleaning Up

§ 3.15.1 The Contractor, on a daily basis, shall keep the premises and surrounding area free from accumulation of waste materials and rubbish caused by operations under the Contract. Contractor shall, not less than one time each week, clean up by removing rubbish, including old and surplus materials, to include dirt, debris, or trash. At no time shall trash, dirt or other debris be allowed to remain in any wall cavity, ceiling plenum, crawl space or concealed space. Immediately after unpacking materials, all packing case lumber or other packing materials, wrapping or other

like flammable waste shall be collected and removed from the building and premises. Contractor shall provide on-site containers for the collection of waste materials, debris and rubbish, and shall periodically remove waste materials, debris and rubbish from the Work and dispose of all such materials at legal disposal areas away from the site. At completion of the Work, the Contractor shall remove all waste materials, rubbish, the Contractor's tools, construction equipment, machinery, and surplus materials from and about the Project and shall clean, sweep, mop, brush and polish, as appropriate, the interior of the improvements or renovated areas, including but not limited to, any floors, carpeting, ducts, fixtures, and ventilation units operated during construction. Contractor shall clean exterior gutters, drainage, walkways, driveways and roofs of debris. All cleaning operations shall be scheduled so as to ensure that contaminants resulting from the cleaning process will not fall on newly-coated or newly-painted surfaces. Care shall be taken by all workers not to mark, soil, or otherwise deface any finish. In the event that any finish becomes defaced in any way as a result of such activities, the Contractor or any of his Subcontractors or Sub-subcontractors shall clean and restore such surfaces to their original condition.

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner, at its discretion, may perform the clean-up and withhold costs incurred from funds due to Contractor or, if the costs incurred are in excess of the funds due to the Contractor, may require the Contractor to reimburse the Owner for the costs incurred.

§ 3.15.3 The Contractor shall be responsible for the protection of the Work. Prior to the Architect's inspection for Substantial Completion, the Contractor shall clean exterior and interior surfaces exposed to view; remove temporary labels, stains, putty, soil, paint and foreign substances from all surfaces, including glass and painted surfaces; polish transparent and glossy surfaces; clean equipment and fixtures to a sanitary condition; replace air filters in mechanical equipment; clean roofs, 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; clean and polish all floors; clean and polish all hardware; and repair all Work damaged during cleaning.

§ 3.15.4 Prior to Final Completion, in addition to any additional final cleaning work specified in the Contract Documents (including the Specifications), Contractor shall: (1) employ skilled workers for final cleaning; (2) remove grease, mastic adhesive, dust, dirt, stains, fingerprints, labels and other foreign materials from all sight-exposed interior and exterior surfaces; (3) wash and shine glazing and mirrors; (4) polish glossy surfaces to a clear shine; (5) vacuum clean carpeted and similar soft surfaces; (6) clean (damp mop with clean mop and water) resilient and hard surface floors repeating as necessary until no visible residue remains on floors; (7) clean plumbing fixtures to a sanitary condition; (8) clean surfaces of all equipment and remove excess lubrication; (9) clean permanent filters and replace disposable filters in ventilating systems if units were operated during construction and clean ducts, blowers and coils; (10) clean light fixtures; (11) remove waste, foreign matter and debris from roofs, gutters, area ways and drainage ways; (12) remove waste, debris and surplus materials from the site; (13) remove stains, spills and foreign substances from paved areas; and (14) broom clean exterior concrete and paved surfaces and rake clean the grounds.

§ 3.16 Access to Work

The Contractor shall provide the Owner and Architect, and their designated representatives, with access to the Work in preparation and progress wherever located. Upon request of the Architect or Owner, the Contractor shall accompany the Architect or Owner on an inspection of the Work. The presence of the Owner, Architect or their representatives does not constitute acceptance or approval of the Work.

§ 3.17 Royalties, Patents and Copyrights

The Contractor shall pay all royalties and license fees with respect to the Contract or the Work. THE CONTRACTOR SHALL DEFEND SUITS OR CLAIMS FOR INFRINGEMENT OF COPYRIGHTS AND PATENT RIGHTS, WAIVE AND RELEASE ANY CLAIMS AGAINST THE OWNER AND ARCHITECT WITH RESPECT THERETO, AND INDEMNIFY AND HOLD HARMLESS THE OWNER AND ARCHITECT FROM ANY LOSS ON ACCOUNT THEREOF, PROVIDED, HOWEVER, THAT CONTRACTOR SHALL NOT BE RESPONSIBLE TO ARCHITECT FOR DEFENSE OR LOSS WHEN A PARTICULAR DESIGN, PROCESS, OR PRODUCT OF A PARTICULAR MANUFACTURER OR MANUFACTURERS IS REQUIRED BY THE CONTRACT DOCUMENTS, OR WHERE THE COPYRIGHT VIOLATIONS ARE CONTAINED IN DRAWINGS, SPECIFICATIONS, OR OTHER DOCUMENTS PREPARED BY THE 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 notice of such infringement is promptly furnished to the Owner and Architect in writing.

§ 3.18 Indemnification

§ 3.18.1 TO THE FULLEST EXTENT PERMITTED BY LAW, THE CONTRACTOR SHALL WAIVE AND RELEASE CLAIMS AGAINST AND SHALL DEFEND, INDEMNIFY AND HOLD HARMLESS THE OWNER, ITS TRUSTEES, OFFICERS, AND CONSULTANTS, ARCHITECT, ARCHITECT'S CONSULTANTS, AND AGENTS AND EMPLOYEES OF ANY OF THEM FROM AND AGAINST CLAIMS, DAMAGES, LOSSES, CAUSES OF ACTION, SUITS, JUDGMENTS, 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 (INCLUDING THE WORK ITSELF), INCLUDING LOSS OF USE RESULTING THEREFROM, BUT ONLY TO THE EXTENT CAUSED IN WHOLE OR IN PART BY THE ACTS OR OMISSIONS OF THE CONTRACTOR, A SUBCONTRACTOR, ANYONE DIRECTLY OR INDIRECTLY EMPLOYED BY THEM, ANYONE THEY CONTROL OR EXERCISE CONTROL OVER, 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 ANY ACTS OR OMISSIONS OF OWNER OR OWNER'S CONSULTANTS OR ANY OTHER 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. ALL COSTS AND EXPENSES SO INCURRED BY ANY OF THE INDEMNIFIED PARTIES IN THAT EVENT SHALL BE REIMBURSED BY CONTRACTOR, AND ANY COSTS AND EXPENSES SO INCURRED BY INDEMNIFIED PARTIES SHALL BEAR INTEREST UNTIL REIMBURSED BY CONTRACTOR, AT THE POST-JUDGMENT INTEREST RATE PROVIDED TO BE PAID UNDER THE LAWS OF THE STATE OF TEXAS.

§ 3.18.2 IN CLAIMS AGAINST ANY PERSON OR ENTITY INDEMNIFIED UNDER THIS SECTION 3.18 BY AN EMPLOYEE OF THE CONTRACTOR, A SUBCONTRACTOR, A SUB-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 INSURANCE POLICIES, WORKERS' COMPENSATION ACTS, DISABILITY BENEFIT ACTS, OR OTHER EMPLOYEE BENEFIT ACTS.

§ 3.18.3

THE OBLIGATIONS OF THE CONTRACTOR UNDER THIS SECTION 3.18 SHALL NOT EXTEND TO THE LIABILITY OF THE ARCHITECT, THE ARCHITECT'S CONSULTANTS, AND AGENTS AND EMPLOYEES OF ANY OF THEM, CAUSED BY OR RESULTING FROM: (1) DEFECTS IN PLANS, DESIGNS, OR SPECIFICATIONS PREPARED, APPROVED, OR USED BY THE ARCHITECT OR ENGINEER, OR (2) NEGLIGENCE OF THE ARCHITECT OR ENGINEER IN THE RENDITION OR CONDUCT OF PROFESSIONAL DUTIES CALLED FOR OR ARISING OUT OF THE CONSTRUCTION CONTRACT AND THE PLANS, DESIGNS, OR SPECIFICATIONS THAT ARE A PART OF THE CONSTRUCTION CONTRACT; AND (3) ARISING FROM: (A) PERSONAL INJURY OR DEATH; (B) PROPERTY DAMAGE; OR (C) ANY OTHER EXPENSE THAT ARISES FROM PERSONAL INJURY, DEATH, OR PROPERTY DAMAGE, OR AS OTHERWISE LIMITED BY TEXAS CIVIL PRACTICE & REMEDIES CODE SECTION 130.001 ET SEQ.

§ 3.18.4 CONTRACTOR SHALL BE RESPONSIBLE FOR AND SHALL HOLD OWNER FREE AND HARMLESS FROM LIABILITY RESULTING FROM LOSS OF OR DAMAGE TO CONTRACTOR'S OR ITS SUBCONTRACTOR'S OR SUB-SUBCONTRACTOR'S CONSTRUCTION TOOLS AND EQUIPMENT AND RENTED ITEMS WHICH ARE USED OR INTENDED FOR USE IN PERFORMING THE WORK REGARDLESS OF WHETHER SUCH LOSS OR DAMAGE IS CAUSED IN PART BY AN ACT OR OMISSION OF OWNER OR ITS AGENTS, OFFICERS, OR EMPLOYEES. THIS PROVISION SHALL APPLY, WITHOUT LIMITATION, TO LOSS OR DAMAGE OCCURRING AT THE WORK SITE OR WHILE SUCH ITEMS ARE IN TRANSIT TO OR FROM THE WORK SITE AND IS IN ADDITION TO CONTRACTOR'S OBLIGATIONS UNDER SECTION 3.18.1.

§ 3.18.5 THE OWNER MAY CAUSE ANY SEPARATE CONTRACTOR WHO MAY HAVE A CONTRACT WITH THE OWNER TO PERFORM CONSTRUCTION OR INSTALLATION WORK IN THE AREAS WHERE WORK WILL BE PERFORMED UNDER THIS AGREEMENT, TO AGREE TO INDEMNIFY AND TO HOLD THE OWNER AND THE CONTRACTOR HARMLESS FROM ALL CLAIMS FOR BODILY INJURY AND

PROPERTY DAMAGE TO THE SAME EXTENT AS IS PROVIDED IN SECTION 3.18.1 ABOVE. LIKEWISE, CONTRACTOR AGREES TO INDEMNIFY AND TO HOLD THE OWNER'S SEPARATE CONTRACTORS HARMLESS FROM ALL CLAIMS FOR BODILY INJURY AND PROPERTY DAMAGE TO THE SAME EXTENT AS PROVIDED IN SECTION 3.18.1 ABOVE.

§ 3.18.6 THE CONTRACTOR AGREES TO WAIVE ANY AND ALL CLAIMS IT MAY HAVE AGAINST THE OWNER, CONNECTED WITH, RESULTING FROM, OR ARISING OUT OF, CLAIMS AND SUITS COVERED BY THE INDEMNIFICATION AGREEMENT CONTAINED HEREIN AND AGREES THAT ANY INSURANCE POLICY SHALL PROVIDE FOR THE WAIVER OF SUBROGATION RIGHTS AGAINST THE OWNER.

§ 3.18.7 To the extent allowed by law, the Contractor agrees to insure the indemnity and hold harmless clauses contained in this Section 3.18, including its subparts, with insurance policies, approved by the Owner, and issued by a carrier authorized to do business in the State of Texas, in the minimum amounts set out in Article 11 and/or Section 11.1 of these General Conditions.

§ 3.18.8 The provisions of Section 3.18 in its entirety, including all of its subparts, shall survive the completion, termination, or expiration of the Contract, howsoever caused, and no payment, partial payment, nor issuance of a certificate of Substantial Completion nor a certificate of Final Completion nor acceptance of occupancy in whole or in part of the Work shall waive or release any of the provisions of Section 3.18 and its subparts.

§ 3.19 Antitrust Violation

To permit the Owner to recover damages suffered in antitrust violations, Contractor hereby assigns to Owner any and all claims for overcharges associated with this Contract which violate the antitrust laws of the United States, 15 U.S.C.A. Section 1 et seq. The Contractor shall include this provision in its agreements with each Subcontractor, Sub-subcontractor and supplier. Each Subcontractor shall include such provisions in agreements with sub-subcontractors and suppliers.

§ 3.20 Record Drawings

§ 3.20.1 At the completion of the Project, the Contractor shall submit complete "as built" drawings, with all changes made during construction, including concealed mechanical, electrical and plumbing items inside of the facility and underground utilities at the site. The drawings shall be submitted in an editable native file format agreed to at the beginning of the project along with (3) full sets of hard copy drawings and one digital copy in PDF format. These documents are to be considered part of the Work beyond the General Conditions. The documents shall not bear any professional seal or information other than project identification. This shall be completed and up to date within (30) working days from Substantial Completion.

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 The Owner shall notify the Contractor when duties, responsibilities, and limitations of authority of the Architect have been modified.

§ 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 duties, responsibilities, or activities of the Architect.

§ 4.2 Administration of the Contract

§ 4.2.1 The Architect or its authorized representative 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 a recommendation that the Final Payment is due, and, with the Owner's concurrence, from time to time during the one-year period for correction of Work described in Section 12.2. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents or expressly authorized by the Owner in writing.

§ 4.2.2 Architect or its authorized representative shall visit the site at least twice per week (or more per week when deemed necessary by the Owner or when necessary to protect Owner's interests) and at other intervals appropriate to the stage of construction, to inspect the progress, quantity and quality of the Work completed, to reject any observed nonconforming Work, and to determine if the Work is being performed in a manner indicating that the Work, when completed, will be in accordance with the Contract Documents and on time. Furthermore, a minimum of two job site meetings per month from commencement of construction through Final Completion will be initiated by the Architect and attended by the Contractor. Attendees will include the Owner, the Contractor's project manager and/or superintendent, Architect's project representative, and Architect. The Architect, Owner and their representatives shall at all times have access to the Work. Architect or its authorized representative will provide on-site observations prior to and during all concrete pours that contribute to the structural integrity of the building, including all pours of concrete piers, footings, grade beams, floor slabs, and concrete superstructure components, if applicable. In addition, Architect or its authorized representative will provide on-site observations prior to covering up or closing up of portions of the construction which, if covered, would conceal problems with the structural integrity of the Project. Contractor shall provide notice and shall not close or cover said Work until said observations have occurred. Contractor or Architect will advise Owner of the need for any third party laboratory or testing services to assist the Architect and Owner. On the basis of the on-site observations by Architect, Architect shall keep Owner and Contractor informed of the progress and quality of the Work, through Architect's field reports, and shall guard Owner against defects and deficiencies in the Work. Architect shall promptly notify Owner and Contractor orally regarding any defect or nonconforming Work, which shall be followed by notice in writing of defects or nonconforming Work noted and corrective actions taken or recommended. The Architect, however, shall not have control over or responsibility for the Contractor's construction means, methods, techniques, sequences, procedures, or safety programs, but this does not relieve Architect of Architect's responsibilities under the Contract. Any services by Contractor made necessary by Contractor's construction defect or nonconforming Work shall be performed at no additional cost to Owner.

§ 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, Sub-subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work. The Contractor shall reimburse the Owner for compensation paid to the Architect for additional site visits made necessary by the fault, neglect, or request of the Contractor.

§ 4.2.4 Communications

Except as otherwise provided in the Contract Documents or when direct communications have been specially authorized by the Owner or Architect, the Owner and Contractor shall endeavor to communicate with each other through the Architect about matters arising out of or relating to the Contract. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors, Sub-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. Notwithstanding the foregoing, Owner reserves the right to communicate directly with the Contractor and Subcontractors.

§ 4.2.5 As further provided in the Contract Documents, based on the Architect's evaluations of the Work progress and quality of the Work and 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, which shall be further subject to the Owner's review, modification, approval, or rejection.

§ 4.2.6 The Architect and Owner each has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect or the Owner considers it necessary or advisable, the Architect and/or the Owner 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 Work is fabricated, installed or completed. Testing or inspections required by this section shall be conducted subject to the requirements of Chapter 2269 of the Texas Government Code. However, neither this authority of the Architect or the Owner 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 or the Owner to the Contractor, Subcontractors, Sub-subcontractors, suppliers, their agents or employees, or other persons or entities performing portions of the Work, or constitute approval or acceptance of Work that is deficient or does not meet the

requirements of the Contract Documents. Architect and/or Contractor shall promptly notify, orally and in writing, the other party and Owner of any fault or defect in the Project or Construction Documents or nonconformance with the Contract Documents they may respectively discover (or reasonably should have discovered using ordinary diligence) and each, upon discovery of the defect or nonconformance, shall be responsible for notifying the other party and Owner of those corrective actions they respectively take; provided, however, Contractor shall have no duty to notify Owner of discoveries made or actions taken by Architect. If Architect or Contractor fails to disclose, in writing, any known defects in the Project or Construction Documents it discovers or reasonably should discover using ordinary diligence, the non-disclosing party (Architect and/or Contractor) shall be liable for the consequences of such defects resulting from the failure to disclose. In the event of a disagreement between the Architect and Contractor, the Owner will make the final determination after reviewing all of the information.

§ 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 and all applicable laws, statutes, codes and requirements applicable to Architect's design services. 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 as to cause no delay in the Work or in the activities of the Owner, Contractor, or Separate Contractors, while allowing sufficient time in the Architect's professional judgment to permit adequate review. Review of such submittals is conducted for the general 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. If any submittal does not comply with the requirements of the Contract Documents, then Architect shall require Contractor to come into compliance. The Architect shall promptly report in writing to the Contractor and Owner any errors, inconsistencies and/or omissions discovered by the Architect in the Shop Drawings, Product Data and Samples.

§ 4.2.8 The Architect shall review, prepare and make recommendations to Owner regarding all Change Orders and Construction Change Directives for the Owner's approval and execution in accordance with the Contract Documents, accompanied by all supporting documentation. The Architect may authorize minor changes in the Work not involving an adjustment in Contract Sum or an extension of the Contract Time which are consistent with the intent of the Contract Documents. If necessary, the Architect shall prepare, reproduce and distribute Drawings and Specifications to describe Work to be added, deleted or modified, as provided in Section 7.4. The Architect shall accept requests by the Owner, and shall review properly prepared, timely requests by the Contractor for changes in the Work, including adjustments to the Contract Sum or Contract Time. A properly prepared request for a change in the Work by the Contractor shall be accompanied by sufficient supporting data and information to permit the Architect to make a reasonable determination without extensive investigation or preparation of additional drawings or specifications. If the Architect determines that requested changes in the Work are not materially different from the requirements of the Contract Documents and do not change the Contract Sum or Contract Time, then the Architect may issue an order for a minor change in the Work with prior written notice to the Owner, or recommend to the Owner that the requested change be denied. The Architect is not authorized to approve changes involving major systems such as: Heating, Ventilation and Air Conditioning ("HVAC"); roof; foundation; outward appearance; color schemes; floor plans; building materials; drainage; or mechanical equipment without Owner's prior written consent.

§ 4.2.9 The Architect will conduct inspections and, in consultation with the Owner, 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. In the event Architect is required to perform more than two inspection(s) to determine the date or dates of Substantial Completion or Final Completion due to Contractor's failure to meet the conditions for such completion, Contractor shall be responsible for paying or reimbursing Owner for the cost of any Additional Services charged by Architect or Consultants under the agreement between Owner and Architect.

§ 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 make recommendations on matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor, which shall be copied to the other. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. The Owner will make the final determination of all matters concerning performance after consultation with the Architect.

§ 4.2.12 Interpretations or recommendations 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 recommendations, 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 The Owner's decisions on matters relating to aesthetic effect shall be final if (a) they are consistent with the intent expressed in the Contract Documents, and (b) the Owner gives its written consent.

§ 4.2.14 Contractor is allowed a reasonable number of requests for information that are initiated by Contractor and if Contractor exceeds that reasonable amount, as determined by the Architect, in its sole discretion. Contractor shall pay the Architect's fee for review of any additional requests for information. 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. In the event of a disagreement between the Architect and Contractor, the Owner will make the final determination after reviewing all of the information.

§4.2.15 The Contractor shall not cover up work without the Architect and Owner performing an observation of such work. The Contractor shall be responsible for any and all associated costs to allow for observation of the work, uncovered, by the Architect and Owner. If the Contractor covers work without either the consent of the Architect and Owner or without providing the Architect and Owner with reasonable opportunity to observe the work, whether or not such work is found to be acceptable by the Architect or Owner, the Contractor shall repair such work at no cost to the Owner.

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, away from the site, or otherwise to furnish labor or materials. 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. The term "Subcontractor" includes persons supplying materials or equipment for the Work.

§ 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, away from the site, or otherwise to furnish labor or materials. 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. The term "Sub-subcontractor" includes persons supplying materials or equipment for the Work.

§ 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. All Subcontractors shall be procured in accordance with Texas Education Code Chapter 44, Subchapter B, and Texas

Government Code Chapter 2269, as applicable. If Contractor is a Construction Manager at Risk, all trade contractors and Subcontractors shall be procured in accordance with Sections 2269.255 and 2269.256 of the Texas Government Code. A notice of no reasonable objection shall in no way relieve the Contractor from full responsibility for performance and completion of the Work and its obligations under the Contract Documents. The Contractor shall be fully responsible for the performance of its Subcontractors, and Sub-subcontractors, including those recommended or approved by the Owner.

§ 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 and timely 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. When the parties agree on a proposed substitute Subcontractor or if the Owner requires use of a specific Subcontractor, then 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. "Reasonable Objection" shall include, but not be limited to, Owner or Architect's prior experience of unsatisfactory work performed by the Subcontractor or debarment of the Subcontractor.

§ 5.2.4 The Contractor shall not substitute a Subcontractor, Sub-subcontractor person, or entity for one previously selected if the Owner or Architect makes reasonable objection to such substitution.

§ 5.2.5 The Owner may require the Contractor to change any subcontractor or supplier previously approved by it, if such a change is due to failure of subcontractor to perform in accordance with the requirements of the Contract. If Owner requires removal of a subcontractor for such failure to perform, and Contractor reasonably objects to such removal, then Owner will pay any actual increase in the cost between the new subcontractor and the subcontractor replaced incurred by Contractor, taking into account any amounts which Contractor withholds or recovers in damages from the replaced subcontractor. If Contractor requests such payment from Owner, Contractor shall provide Owner with satisfactory proof of such additional costs incurred by Contractor.

§ 5.2.6 Contractor shall be fully responsible for the performance of its subcontractors, including those selected or approved by the Owner.

§ 5.3 Subcontractual Relations

§ 5.3.1 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. The terms and conditions of the Contract Documents shall be incorporated by reference into each subcontract agreement, except as provided below. 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. Each Subcontractor and Sub-subcontractor shall provide proof of insurance to Contractor consistent with the Contractor's insurance to Owner and in amount commensurate with the Work to be performed by the Subcontractor or Sub-subcontractor.

§ 5.3.2 Neither the Owner nor the Architect shall be obligated to pay or to ensure the payment of any monies to Subcontractors or Sub-subcontractor due to any non-payment to the Contractor, non-payment of Subcontractors by the Contractor, or non-payment of Sub-subcontractors by Subcontractors.

§ 5.3.3 The Contractor shall require any potential Subcontractor to disclose to the Contractor any ownership interest or familial relationship between the Contractor, the Architect or the Owner and the potential Subcontractor prior to entering into a subcontract. Contractor shall report to Owner all such disclosures and the Owner shall have the right, in its sole discretion, to reject any such affiliated Subcontractor.

§ 5.4 Contingent Assignment of Subcontracts

§ 5.4.1 Each subcontract agreement for any unperformed portion of the Work is assigned by the Contractor to the Owner, provided that

- .1 assignment is effective only after termination of the Contract either in accordance with Article 14 or abandonment of the Project by the Contractor and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor;
- .2 assignment is subject to the prior rights and obligations of the surety, if any, obligated under bonds relating to the Contract;
- .3 such assignment shall not constitute a waiver by Owner of any of its rights against Contractor, because of defaults, delays and defects for which a Subcontractor or material vendor may also be liable; and
- .4 the Subcontractor provides bonds as required by law of prime contractors, and by Owner.

If the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract, provided, however, that Owner does not assume Contractor's obligations or liabilities for defaults occurring prior to Owner's assumption, or for the payment to the Subcontractor or supplier for Work, if payment for such Work has previously been made to Contractor. Such liabilities or obligations shall remain with Contractor. Owner shall only be responsible for compensating Subcontractors for Work performed or materials furnished from and after the date on which the Owner gives written notice of its acceptance of the subcontract agreement. Owner shall not be responsible for any Work performed or materials furnished by Subcontractors prior to the date of Owner's written notice of acceptance.

§ 5.4.2 Such assignment shall not constitute a waiver by Owner of any of its rights against Contractor, including, but not limited to, claims for defaults, delays or defects for which a Subcontractor, Sub-subcontractor, or vendor may also be liable.

§ 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.

§ 5.4.4 All subcontracts shall state that they will be assignable to the Bond Trustee or his designee, if funding for the Project is obtained through bond proceeds.

§ 5.5 Notice of Subcontractor Default

Contractor shall promptly notify Owner and Architect in writing of any material defaults by any Subcontractor or Sub-subcontractor. Notwithstanding any provision contained in Article 5 to the contrary, it is hereby acknowledged and agreed that Owner has in no way agreed, expressly or implicitly, nor will Owner agree, to allow any Subcontractor, Sub-subcontractor or other materialman or worker employed by Contractor the right to obtain a personal judgment or to create a mechanic's or materialman's lien against Owner for the amount due from the Owner or the Contractor.

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 construction or operations related to the Project with the Owner's own forces, and with Separate Contractors retained for the Project. The Owner further reserves the right to perform other non-Project-related construction work, maintenance and repair work, and school program operations at the site and near the site during the time period of the Work.

§ 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.

§ 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 and submit such revisions to the Owner for the Owner's approval. The construction schedules, if approved by the Owner, 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 rights that the Contractor has under the Conditions of the Contract.

§ 6.2 Mutual Responsibility

§ 6.2.1 It shall be the responsibility of the Contractor to assist, review, and coordinate the scheduling of work performed by any of the Owner's Separate Contractors. In addition, the Contractor shall be responsible for coordinating and providing all construction administration necessary for the Work and the work of any of Owner's Separate Contractors. The Contractor shall afford the Owner and Separate Contractors reasonable site access and opportunity for introduction and storage or staging 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. Contractor shall be responsible for coordination between Contractor's Subcontractors, Sub-subcontractors and Owner's Separate Contractors. Contractor shall review Owner's contract with Owner's Separate Contractors and become familiar with the requirements and scope of services contained therein.

§ 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 and Owner in writing 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 and shall promptly report in writing to the Architect and Owner if Owner's Separate Contractors otherwise fail in any way to timely perform their services or negatively impact Contractor's schedule or ability to perform the Work. Failure of the Contractor to notify the Architect and Owner 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 and is performed in a timely manner. The Contractor shall not be responsible for discrepancies or defects in the construction or operations by the Owner or Separate Contractor that are not actually known to Contractor and are not reasonably 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 actual costs the Contractor incurs because of a Separate Contractor's delays, improperly timed activities, damage to the Work or defective construction.

§ 6.2.3.1 If the Architect is required to provide contingent additional services as provided in the Agreement between the Owner and the Architect, specifically relating to additional compensation for the Architect for evaluating an excessive number of claims submitted by the Contractor or others in connection with the Work in accordance with the Owner's Agreement with the Architect, then such services shall be paid for by the Contractor through the Owner, unless the contingent additional services result from negligence or an omission by the Architect.

§ 6.2.3.2 If the Architect provides services in connection with a legal proceeding, except when the Architect is a party thereto, and the Owner requests the Architect in writing to provide such services, then the cost of such services shall be paid for by the party whose act or omission was a proximate cause of the problem that led to the requirement to provide such services. Such services shall be paid for by such party through the Owner, who upon receipt of same shall reimburse the Architect.

§ 6.2.3.3 All construction costs resulting from the Contractor's negligence, lack of oversight, inattention to detail, failure to investigate or failure to follow the Contract Documents, will be borne by the Contractor.

§ 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. If such Separate Contractor initiates a claim or legal or any other proceedings against the Owner on account of any damage alleged to have been caused by the Contractor, the Owner shall notify the Contractor, who shall defend such proceedings at its own expense, and if any judgment or award against the Owner arises therefrom, based on Contractor's act or omissions or the act or omissions of Contractor's employees, Subcontractor, Sub-subcontractor, or parties for whom Contractor has liability, the Contractor shall pay or satisfy it and shall reimburse the Owner for all attorneys' fees and court and other costs which the Owner has incurred over and above those paid for directly by the Contractor.

§ 6.2.6 The Contractor shall be responsible for any delays to a Separate Contractor caused by the Contractor or its Subcontractors, Sub-subcontractors, or suppliers.

§ 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 then 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. A properly prepared written request for a change in the Work by Contractor shall be accompanied by sufficient supporting data and information to permit the Architect to make a recommendation to Owner.

§ 7.1.2 A Change Order shall be based upon agreement among the Owner, Contractor, and Architect. A Construction Change Directive requires the approval of the Owner and may or may not be agreed to by the Contractor. An order for a minor change in the Work may be issued, subject to the Owner's approval, by the Architect alone.

§ 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. Contractor shall not make any claim for an adjustment to the Contract Sum or Contract Time due to: a change in the materials used; a change in the specified manner of constructing and/or installing the Work; or additional labor, services, or materials, beyond that actually required by the terms of the Contract Documents, unless made pursuant to a written order or directive from Owner authorizing Contractor to proceed with a Change in the Work. No claim for an adjustment to Contract Sum or Contract Time shall be valid unless so ordered or directed.

§ 7.1.4 Calculation of costs or credits for Changes, minor changes, Proposals, Contingency expenditures and Allowance expenditures:

1. When calculating the Cost of the Work for Changes, minor changes, Proposals, Contingency expenditures and Allowances, the Contractor shall furnish and include substantiation to satisfaction of the Owner of the following from Subcontractors:

Description of Subcontractor Cost of the Work Element

- A Bare Material Costs
- B Labor Hours
- C Direct Labor Costs (See Article 1 Definitions)
- D Labor Cost Burden (See Article 1 Definitions)
- E Equipment
- F Work performed by Sub-subcontractor (if any), where Sub-subcontractor Overhead and Profit shall not exceed 10%
- G Subcontractor's Overhead and Profit, which shall not exceed 10% of A through F
- H Contractor's Overhead and Profit, which shall not exceed 10% of A through G
- I Cost of the Work (Sum of A through H)

2. When Contractor self performs work, when calculating the Cost of the Work for Changes, minor changes, Proposals, Contingency expenditures and Allowances, the Contractor shall furnish and include substantiation to satisfaction of the Owner of the following:

Description of Contractor Cost of the Work Element

- A Bare Material Costs
- B Labor Hours
- C Direct Labor Costs (See Article 1 Definitions)
- D Labor Cost Burden (See Article 1 Definitions)
- E Equipment
- F Contractor's Overhead and Profit, which shall not exceed 10% of A through E
- G Cost of the Work (Sum of A through F)

No additional Fee or General Conditions cost shall apply to self-performed Work.

3. 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.

§ 7.1.4.1 The Contractor, upon receipt of written notification by the Owner or the Architect of a proposed item of change in the Work, shall prepare within 10 Calendar Days a Change Proposal in such form or forms as directed by the Owner or the Architect.

- .1 Each separate Change Proposal shall be numbered consecutively and shall include all cost related to the proposed Change in the Work, including any disruption or impact on performance.
- .2 The Subcontractor's itemized accounting shall be included with the Change Proposal;
- .3 If a Change Proposal is returned to the Contractor for additional information or if the scope of the proposed Change in the Work is modified by additions, deletions or other revisions, the Contractor shall revise the Change Proposal accordingly and resubmit the revised Change Proposal to the Architect and the Owner;
- .4 A revised Change Proposal shall be the original Change Proposal number suffixed by the letter "R" to designate a revision in the original Change Proposal. If additional revisions to a revised Change Proposal are necessary, each subsequent revision shall be identified by an appropriate numeral suffix immediately following the "R" suffix;
- .5 Upon written approval of a Change Proposal by Owner, the Architect and the Contractor, the Architect will prepare an Allowance Expenditure Authorization or Change Order authorizing such change in the Work; and
- .6 The Contractor shall request extensions of Contract Time due to changes in the Work only at the time of submitting its Change Proposal. Contractor's failure to do so shall represent a waiver of any right to request a Contract Time extension. Any request for extensions of Contract Time must be substantiated through the demonstration of the impact of the proposed item of change in the Work to the critical path schedule for the Project.

§ 7.1.4.2 Formal Notice of Essence. Contractor recognizes and acknowledges that timely submission of a formal Change Proposal, whether or not the circumstances of the Change may be known to the Owner or available to Owner through other means, is not a mere formality but is of crucial importance to the ability of Owner to promptly identify, prioritize, evaluate and mitigate the potential effects of Changes. Any form of informal notice, whether verbal or written (including, without limitation, statements in Requests for Information, statements at regular job meetings or entries on monthly reports, daily logs or job meeting minutes), that does not strictly comply with the formal requirements of Paragraph 7.1.4.1, above, shall therefore be insufficient.

§ 7.1.5 In accordance with Texas Education Code §44.0411 if the Contract Sum is \$1,000,000.00 or more, or if the Contract Sum is less than \$1,000,000.00, and any Change Order, Construction Change Directives, or other Changes in the Work would increase the Contract Sum to \$1,000,000.00 or more, the total of all Change Orders, Construction Change Directives, or other Changes in the Work may not increase the Contract Sum by more than 25% of the original Contract Sum. Any Change Order, Construction Change Directive, or other Change in the Work that would exceed that limit is void and of no effect.

§ 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 In no event shall a single change, or the aggregate of all changes, result in the total costs, reimbursements and fees exceeding the Contract Sum or be the basis of a change in the Contract Time unless and until such change has been authorized by a Change Order executed and issued by the Owner in accordance with the Contract Documents prior to the commencement of such modified or changed Work. Changes in the Work may be made without notice to Contractor's sureties and absence of such notice shall not relieve such sureties of any of their obligations to Owner.

§7.2.3 Contractor stipulates that acceptance of a Change Order by the Contractor shall constitute full accord and satisfaction for any and all Claims, whether direct or indirect, including but not limited to, impact or delay damages, arising from the subject matter of the Change Order and attorney's fees and costs arising from a dispute with a Subcontractor or Sub-subcontractor over the Change Order.

§ 7.2.4 Methods used in determining adjustments to the Contract Sum may include those listed in Section 7.3.3.

§ 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, if required by the Owner, the 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 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 (additional mark-ups for overhead, profit and fees will not be allowed);
- .3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee subject to the limitations of Section 7.1; or
- .4 As provided in Section 7.3.4 subject to the limitations of Section 7.1.

§ 7.3.4 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall make a recommendation of the amount by which the Contractor's direct costs have actually been increased over the direct cost of performing the Work without the Change in the Work, all subject to the approval of the Owner. The Contractor shall keep and present, in such form as the Architect or Owner 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 Actual 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 Actual costs of materials, supplies, and equipment, including cost of transportation, whether incorporated or consumed;
- .3 Actual rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others at rates that are no greater than market rates in the locale of the Work at the time of the Work. Unless otherwise established in the Contract, the rental value of the Contractor's own equipment shall not be more than the normal local rental rate for similar equipment; and
- .4 Actual costs of premiums for all bonds and insurance, permit fees, and sales, use, or similar taxes, directly related to the change Work, except that sales, use or similar taxes to which the Owner is exempt shall not be included in the calculation of costs; and

- .5 Actual additional costs of supervision and field office personnel directly attributable to the change only if the adjustment causes an extension of the Contract Time.

§ 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 regardless of the Contractor's agreement with or disagreement with the adjustment in the Contract Sum or Contract Time or the method for determining them, and shall promptly 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 plus the Contractor's allocated percent of profit and overhead as confirmed by the Architect. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for Work completed under the Construction Change Directive in Applications for Payment. The Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Architect determines, in the Architect's professional judgment, to be reasonably justified, which shall be further subject to the Owner's review, modification, approval, or rejection. The Architect's interim determination of cost, as modified and/or approved by the Owner, shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of the Contractor 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, subject to Owner approval, 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, Allowances, Contingencies or Contract Time, the Contractor shall notify the Architect in writing 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, Allowances, Contingencies or Contract Time and written instruction from the Architect to proceed, the Contractor waives any adjustment to the Contract Sum or extension of the Contract Time. The Owner shall also retain authority to order such minor changes in the Work. The Contractor shall carry out such written orders promptly. Minor changes in the Work shall not include changes that involve the outward appearance of the structure, color schemes, floor plans, building materials, landscaping, or mechanical equipment.

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 and approved by the Owner in accordance with Section 9.8. The date of Final Completion is the date certified by the Architect and Owner in

accordance with Section 9.10. Unless otherwise agreed in writing by the Owner, the Contractor agrees that Final Completion shall occur by the date set forth in the Agreement, or by such dates thereafter as may be established in any written extensions granted under Article 8 of the General Conditions.

§ 8.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

§ 8.2 Progress and Completion

§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement, the Contractor stipulates 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's approval of such insurance..

§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

§ 8.2.4 The Contractor is subject to liquidated damages, as specified in the Agreement, if the Work is not completed by the date of Substantial Completion and/or the date of Final Completion.

§ 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 (1) an act or neglect of the Owner or Architect, of an authorized employee of either, or of a Separate Contractor; (2) by changes ordered in the Work; (3) by fire, governmental actions, adverse weather conditions documented in accordance with Section 15.1.6.2, or other causes beyond the Contractor's reasonable control which do not arise through the action or inaction of Contractor or its Subcontractor, Sub-subcontractor or suppliers, could not have been reasonably anticipated, and could not have been avoided through the exercise of reasonable care or prudent construction management by the Contractor; (4) by delay authorized in writing by the Owner; or (5) by other causes that the Contractor asserts, and the Architect and Owner determine, justify delay, then the Contract Time may be extended in writing for such reasonable time as the Architect and Owner may determine. The foregoing notwithstanding, the Contractor shall not be entitled to an extension of time for changes in the Work required due to Contractor fault, or which extend beyond the time extension provided in a Change Order. Nothing in this provision will limit the rights of Owner under other provisions of this Contract. Any provision of the Contract Documents to the contrary notwithstanding, it is expressly agreed that the extension of the Contract Time shall be Contractor's sole remedy for any delay unless the same shall have been caused by acts constituting intentional interference by the Owner which materially interfere with Contractor's performance of the Work, and then only to the extent that such acts continue after Contractor's reasonable prior written notice to Owner of such interference.

§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article 15. A disagreement concerning time extensions shall not relieve the Contractor from performing the Work required by the Contract Documents and shall not be cause for the Contractor to suspend Work on the Project.

§ 8.3.3 The Contract does not permit the recovery of damages, including, without limitation, extended home office overhead expenses, general conditions or other consequential damages, by the Contractor for delay or disruption or for extensions of time due to bad weather, acts of God, supply chain issues, or market escalation. Contractor agrees that Contractor shall be fully compensated for all delays solely by an extension of time. Owner's exercise of any of its rights under the Contract Documents, including without limitation, its rights under Article 7, Changes in the Work, regardless of the extent or number of such changes or Owner's exercise of any of its remedies of suspension of the Work or requirement of correction or re-execution of any defective Work, shall not, under any circumstances, be construed as interference with Contractor's performance of the Work and shall not entitle the Contractor to any additional compensation.

§ 8.3.4 In the event of inexcusable delay by Contractor, Owner may direct that the Work be accelerated by means of overtime, additional crews or additional shifts or re-sequencing of the Work. All such acceleration shall be at no cost to Owner.

§ 8.3.5 In the event that Contractor does not complete the Work within the Contract Time, then in addition to any other costs and damages (liquidated or otherwise) for which Contractor is responsible, Contractor will provide, at its expense, any bonds required by governmental authorities to enable Owner to secure a Certificate of Occupancy (if required) even though there are items of Work which are incomplete.

§ 8.3.6 The Contractor's claims related to time shall be made in accordance with applicable provisions of the Contract Documents or they shall be deemed waived.

§ 8.3.7 Any provision of the Contract Documents to the contrary notwithstanding, it is expressly agreed that the extension of the Contract Time shall be Contractor's sole remedy for any delay unless the same shall have been caused by acts constituting interference by the Owner which interfere with Contractor's performance of the work, and then only to the extent that such acts continue after Contractor's written notice to Owner of such interference. Owner's exercise of any of its rights under the Contract Documents or Owner's exercise of any of its remedies of suspension of the Work or requirement or correction or re-execution of any defective Work shall not, under any circumstances, be construed as interference with Contractor's performance of the Work.

§ 8.3.8 Concurrent Delays. For purposes of the calculations provided for in this Paragraph 8.3.8, the words "concurrent delay", "concurrently delay" or "occur concurrently" mean the portion of two or more Delays affecting the critical path to Substantial Completion that are overlapping or co-existent. Contractor's right to a Contract Adjustment of the Contract Time (pursuant to Subparagraphs 8.3.8.1, 8.3.8.2 and 8.3.8.3, below) and Contract Price (pursuant to Subparagraphs 8.3.8.4, 8.3.8.5 and 8.3.8.6, below) shall, in the case of concurrent delays, be calculated in accordance with the following:

§ 8.3.8.1 If an Excusable Delay and a Compensable Delay occur concurrently, the maximum extension of the Contract Time shall be the number of Days from the commencement of the first Delay to the cessation of the Delay which ends last.

§ 8.3.8.2 If an Unexcused Delay occurs concurrently with either an Excusable Delay or a Compensable Delay, the maximum extension of the Contract Time shall be the number of Days, if any, by which such Excusable Delay or Compensable Delay exceeds the number of Days of such Unexcused Delay.

§ 8.3.8.3 If an Unexcused Delay occurs concurrently with both an Excusable Delay and a Compensable Delay, the maximum extension of the Contract Time shall be the number of Days, if any, by which such Excusable Delay and Compensable Delay, as determined pursuant to Subparagraph 8.3.8.1, above, exceeds the number of Days of such Unexcused Delay.

§ 8.3.8.4 If an Unexcused Delay occurs concurrently with a Compensable Delay, the maximum period of time for which Contractor shall be entitled to a Change Order to the Contract Price in accordance with the Agreement shall be the number of Days, if any, by which such Compensable Delay exceeds the number of Days of such Unexcused Delay.

§ 8.3.8.5 If a Compensable Delay occurs concurrently with an Excusable Delay, the maximum period of time for which Contractor shall be entitled to a Change Order to the Contract Price in accordance with the Agreement shall be the number of Days, if any, by which such Compensable Delay exceeds the number of Days of such Excusable Delay.

§ 8.3.8.6 If an Unexcused Delay occurs concurrently with both an Excusable Delay and a Compensable Delay, the maximum period of time for which Contractor shall be entitled to a Change Order to the Contract Price in accordance with the Agreement shall be the number of Days, if any, by which such Compensable Delay exceeds the number of Days of such Unexcused Delay.

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 Contract Sum

§ 9.1.1 The Contract Sum, or if the Project is a Construction Manager at Risk Project, Guaranteed Maximum Price, 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.

§ 9.1.2 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 may, by mutual written agreement, be equitably adjusted.

§ 9.1.3 Notwithstanding anything to the contrary contained in the Contract Documents, the Owner may withhold any payment to the Contractor hereunder if and for so long as the Contractor fails to perform any of its material obligations hereunder or otherwise is in default under any of the provisions of the Contract Documents, subject to the requirements of applicable law.

§ 9.2 Schedule of Values

§ 9.2.1 Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, the Contractor shall submit a Schedule of Values to the Architect and the Owner before the first Application for Payment, or in the case of a Guaranteed Maximum Price, within 15 days after establishing the Guaranteed Maximum Price, allocating the entire Contract Sum to the various portions of the Work, minimally separating the entire Contract Sum into categories matching the sections of the Project Manual. The Schedule of Values shall be prepared in the form, and supported by the data to substantiate its accuracy, required by the Architect and the Owner. This Schedule, unless objected to by the Architect or Owner, 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 or Owner, shall be used as a basis for reviewing the Contractor's subsequent Applications for Payment. The Schedule of Values shall be prepared in such a manner that each major item of Work, whether done by Contractor's own forces or subcontracted, is shown as a single line item on AIA Documents G702 and G703, Application and Certificate for Payment. If the Contractor is a Construction Manager at Risk, then the Contractor's fee and general conditions shall be specifically shown, and AIA Documents G732 and G703 shall be used.

§ 9.2.2 In order to facilitate the review of Applications for Payment, the Schedule of Values shall be submitted on AIA Documents G702 and G703 (or G732 and G703, as applicable), and shall include the following:

- .1 Contractor's cost for Contractor's fee (if applicable) bonds and insurance, mobilization, general conditions, etc. shall be listed as individual line items.
- .2 Contractor's costs for various construction items shall be detailed, generally categorized by specification section, and further by type of application. For example, concrete work shall be subdivided into footings, grade beams, floor slabs, paving, etc.
- .3 On major subcontracts, such as mechanical, electrical and plumbing, the schedule shall indicate line items and amounts in detail (for example: underground, major equipment, fixtures, installation fixtures, start-up, etc.).
- .4 Costs for subcontract work shall be listed without any additional mark-up of Contractor's costs for overhead, profit or supervision.
- .5 If payment for stored materials is requested prior to installation, then material and labor shall be listed as separate line items.
- .6 Contractor shall provide a report of actual versus projected reimbursable expenses (general conditions), updated monthly.

§ 9.3 Applications for Payment

§ 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, Sub subcontractors, and suppliers, and shall reflect retainage if provided for in the Contract Documents.

§ 9.3.1.1 Contractor agrees that, for purposes of Texas Government Code Sections 2251.021 and 2251.042, receipt of the Application for Payment by the Architect shall not be construed as receipt of an invoice by the Owner. Contractor further agrees that Owner's receipt of the Certificate for Payment from the Architect shall be construed as receipt of an invoice by the Owner, for purposes of Texas Government Code Sections 2251.021 and 2251.042.

§ 9.3.1.2 Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor has not been invoiced by a Subcontractor, Sub-subcontractor, or supplier, unless Contractor has self-performed the Work.

§ 9.3.1.3 Until Final Completion of the Work, the Owner shall withhold retainage as provided in the Contract Documents, except that Owner shall not pay amounts for which the Architect refuses to certify payment, or the Owner refuses to pay, as provided herein in Section 9.4.3 or 9.5. The retainage shall be paid with the Final Payment.

§ 9.3.1.4 All progress payment requests shall be accompanied by (i) an itemization of all Subcontractors, Sub subcontractors, and material suppliers, the amounts due each and the amounts to be paid out of said progress payment to each of them and (ii) by unconditional lien waivers releasing all liens and lien rights with respect to Work for which Owner has made payment under a prior progress payment request in a form reasonably satisfactory to Owner from Contractor and all its subcontractors and material suppliers with contracts in excess of \$25,000.00 (Evidence of prior progress payment shall apply to progress payments 61-days or older). When Contractor submits its request for payment of retainage, Contractor shall submit "All Bills Paid" affidavits and unconditional final lien waivers fully releasing all liens and lien rights with respect to the Work in a form reasonably satisfactory to Owner from Contractor and all its Subcontractors, Sub subcontractors, and material suppliers with contracts in excess of \$25,000.00. Applications for Payment shall be certified as correct by Contractor. When requested by Owner or when required by the Davis-Bacon Act, each Application for Payment shall also be accompanied by Certified Payrolls and such other affidavits, certificates, information, data and schedules as Owner may reasonably require. The Owner is not required to make any payment to Contractor to the extent reasonably necessary to protect Owner. In addition to the other requirements of this Article, the initial Application for Payment shall be proceeded or accompanied by the following:

1. List of subcontractors,
2. Schedule of values,
3. Contractor's construction schedule (preliminary if not final),
4. If applicable, Combined Contractor's construction schedule (preliminary if not final) incorporating Work of multiple contracts, with indication of acceptance of schedule by each Contractor,
5. Products list (preliminary if not final),
6. Schedule of unit prices,
7. Submittal schedule (preliminary if not final),
8. List of Contractor's staff assignments,
9. List of Contractor's principal consultants,
10. Copies of building permits,
11. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work,
12. Initial progress report,
13. Report of preconstruction conference,
14. Certificates of insurance and insurance policies,
15. Performance and payment bonds,
16. Data needed to acquire Owner's insurance, and
17. Initial settlement survey and damage report if required

In addition to the other requirements of this Article, each subsequent Application for Payment shall be accompanied by:

1. Updated Microsoft Project schedule meeting the requirements of Section 3.10,
2. Log of Adverse Weather Days, and Instructional Days, including backup documentation,
3. Where Unit Costs are in use, measurements for payments will be made only for actual measured and/or computed length, area, solid contents, number, and weight, unless other provisions are made in the Contract Documents. Payment on a unit price basis will not be made for Work outside finished dimensions shown in the Contract Documents. Include costs for waste, overages and tolerances in the unit price for that line item, and
4. Measurements for unit price quantities will be verified by the Architect/Engineer in conjunction with the General Contractor via inspection of the Work prior to submittal of interim Applications for Payment

§ 9.3.2 Payments will be made on the basis of invoices for specific materials or equipment incorporated in the Work and specific materials or equipment (1) suitably stored at the site or (2) 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 The Contractor's Surety must agree, in writing, to the amounts included in each Application for Payment.
- .4 The Contractor must bear the cost of the Owner's and Architect's expenses related to visiting the off-site storage area and reviewing the stored contents. Contractor acknowledges that Architect's time is an additional service and shall compensate Architect directly for same.
- .5 Payment shall not include any charges for overhead or profit on stored materials.
- .6 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 naming the specific materials or equipment stored and their location) 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 until the materials or equipment are delivered to Owner's site. Failure to follow these procedures shall result in nonpayment for storage of or insurance on stored materials and equipment. Failure to follow these procedures shall also result in nonpayment of materials and equipment until said materials and equipment are incorporated into the Work.

§ 9.3.3 The Contractor warrants that title to all Work, materials, and equipment covered by an Application for Payment will irrevocably pass to the Owner no later than the time of Owner's payment to Contractor of the invoiced cost. Such title shall be free and clear of all liens, claims, security interests or encumbrances. No Work, material or equipment covered by an Application for Payment shall be subject to an agreement under which an interest is retained or an encumbrance is attached by the seller, the Contractor, or other party. The Contractor further warrants that, upon submittal of an Application for Payment, all Work, materials, and equipment 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, Sub-subcontractors, suppliers, or other persons or entities that provided labor, materials, and equipment relating to the Work. **CONTRACTOR SHALL DEFEND, INDEMNIFY AND HOLD OWNER HARMLESS FROM AND AGAINST ANY LIENS, CLAIMS, SECURITY INTERESTS OR ENCUMBRANCES FILED BY THE CONTRACTOR, SUBCONTRACTORS, OR ANYONE CLAIMING BY, THROUGH OR UNDER THE CONTRACTOR OR SUBCONTRACTOR FOR WORK, MATERIALS, EQUIPMENT, OR OTHER ITEMS COVERED BY PAYMENTS MADE BY THE OWNER TO CONTRACTOR.**

§ 9.3.4 Contractor shall submit monthly Applications for Payment electronically, or, if requested by Owner, in writing, to both the Architect and Program Manager, if applicable, in quadruplicate using AIA Documents G702 and G703 Application and Certificate of Payment (or G732 and G703, if applicable) and Continuation Sheet. All blanks in the form must be completed and signatures of Contractor and Notary Public must be original on each form. The Architect and Program Manager, if applicable, may require any additional information deemed necessary and appropriate to substantiate the Application for Payment. Materials that are verified to be on the jobsite or other approved location for use in the Project may also be incorporated into the Application for Payment. Incomplete or inaccurate Applications for Payment shall be returned to the Contractor by the Architect for completion and/or correction. Owner shall have no responsibility for payment of same if the Application for Payment is incomplete or inaccurate.

§ 9.3.5 By signing each Application for Payment, the Contractor stipulates and certifies to the following: that the information presented is true, correct, accurate and complete; that the Contractor has made the necessary detailed examinations, audits and arithmetic verifications; that the submitted Work has been completed to the extent represented in the Applications for Payment; that the materials, equipment, and supplies identified in the Applications for Payment have been purchased, paid for and received; that the Subcontractors, Sub-subcontractors, and suppliers have been paid as identified in the Applications for Payment or that Contractor has been invoiced for same; that Contractor has made the necessary on-site inspections to confirm the accuracy of the Applications for Payment; that there are no known mechanics' or materialmen's liens outstanding at the date of this requisition; all due and payable bills with respect to the Work have been paid to date or are included in the amount requested in the current application; that, except for such bills not paid but so included, there is no known basis for the filing of any mechanics' or materialmen's liens on the Work; that the Payment Application includes only Work self-performed by

Contractor or for which Contractor has been invoiced; and that releases from all Subcontractors, Sub-subcontractors, suppliers, and materialmen have been obtained in such form as to constitute an effective release of lien under the laws of the State of Texas covering all Work performed and for which payment has been made by the Owner to the Contractor. Contractor understands that documents submitted to Owner become government documents under the laws of the State of Texas. Contractor further understands that falsification of Contractor's Application for Payment may constitute a violation of the penal laws of the State of Texas, including, but not limited to, Texas Penal Code Sections 32.46, 37.09, and 37.10, and may justify termination of Contractor's Contract with Owner.

§ 9.3.6 Contractor's request for payment of the retainage may be made only upon expiration of thirty (30) calendar days after Final Completion. The request shall be accompanied by the Contractor's Affidavit of Payment of Debts and Claims or a comparable affidavit on a form acceptable to Owner. This document must be executed under oath and notarized. Per Tex. Gov't Code Section 2252.032(f), on application to Owner for final payment and release of retainage, Owner may withhold retainage if there is a bona fide dispute between Owner and the Contractor and the reason for the dispute is that labor, services, or materials provided by the Contractor, or by a person under the direction or control of the Contractor, failed to comply with the express terms of the Contract or if the surety on any outstanding surety bond executed for the Contract does not agree to the release of retainage. Owner shall provide to Contractor written notice of the basis on which Owner is withholding retainage under this section.

§ 9.4 Certificates for Payment

§ 9.4.1 The Architect and Program Manager, if applicable, will, within seven (7) days after receipt of the Contractor's Application for Payment, either (1) certify, sign and 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) certify, sign and issue to the Owner a Certificate for Payment for such amount as the Architect determines is properly due, and notify the Contractor and Owner in writing with a detailed statement of the Architect's reasons for withholding certification and disputing in part certification in accordance with Texas Government Code Section 2251.042(a) and as provided in Section 9.5.1; or (3) withhold certification of the entire Application for Payment, and notify the Contractor and Owner in writing with a detailed statement of the Architect's reason for withholding certification in whole in accordance with Texas Government Code Section 2251.042(a) and as provided in Section 9.5.1; or (4) return the Payment Application to the Contractor as provided in Section 9.3.4. Architect's written reason(s) for withholding certification shall be submitted in accordance with, and construed as, the notice required by Texas Government Code Section 2251.042 *et seq.* The Owner shall have the right to reject, modify, or approve the Architect's Certificate for Payment in whole or in part, and shall have the right to make the final determination of the payment to be made to the Contractor. The Owner shall pay the undisputed amounts certified by the Architect and Program Manager, if applicable, to the Contractor within forty-five (45) days of receipt of the Certificate for Payment from the Architect and Program Manager, if applicable, unless otherwise provided in the Contract Documents. Undisputed amounts unpaid after the date on which payment is due shall bear interest pursuant to Texas Government Code Section 2251.025.

§ 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's evaluation of the Work and the data in the Application for Payment, that, to the best of the Architect's knowledge, information, and belief, the Work has progressed to the point indicated, the quality of the Work is in accordance with the Contract Documents, and that the Contractor is entitled to payment in the amount certified. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion, and to specific qualifications expressed in writing to the Owner by the Architect. However, the issuance of a Certificate for Payment will not be a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work; (2) reviewed construction means, methods, techniques, sequences, or procedures; (3) reviewed copies of requisitions received from Subcontractors, Sub-subcontractors, and suppliers and other data unless 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. Such examinations, audits, and verifications, if required by the Owner, will be performed by the Owner's auditors, accountants or other representatives acting in the sole interest of the Owner. By submitting the Contractor's Applications for Payment, the Contractor is certifying that the information presented is true, correct, accurate and complete; that he has made the necessary detailed examinations, audits and arithmetic verifications; that the submitted Work has been completed to the extent represented in the Applications for Payment; that the materials and supplies identified in the previous Applications for Payment have been purchased, paid for and received; that the subcontractors have been paid as identified in the previous Applications for Payment; and that he has made the necessary on-site inspections to confirm the accuracy of the Applications for Payment; that there are no known mechanic's or material men's liens

outstanding at the date of requisition; that all due and payable bills with respect to the Work have been paid to date or are included in the amount requested in the current application; that except for such bills not paid but so included, there is no known basis for the filing of mechanic's or material men's liens; and that releases from all subcontractors and material men have been obtained in such form as to constitute an effective release of lien under the laws of the State of Texas causing all Work performed and for which payment has been made by the Owner to the Contractor. In certifying the Contractor's Applications for Payment, the Architect represents that he has observed the progress of the Work, critically evaluated, reviewed and certified that the amounts requested are valid and correct. The issuance of a certificate for payment shall not be a representation by the Architect that the Architect has made exhaustive or continuous on-site inspections or that the Architect has made examinations to ascertain how or for what purposes the Contractor has used amounts previously paid on account of the Contract. Such examinations, audits and verifications, if required by the Owner, will be performed by the Owner's accountants or other representatives of the Owner acting in the sole interest of the Owner. The Contractor acknowledges that the Owner may authorize minor changes to the work and that those minor changes may be funded in full or in part from contingencies or allowances which are represented in Applications for Payment and supporting documents. The Owner will rely upon the accuracy of the Application for Payment and supporting documentation furnished by the Contractor in authorizing minor changes and expenditures against Allowances. Therefore, the Contractor agrees that any arithmetic error made by the Contractor in any Application for Payment and supporting documents such as contingency logs or allowance balances shall not create an obligation on the part of the Owner to pay additional sums to correct previously approved Applications for Payment. **CONTRACTOR SHALL INDEMNIFY AND HOLD OWNER HARMLESS FROM ANY LIENS, CLAIMS, SECURITY INTERESTS OR ENCUMBRANCES FILED BY THE CONTRACTOR, SUBCONTRACTORS, OR ANYONE CLAIMING BY, THROUGH OR UNDER THE CONTRACTOR OR SUBCONTRACTOR FOR ITEMS COVERED BY PAYMENTS MADE BY THE OWNER TO CONTRACTOR.**

§ 9.4.3 The issuance of a Certificate for Payment shall constitute a recommendation to the Owner regarding the amount to be paid and shall be a prerequisite to any payment being made by the Owner to the Contractor. The Certificate of Payment is not binding on the Owner, and the Owner may rely on other provisions of the Contract Documents, as well as the Architect's Certificate, and on other information known to the Owner to determine the amount to be paid to or withheld from the Contractor.

§ 9.5 Decisions to Withhold Certification

§ 9.5.1 The Architect 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 opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect 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 in the Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including, but not limited to, loss resulting from acts and omissions described in Section 3.3.2, because of

- .1 defective Work not remedied;
- .2 third party claims filed 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, Sub subcontractors, or suppliers 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 a Separate Contractor;
- .6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay;
- .7 failure to carry out the Work in accordance with the Contract Documents;
- .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; or
- .9 failure to provide any submittals or documentation required under the Contract Documents in a timely manner, including a schedule of values and a construction schedule.

§ 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 Notwithstanding any provision contained within this Article, if the Work has not attained Substantial Completion or Final Completion by the required dates, subject to extensions of time allowed under these General Conditions, then Architect may withhold any further Certificate for Payment to Contractor to the extent necessary to preserve sufficient funds to complete the construction of the Project and to cover liquidated damages. The Owner shall not be deemed to be in breach of the Contract Documents by reason of the withholding of any payment which Owner is entitled to withhold pursuant to any provision of the Contract Documents or withholding in reliance on any such Contract Document provision in good faith, or withholding, in good faith, in reliance on information that has come to the attention of the Owner that Owner reasonably believes constitutes sufficient reason to withhold payment, and no interest shall accrue in connection with the withheld payment(s) determined to have been properly withheld.

§ 9.5.5 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.

§ 9.6 Progress Payments

§ 9.6.1 After the Architect has issued a Certificate for Payment for undisputed amounts, the Owner shall review the Application for Payment and the Architect's Certificate and shall make payment or withhold payment in the manner and within the time provided in the Contract Documents, and shall notify Contractor within 21 days if Owner disputes the Architect's Certificate for Payment, pursuant to Texas Government Code Section 2251.042 et seq, listing the specific reasons for nonpayment. Payments to the Contractor shall not be construed as releasing the Contractor or his Surety from any obligations under the Contract Documents..

§ 9.6.2 The Contractor will receive the payments made by Owner and will hold such payments in trust to be applied first to the payment of Subcontractors, Sub-subcontractors, suppliers and any other parties furnishing labor, materials, equipment or services for the Work in accordance with the provisions of their subcontracts. The Contractor shall pay each Subcontractor, Sub-subcontractor, and supplier, no later than seven days after receipt of payment from the Owner and before using any part of the payment from the Owner for any other purpose, the amount to which such party is entitled, reflecting percentages actually retained from payments to the Contractor on account of such party's portion of the Work, and shall, if requested, provide the Owner with evidence of such payment. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner, and if the Owner so requests, shall provide to the Owner copies of such Subcontractor payments. If the Contractor has failed to make payment promptly to the Contractor's Subcontractors, Sub-subcontractor, or for materials or labor used in the Work for which the Owner has made payment to the Contractor, the Owner shall be entitled to withhold payment to the Contractor, in part or in whole, to the extent necessary to protect the Owner. This Section is subject to the provisions of Texas Business and Commerce Code Chapter 56, as applicable to Owner.

§ 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. The Owner shall have the right at all times to contact Subcontractors, Sub-subcontractors, and material and equipment suppliers to ascertain whether they have been properly paid. Progress payments may, in the discretion of Owner, be made in the form of checks payable jointly to the Contractor and such parties. In the event Owner receives any notices of non-payment from parties furnishing labor, materials, equipment or services for the Work, progress payments and/or Final Payment may, in the discretion of Owner, be made in the form of checks payable jointly to the Contractor and such parties for such amounts as the Contractor agrees or the Owner determines are due. Notwithstanding any other provision in the Contract Documents, neither the Owner nor Architect shall have an obligation to pay, or to see to

the payment of money to, a Subcontractor Sub-subcontractor or supplier. Action on the part of the Owner to require Contractor to pay a Subcontractor, Sub-subcontractor, or supplier shall not impose any liability on Owner.

§ 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 The Contractor shall, as a condition precedent to any obligation of the Owner under the Contract, provide to the Owner payment and performance bonds in the full penal amount of the Contract in accordance with the terms and provisions of the Contract Documents, including Article 11 herein, and in accordance with Texas Government Code Chapter 2253. Payments received by the Contractor from the Owner for Work properly performed by Subcontractors, Sub subcontractors, or provided by suppliers shall be held in trust by the Contractor for the benefit of those Subcontractors, Sub subcontractors, or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner.

§ 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 may notify the Contractor. The Contractor acknowledges that no lien rights exist with respect to public property.

§ 9.6.9 Contractor shall not withhold as a retainage a greater percentage from Subcontractors or materialmen than the percentage that Owner withheld as retainage from payments to Contractor.

§ 9.7 Failure of Payment

§ 9.7.1 Pursuant to Texas Government Code Section 2251.051, if the Owner does not pay the Contractor any payment certified by the Architect, which is undisputed, due and owing after the date the payment is due under the Contract Documents, then the Contractor may, upon ten (10) additional days' notice to the Owner and Architect that payment has not been made and the Contractor intends to suspend performance for nonpayment, may, subject to applicable law, stop the Work until payment of the undisputed amount owing has been received. If the Owner provides written notice to the Contractor that: 1) payment has been made; or 2) a bona fide dispute for payment exists, listing the specific reasons for nonpayment, then Contractor shall be liable for damages resulting from suspension of the Work. If a reason specified is that labor, services, or materials provided by the Contractor are not provided in compliance with the Contract Documents, then the Contractor shall be provided a reasonable opportunity to cure the noncompliance or to compensate Owner for any failure to cure the noncompliance. No amount shall be added to the Contract Sum as a result of a dispute between Owner and Contractor unless and until such dispute is resolved in Contractor's favor.

§ 9.7.2 If the Architect does not issue a Certificate for Payment within seven (7) days after receipt of the Contractor's Application for Payment, through no fault of the Contractor, then the Contractor shall provide written notice to the Owner, and the Owner shall have fourteen (14) Business Days after receipt of such notice to provide or obtain a Certificate for Payment. If Owner fails to provide or obtain the Certificate for Payment, then the Contractor may, upon fourteen (14) additional Business Days' written notice to the Owner and Architect, stop the Work until payment of the undisputed amount owing has been received.

§ 9.7.3 If the Owner is entitled to reimbursement or payment from the Contractor under or pursuant to the Contract Documents, such payment shall be made promptly upon demand by the Owner. Notwithstanding anything contained in the Contract Documents to the contrary, if the Contractor fails to promptly make any payment due to Owner, pursuant to the Contract, or the Owner incurs any costs or expenses to cure any default of the Contractor or to correct defective Work, then the Owner shall have an absolute right to offset such amount against the Contract Sum and may, in the Owner's sole discretion and without waiving any other remedies, elect either to:

- .1 deduct an amount equal to that to which the Owner is entitled from any payment then or thereafter due to Contractor from the Owner; or
- .2 issue a written notice to the Contractor reducing the Contract Sum by an amount equal to that to which the Owner is entitled.

§ 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; all Project systems included in the Work or designated portion thereof have been successfully tested and are fully operational; system demonstrations have been performed; and a certificate of occupancy shall have been issued before Substantial Completion can be achieved. The Work will not be considered suitable for Substantial Completion review until all required governmental inspections and certifications required of the Work have been made, approved, and posted; designated initial demonstration and instruction of Owner's personnel in the operation of Project systems has been completed; all final finishes set out within the Contract Documents are in place as required by the Specifications, and there shall have been a completion of and acceptance by Owner of all major punch-list items and a majority of minor items are of a cosmetic nature, so that the Owner could occupy or otherwise utilize the Project on that date and the completion of the Work by the Contractor would not materially interfere or hamper the Owner's (or those claiming by, through or under the Owner) normal business operations. All work that could interfere with the Owner's use following Substantial Completion shall be performed by the Contractor after hours at no additional expense to the Owner. As a further condition of Substantial Completion acceptance, the Contractor shall certify that all remaining Work will be completed by the date of Final Completion stated in the Contract Documents. In the event Substantial Completion is not achieved by the designated date, or as it may be extended, Owner may withhold payment of any further sums due until Substantial Completion is achieved. Owner shall also be entitled to deduct out of any sums due to Contractor any or all Liquidated Damages due Owner in accordance with the Contract Documents. In addition to the requirements of the Contract Documents, it is expressly understood that the establishment of Substantial Completion is subject to the following:

1. All fire alarm system components must be completed and demonstrated to the Owner.
2. Local fire marshal approval certificate must be delivered to the Owner.
3. All Project systems included in the Work or designated portion thereof have been successfully tested and are fully operational.
4. All HVAC air and water balancing must be complete.
5. All Energy Management Systems must be complete and fully operational and demonstrated to the Owner.
6. All school communications equipment, building security/access control, and telephone systems must be complete and demonstrated to the Owner.
7. All final lockset cores and keys must be installed, transmitted to the Owner, and labeled with a hitting list.
8. All room plaques, signage, and wayfinding signage must be complete.
9. All Owner demonstrations and training must be completed, including kitchen equipment, HVAC equipment, plumbing equipment, and electrical equipment.
10. All final finishes set out within the Contract Documents are in place as required by the Specifications.
11. All exterior clean-up and landscaping must be complete.
12. All final interior clean-up must be complete.
13. A final Certificate of Occupancy and/or Certificate of Completion conforming to the requirements of the location jurisdictional authority must be signed by the Contractor and delivered to the Owner.
14. All operation and maintenance manuals must be submitted to the Architect, approved by the Architect, and delivered to the Owner.
15. Temporary facilities and utility services have been removed.
16. If required, Flood elevation certificate furnished and accepted by all authorities having jurisdiction, including but not limited to the County in which the Project is located.
17. If required, Windstorm (WPI-8) certificate furnished and accepted by all authorities having jurisdiction, including but not limited to the County in which the Project is located.

§ 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, using the Owner's Project Management Software, prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to Final Payment. The punch list shall contain an area or room description, and a photograph of each deficiency listed in the punch list and a space for contractor and architect to individually indicate the date of the correction and observation of the correction, respectively. 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. The Architect and/or Owner shall have the right to add additional items to be completed or corrected to the comprehensive list submitted by the Contractor.

§ 9.8.2.1 The Contractor's Project Manager or superintendent shall participate in the preparation of the Contractor's punch list that is submitted to the Architect and Owner for supplementation. Upon receipt, the Architect shall

perform a spot review to determine the adequacy and completeness of the Contractor's punch list. 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 further inspection and revision. The date of Substantial Completion will be delayed until the punch list submitted is a reasonable representation of the Work to be done.

§ 9.8.2.2 Upon receipt of an acceptable Contractor's punch list, the Contractor's Superintendent or Project Manager shall accompany the Architect, his Consultants and the Owner (at his discretion) during their inspections and the preparation of verbal or written additions to the Contractor's punch list. The Contractor's Project Manager or Superintendent shall record or otherwise take notes of all supplementary items and incorporate into the Final Punch List. A typed addition to the supplements to the punch list will be made by the Contractor. This procedure will produce a Final Punch List that has the Contractor's, Architect's, Consultant's and Owner's comments incorporated in only one list using the Owner's Project Management Software. Delay in the preparation of the Final Punch List 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 its consultants and will have been expected to have taken appropriate own notes.

§ 9.8.2.3 The Contractor's Project Manager or Superintendent shall have been in attendance during the inspections of the Architect and his Consultants and will have been expected to take his own notes for addition to the Final Punch List.

§ 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, then the Architect shall so notify the Contractor and Owner in writing, and the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect or Owner. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion. Architect is obligated under the agreement between Owner and Architect to make only a limited number of site visits to determine dates of Substantial Completion. Any fee which Owner incurs for additional site visits of Architect for determination of Substantial Completion will be at the expense of Contractor. Owner will deduct amount of Architect's compensation for re-inspection services from Final Payment or, at the Owner's discretion, may require the Contractor to reimburse the Owner for such costs directly.

§ 9.8.4 When the Work or designated portion thereof is substantially complete, the Architect will prepare, sign, and issue to Owner 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 Final Punch 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.

§ 9.8.5.1 After the date of Substantial Completion of the Project as evidenced by the Certificate of Substantial Completion, the work to correct all deficiencies contained in the punch list attached to the Certificate of Substantial Completion shall be completed by the date set forth in the Agreement, or by such dates thereafter as may be established in any written extensions granted under Article 8 of the General Conditions. Failure by 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 ninety (90) additional days, the Owner will initiate action to complete corrective work out of the remaining contract funds in accordance with Article 14.2. Additional costs of the Owner, Architect, and other consultants incurred because of the Contractor's failure to complete the correction of deficiencies by the date set forth in the Agreement, or by such dates thereafter as may be established in any written extensions granted under Article 8 of the General Conditions, will be deducted from the funds remaining to be paid to the Contractor. Should corrective work following Substantial Completion require more than one re-inspection after notification by the Contractor that corrections are complete; the cost of subsequent inspections shall also be deducted from funds remaining unpaid to the Contractor.

§ 9.8.5.2 The issuance of a Partial Certificate of Substantial Completion shall not relieve the Contractor from the obligation to obtain Substantial Completion for the portions of the project not included in the Partial Certificate of Substantial Completion by the dates indicated in this Agreement. The issuance of a Partial Certificate of Substantial Completion shall not relieve the Contractor from the assessment of liquidated damages for the portions of the project not included in the Partial Certificate of Substantial Completion by the dates indicated in this Agreement.

§ 9.8.6 Retainage is not due to the Contractor until thirty-one (31) days after Final Completion of the Work as set out in Section 9.10. After the Certificate of Substantial Completion is accepted by the Owner, the Owner may, at its sole discretion and upon acceptance and consent of surety, make payment of retainage on all or a part of the Work accepted. Final Completion includes submittal of all required closeout and record documents. The Contractor's request for retainage payment shall be accompanied by the Contractor's Affidavit of Payment of Debts and Claims or a comparable affidavit on a form acceptable to Owner. This document must be executed under oath and notarized.

§ 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, if such consent is necessary, 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 that 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 and Owner 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 or Owner. Contractor agrees that the Owner may place and install as much equipment and furnishings as is possible before completion or partial completion of portions of the Work.

§ 9.9.2 Immediately prior to such partial occupancy, use, or installation, 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 in writing, partial occupancy or use of a portion or portions of the Work or installation of furnishings and equipment shall not constitute acceptance of Work not complying with the requirements of the Contract Documents nor shall it constitute evidence of Substantial Completion or Final Completion.

§ 9.9.4 In the event that Owner takes partial occupancy or installs furnishings and equipment prior to Substantial Completion of the Project, Contractor shall obtain an endorsement to Contractor's Builder's Risk Policy to provide extended coverage for partial occupancy if the Contractor's Builder's Risk Coverage required by Article 11 would not otherwise provide such coverage.

§ 9.9.5 Non-Triggering of Substantial Completion by Owner Occupancy: The parties expressly acknowledge and agree that any occupancy or use of the Project, or any portion thereof, by the Owner prior to formal acknowledgment of Substantial Completion as defined in the Contract Documents does not constitute or imply the attainment of Substantial Completion. Any necessity or decision by the Owner to occupy the Project, or any portion thereof, prior to the Contractor's full completion of all contractual obligations does not accelerate or alter the Contractor's duties or the standards for Substantial Completion. The Contractor remains fully obligated to achieve Substantial Completion according to the terms set forth in the Contract Documents, irrespective of any such early occupancy or use by the Owner. The Owner's occupancy, whether full or partial, will not trigger or cause Substantial Completion or affect any rights or obligations that arise upon Substantial Completion, including but not limited to, commencement of any warranties or guarantees, or the period for final completion.

§ 9.10 Final Completion and Final Payment

§ 9.10.1 When all of the Work is finally completed and all required documentation has been submitted, and the Contractor is ready for a final inspection, it shall notify the Owner and the Architect thereof in writing. Upon receipt of the Contractor's notice that the Work is ready for final inspection and acceptance, the Architect will promptly make such inspection. When the Architect finds the Work acceptable under the Contract Documents and the

Contract fully performed, the Contractor shall issue its final Application for Payment. Upon the Architect's agreement and approval, the Architect will promptly prepare, sign, and issue a Owner's Certificate of Final Completion and final Certificate for Payment certifying to the Owner that best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with the Contract Documents and that the entire balance, including all retainage, found to be due the Contractor and noted in the final Certificate is due and payable. The Architect'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. Owner may rely on other provisions of the Contract Documents, as well as the Architect's certifications, in determining the payment to be made to Contractor. Final Payment shall be made by the Owner in accordance with Owner's regular schedule for payments. The Architect is obligated under the agreement between Owner and Architect to make only a limited number of site visits to determine Final Completion. Any fee which Owner incurs for additional site visits of Architect for determination of Final Completion will be at the expense of Contractor. Owner will deduct amount of Architect's compensation for re-inspection services from final payment or, at the Owner's discretion, may require the Contractor to reimburse the Owner for such costs directly.

§ 9.10.2 Neither Final Payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) using AIA Document G706, 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) evidence satisfactory to Owner 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) using AIA Document G707, Consent of Surety, if any, to Final Payment, (5) documentation of any special warranties, such as manufacturers' warranties or specific Subcontractor warranties, and (6) except for amounts currently withheld by the Owner, other data establishing payment or satisfaction of obligations, such as AIA Document G706A, notarized subcontractor lien releases, and other receipts and releases and waivers of liens, claims, security interests, or encumbrances arising out of the Contract or the Work, to the extent and in such form as may be designated by the Owner. If a Subcontractor, Sub-subcontractor, or supplier 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. In addition, the following items must be completed and received by the Owner before Final Payment will be due:

- .1 Written certifications required by Sections 10.5, 10.6, and 10.7.
- .2 Final List of Subcontractors (AIA Document G705);
- .3 Contractor's certificate(s) required by 19 Tex. Admin. Code 61.1036-61.1040, as applicable;
- .4 Contractor's and other required warranties, organized as required elsewhere in the Contract Documents;
- .5 Maintenance and Instruction Manuals;
- .6 Owner's Final Completion Certificate; and
- .7 Record drawings and "as built" drawings as required elsewhere in the Contract Documents.

Documents identified as affidavits must be notarized. All manuals will contain an index listing the information submitted. The index section will be divided and identified by tabbing each section as listed in the index. Upon request, the Architect will furnish the Contractor with blank copies of the forms listed above. Final Payment shall be paid by the Owner to the Contractor within thirty (30) days after Owner's Board of Trustees has voted to accept the Work and approve Final Payment, unless otherwise delegated.

Owner, Architect, Contractor, and prime subcontractors, if applicable, shall certify compliance with all applicable school facility standards required in 19 TAC Section 61.1040 subsections (d) and (g)-(k). 19 TAC Section 61.1040(f).

Per 19 TAC Section 61.1040(6)(f)(C), Contractor shall certify the following:

(i) Process certifications. To ensure construction quality and performance of contract terms, the Contractor and prime subcontractors, if applicable, shall certify compliance that the Project has been built in conformance with the contract documents.

(ii) Certifications related to construction quality standards under subsection (j) of 19 TAC Section 61.1040.

To ensure compliance with construction quality standards, the Contractor and prime subcontractors, if applicable, shall certify compliance at the completion of a capital improvement project that the Project has been built in conformance with the contract terms and performance standards specified by the Contract Documents for the Contractor and for any of its subcontractors or subconsultants of any tier, which shall include certification of compliance with any subsequent change order documents approved by the Owner and Architect.

Where a third-party code compliance officer is required by subsection (j) of 19 TAC Section 61.1040 to ensure that a third-party code compliance officer does not find any violations of the provisions of the required construction codes identified in subsection (j)(1) of 19 TAC Section 61.1040 that are not enforced by a state or local authority having jurisdiction, Owner shall require that a third-party code compliance officer issue a third-party certificate of occupancy. Where a local authority having jurisdiction enforces some of the required construction codes, a third-party code compliance officer shall not issue a third-party certificate of occupancy until either the local authority having jurisdiction has issued a certificate of occupancy or the local authority having jurisdiction indicates in writing to the third-party code compliance officer that the local authority having jurisdiction does not issue certificates of occupancy.

Certifications related to safety and security standards under subsection (k) of 19 TAC Section 61.1040. To provide a safe and secure environment, the Contractor and prime subcontractors, if applicable, shall certify compliance that the Project has been built in reasonable accordance with the safety and security directives provided by the school district and reflected in the Contract Documents prepared by the Architect.

Special provisions for a Construction Manager-Agent. For projects that use the construction manager agent contracting method established in Texas Government Code Chapter 2269, Subchapter E, the Construction Manager Agent and each construction prime contractor must provide certification in accordance with clause (i) of 19 TAC Section 61.1040, and each shall certify the scope of work for which they are contractually responsible.

§ 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, if necessary, written consent of the surety, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed, corrected, and accepted, less retainage. 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 by Owner. Nothing in this subsection is intended to limit or reduce Owner's rights and remedies in the event of a Contractor default.

§ 9.10.4 The making of Final Payment shall not constitute a waiver of Claims by the Owner

§ 9.10.5 Acceptance of Final Payment by the Contractor, a Subcontractor, Sub-subcontractor, or a supplier, shall constitute a waiver of claims by that payee except those previously asserted pursuant to Article 15 made in writing and identified by that payee as unsettled at the time of final Application for Payment.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 Safety Precautions and Programs

§ 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 Contractors 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 performance of its obligations under Article 10 shall not relieve any Subcontractor, Sub-subcontractor, supplier, or any other person or entity, of their responsibilities for the safety of persons and property and for compliance with all applicable federal, state and local laws, rules, regulations, and ordinances, nor shall any such party be relieved from 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, Sub-subcontractors, suppliers or 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, possess, 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 adopted or will adopt its own policy 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, Sub-subcontractors, suppliers, 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 incident 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 for-cause alcohol or drug test.

§ 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, school personnel, students, and other persons on or off Owner's premises who may be affected thereby, including the installation of fencing between the Work site and the occupied portion of a connecting or adjacent educational or other facility;
- .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, a Sub-subcontractor, or a supplier; and
- .3 other property at the site or adjacent thereto, such as other buildings and their contents, fencing, trees, shrubs, lawns, walks, athletic fields, facilities and tracks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction.

The Contractor shall also do all things necessary to protect the Owner's premises and all persons from damage and injury, when all or a portion of the Work is suspended for any reason. Contractor's obligations under Section 10.2 as to each portion of the Project shall continue until Owner takes full possession of and occupies that portion of the Project.

§ 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. The Contractor shall promptly report in writing to the Owner and Architect all accidents arising out of or in connection with the Work which cause death, bodily injury, or property damage, giving full details and statements of any witnesses. In addition, if death, serious bodily injuries, or serious property damages are caused, the accident shall be reported immediately by telephone or messenger to the Owner and the Architect.

§ 10.2.3 The Contractor shall implement, erect, and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including installing fencing, posting danger signs and other warnings against hazards; promulgating safety regulations; and notifying the owners and users of adjacent sites and utilities of the safeguards. 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 or improvements shall be promptly repaired by the Contractor. Contractor shall provide reasonable fall protection safeguards and provide approved fall protection safety equipment for use by all exposed Contractor employees.

§ 10.2.4 When use or storage of explosives or other hazardous materials or 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 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 explosive materials on Owner's property is prohibited unless expressly approved in advance in writing by Owner and Architect..

§ 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.

§ 10.2.7 The Contractor shall not load or permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition.

§ 10.2.8 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 or to other portions of the Project. The Contractor shall be responsible for performing all repairs and/or replacement of any Work that results from foreseeable weather conditions, and shall also be responsible for all repairs and/or replacement of any other portions of the Project to the extent such repairs and/or replacement are required as a result of Contractor's failure to properly secure the Work or otherwise take precautions with respect to the Work as required under this Section 10.2.8.

§ 10.2.9 Injury or Damage to Person or Property

If either party to the Contract suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts and omissions 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 twenty-one (21) days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter. Provided, however, Contractor understands that, under Texas law, Owner has tort immunity.

§ 10.2.10 The performance of the foregoing services 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.

§ 10.2.11 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.

§ 10.3 Hazardous Materials and Substances

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials or substances. 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), 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. The Contractor shall have no responsibility to initially discover the presence of such hazardous materials on the project site, but shall have an affirmative duty to immediately report to the Owner the existence of such materials actually known by the Contractor or the Contractor's subcontractors to be present on the project site. Provided, however, that these limitations shall not apply if the Contractor places or allows such hazardous materials to be placed on the Project site. If Contractor encounters polychlorinated biphenyl (PCB), and the specifications require the PCB's removal, the Contractor shall remove the PCB and store it in marked containers at the jobsite provided by the

Owner. If PCBs are found which are leaking, then Contractor shall stop work on the affected fixture and shall contact Owner for removal and disposal of the leaking PCBs.

§ 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 within a reasonable time to be determined upon written agreement of the Owner and Contractor. The Contractor may be entitled to an equitable adjustment regarding the Date of Substantial Completion and/or Final Completion to the extent of any delay directly attributable to efforts to remove or safely contain a material or substance as required hereunder. If Contractor is engaged by Owner to remove and/or contain a material or substance as required under Section 10.3, Owner and Contractor shall mutually agree, in writing, on a Change Order to reflect payment for such work.

§ 10.3.3 IF CONTRACTOR IMPORTS HAZARDOUS MATERIALS ONTO THE PROJECT SITE, THEN CONTRACTOR HEREBY AGREES TO DEFEND, INDEMNIFY AND HOLD HARMLESS THE OWNER, ITS CONSULTANTS, TRUSTEES, OFFICERS, AGENTS AND EMPLOYEES, AGAINST ANY CLAIMS ARISING OUT OF OR RELATED TO SUCH IMPORTATION, INCLUDING BUT NOT LIMITED TO COSTS AND EXPENSES THE OWNER INCURS FOR REMEDIATION OF A MATERIAL OR SUBSTANCE THE CONTRACTOR BRINGS TO THE SITE, AS PROVIDED FOR IN SECTION 3.18.

§ 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 actual cost and expense thereby incurred.

§ 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.

§ 10.5 Materials Containing Asbestos, Lead or PCB's

§ 10.5.1 As part of submittals under the section in the Project Manual related to Contract Closeout, and prior to Final Payment and payment of retainage, the Contractor and, as applicable, each Subcontractor, Sub-subcontractor and supplier shall submit all applicable Safety Data Sheets (SDS) and a notarized statement on company or other official letterhead certifying to the best of their information, knowledge and belief, that no lead, asbestos, asbestos-containing (or, under reasonably foreseeable conditions, releasing) materials or PCBs in excess of amounts allowed by Local/State standards, laws, codes, rules and regulations; the Federal Environmental Protection Agency (EPA) standards and/or the Federal Occupational Safety and Health Administration (OSHA) standards, whichever is most restrictive, have been used or incorporated into the Work, and lead or lead-bearing (or, under reasonably foreseeable conditions, releasing) materials have not been incorporated into potable water systems. As used in this statement, the term "potable water systems" shall include, without limitation, those water systems for drinking fountains, all sinks, showers, bath tubs, residential and commercial kitchen equipment, ice machines, and hose bibs, as applicable

to the Project. The notarized statement shall further state that, should any such materials be found in any of the Work in contravention of the notarized statement, then Contractor shall be responsible for taking all necessary corrective action to remove those materials from the Work, at no additional cost to the Owner. The notarized statement shall be dated, shall reference this specific Project, and shall be signed by not less than two (2) officers of the Contractor or the applicable Subcontractor, Sub-subcontractor, or supplier.

§ 10.5.2 To the best knowledge of the Owner, the Architect and his consultants, no products or materials containing asbestos or polychlorinated biphenyl (PCB) or other toxic substances have been specified for this Project. In the event the Contractor, its Subcontractors, Sub-subcontractors, or suppliers become aware that any products or materials specified, ordered, scheduled for or already incorporated in the Work on this Project, contain any hazardous material, whether stated in the Contract Documents or not, the situation shall be reported immediately to the Owner and Architect in writing. An acceptable, equal substitute for the product or material in question shall be proposed by the Contractor, and the product or material in question, if already onsite or incorporated in the Work, shall be removed from the site immediately and returned to the supplier or manufacturer.

§ 10.5.3 Final Payment and payment of retainage shall not be made until the information and notarized statements required under Section 10.5 have been received by Owner.

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 Contractor's Insurance and Bonds

§ 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, its trustees, officers, employees, agents, and representatives, Architect, and Architect's consultants, the Program Manager, if applicable, shall be named as additional insureds under the Contractor's commercial general liability policy or as otherwise described in the Contract Documents.

§ 11.1.2 The Contractor shall provide surety bonds of the types, for such penal sums, and subject to such terms and conditions as required by the Contract Documents. The Contractor shall purchase and maintain the required bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 11.1.3 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

§ 11.1.4 Notice of Cancellation or Expiration of Contractor's Required Insurance. Without limiting or waiving Owner's right to earlier notice of any modification, termination, or expiration of insurance coverages as provided in the Contract Documents, immediately upon 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, expiration, or other lapse. Upon receipt of written 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

§ 11.2.1 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. The Owner shall be responsible for purchasing and maintaining property and casualty insurance no later than the date of Substantial Completion and such dates of Owner responsibility shall be documented in the Certificate of Substantial Completion. If Owner occupies or uses any completed or partially-completed portion of the Work at any stage, then such occupancy or use must be consented to by the insurer and authorized by public authorities having jurisdiction over the Work. To the extent of overlap between Owner's property insurance and Contractor's builder's risk insurance, if any, Contractor's builder's risk shall be primary and non-contributory.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 Uncovering of Work

§ 12.1.1 If the Contract Documents specify, or the Architect or Owner requests, that certain Work shall not be covered until the Architect has had an opportunity to examine such Work, the Contractor shall notify the Architect in writing a minimum of 48 hours prior to covering up any such Work in progress in order for the Architect to make proper field observations of the Work in place. The Contractor shall place no concrete, fill-in ditches, or cover up walls or ceilings without first contacting the Architect as noted above and receiving approval. If a portion of the Work is covered contrary to the Architect's or Owner's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Architect or Owner, 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 and the Contract Documents do not specify otherwise and the Architect or Owner 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 may be entitled to an equitable adjustment to the Contract Sum and Contract Time as may be appropriate for the actual cost to uncover and replace such Work. If such Work is not in accordance with the Contract Documents, the costs of uncovering the Work, and the cost of correction, and replacement, 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 circumstances, 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.

§ 12.2.2 After Substantial Completion

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the entire 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 nonconforming condition. The Owner shall give such notice promptly after discovery of the condition. 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. Nothing contained in this Section 12.2 is intended to limit or modify any obligations under the law or under the Contract Documents, including any warranty obligations, expressed or implied.

§ 12.2.2.1.1 If the Contractor fails to perform the corrective Work, then Owner may perform corrective Work, at Contractor's cost. If Owner performs corrective Work, then Owner may, but is not obligated to, also remove nonconforming Work and store the salvageable materials or equipment at Contractor's expense. If the Contractor does not pay all costs incurred by Owner within ten (10) days after written notice, then Owner may, upon ten (10) additional days' written notice, sell the removed materials and equipment in accordance with Owner's policies, and shall account for the proceeds thereof, after deducting costs and damages that should have been borne by the Contractor, including compensation for the Architect's services and expenses made necessary thereby. If such proceeds of sale do not cover costs which the Contractor should have borne, then the Contractor shall pay the difference to the Owner.

§ 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 be extended by corrective Work performed by the Contractor pursuant to this Section 12.2, but only as to that corrected Work.

§ 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.

§ 12.2.6 Contractor shall replace, repair, or restore any parts of the Project or furniture, fixtures, equipment, or other items placed therein (whether by Owner or any other party) that are injured or damaged by any such parts of the Work that do not conform to the requirements of the Contract Documents or by defects in the Work.

§ 12.2.7 The provisions of this Section 12.2 apply to Work done by Subcontractors and Sub-subcontractors of the Contractor as well as Work done directly by employees of the Contractor. The provisions of this Section 12.2 shall not apply to corrective work attributable solely to the acts or omissions of any Separate Contractor of Owner (unless Contractor is acting in such capacities). The cost to Contractor of performing any of its obligations under this Section 12.2 to the extent not covered by insurance shall be borne by Contractor.

§ 12.2.8 If, however, Owner and Contractor deem it inexpedient to require the correction of Work damaged or not done in accordance with the Contract Documents, then an equitable deduction from the Contract Sum shall be made by agreement between Contractor and Owner. Until such agreement, Owner may withhold such sums as Owner deems just and reasonable from moneys, if any, due Contractor. The agreement shall not be unreasonably delayed by the Owner and the amount of money withheld shall be based on estimated actual cost of the correction to Owner.

§ 12.3 Acceptance of Nonconforming Work

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.

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 Governing Law

The Contract shall be governed by the laws of the State of Texas, and any litigation shall be conducted in state district court. Mandatory and exclusive venue for any disputes shall be in Montgomery County, or, if no county is specified, then the county in which the Owner's main administrative office is located.

§ 13.2 Successors and Assigns

§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns, and legal representatives to the other party hereto and to partners, successors, assigns and legal representatives of such other party in respect to covenants, agreements, and obligations contained in the Contract Documents. Except as expressly provided otherwise in the Contract Documents, neither party to the Contract shall assign the Contract, in whole or in part, 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 invalidity of any part or provision of the Contract Documents shall not impair or affect in any manner whatsoever the validity, enforceability or effect of the remainder of the Contract Documents.

§ 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 at appropriate times as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules, and regulations or lawful orders of public authorities having jurisdiction. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections, and approvals, which shall be included in the Cost of the Work. Provided, however, per Texas Government Code Chapter 2269, Owner shall bear all costs of inspection services, the testing of construction materials engineering, and the verification testing services necessary for acceptance of the facility by the Owner 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.

§ 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, but not limited to, 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, with copy to the Owner.

§ 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

Undisputed payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at the rate provided by Texas Government Code Section 2251.025. Any such payment shall be deemed overdue on the thirty-first day after Owner received Architect's invoice or Contractor's Certificate for Payment from the Architect; if Owner's Board of Trustees meets more than once per month. Any such payment shall be deemed overdue on the forty-sixth day after Owner receives Architect's invoice or Contractor's Certificate for Payment from the Architect, if Owner's Board of Trustees meets once a month or less frequently. No interest shall be due on sums properly retained by Owner, except as provided by law, or on disputed sums unpaid by Owner.

§ 13.6 Equal Opportunity in Employment

§ 13.6.1 The Contractor and the Contractor's Subcontractors and Sub-subcontractors shall not discriminate against any employee or applicant for employment in the performance of the Agreement, with respect to hire, tenure, terms, conditions and privileges of employment, or a matter directly or indirectly related to employment, because of race, color, religion, age (except where based on a bona fide occupational qualification), disability, sex except where based on a bona fide occupational qualification), national origin, ancestry, or any other basis protected by law. The

Contractor agrees to post in conspicuous places, available to employees and applicants, notices setting forth the Contractor's nondiscrimination policies. Contractor further agrees that every subcontract entered into for the performance of the Agreement will contain a provision requiring non-discrimination in employment herein specified. Breach of this covenant may be regarded as a material breach of the Agreement.

§ 13.6.2 The Contractor and the Contractor's Subcontractors and Sub-subcontractors shall, in all solicitations or advertisements for employees placed by them or on their behalf, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, age, disability, sex, national origin, ancestry, or any other basis protected by law.

§ 13.7 Records

§ 13.7.1 Contractor shall at all times through the date of Final Completion, maintain Job Records, including, but not limited to, invoices, payment records, payroll records, daily reports, diaries, logs, instructions, drawings, receipts, subcontracts, purchase orders, vouchers, memoranda, other financial data and job meeting minutes applicable to the Project, in a manner which maintains the integrity of the documents. Job Records must be retained by Contractor for at least twelve (12) years after the date of Final Completion of the Project. Within ten (10) days of Owner's request, Contractor shall make such Job Records available for inspection, copying and auditing by the Owner, Architect or their respective representatives, at Owner's central office.

§ 13.7.2 If Contractor is a Construction Manager at Risk, then Contractor shall also maintain, in accordance with the provisions of Section 13.7.1, the following: subcontract files, including proposals of successful and unsuccessful bidders, bid recaps and subcontractor payments; original estimates; estimating work sheets; general ledger entries detailing cash and trade discounts received; insurance rebates and dividends; and any other supporting evidence deemed necessary by the Owner to substantiate charges related to the Contract.

§ 13.7.3 Contractor shall keep a full and detailed financial accounting system and shall exercise such controls as may be necessary for proper financial management under this Contract; the accounting and control systems shall be satisfactory to the Owner and shall be subject to the provisions of Section 13.7.1.

§ 13.7.4 Contractor shall keep all Construction Documents related to the Project, subject to the provisions of Section 13.7.1, provided, however, Contractor shall not destroy said documents until Contractor has confirmed with Owner in writing that Owner has obtained a copy of all as-built drawings.

§ 13.7.5 In the event that an audit by the Owner reveals any errors/overpayments by the Owner, then the Contractor shall refund to the Owner the full amount of such overpayments within thirty (30) days of such audit findings, or the Owner, at its option, reserves the right to deduct such amounts owed to the Owner from any payments due to the Contractor.

§ 13.8 Proprietary Interests and Confidential Information

§ 13.8.1 Neither Architect nor Contractor shall use the image or likeness of Owner's Project or Owner's official logo or emblem and any other trademark, service mark, or copyrighted or otherwise protected information of Owner, without Owner's prior written consent. Contractor and Architect shall not have any authority to advertise or claim that Owner endorses Architect or Contractor's services, without Owner's prior written consent.

§ 13.8.2 Neither Architect nor Contractor shall disclose any confidential information which comes into the possession of Architect or Contractor at any time during the Project, including but not limited to, the location and deployment of security devices, security access codes, student likenesses, student record information or employee information.

§ 13.8.3 The parties acknowledge that, as a public entity in the State of Texas, Owner is subject to, and must comply with, certain open records laws and other disclosure requirements, including, but not limited to, the Texas Public Information Act, Texas Government Code Chapter 552, et seq., subpoenas, and court orders. Nothing in the Contract shall be construed as prohibiting Owner from disclosing any information related to or in connection with the Contract in accordance with such requirements, and Contractor hereby waives any claim against and releases from liability Owner, its trustees, officers, employees, agents, and attorneys with respect to any such disclosure.

§ 13.9 The Architect may appoint an employee or other person to assist it during the construction. These representatives will be instructed to assist the Contractor in interpreting the Contract Documents; however, such

assistance shall not relieve the Contractor from any responsibility as set forth by the Contract Documents. The fact that the Architect's Representative may have allowed Work not in accordance with the Contract Documents shall not prevent the Architect or the Owner from insisting that the faulty Work be corrected to conform with the Contract Documents and the Contractor shall correct same.

§ 13.10 The Contractor and its employees, agents, consultants, suppliers and subcontractors shall abide by all Owner policies and procedures regarding campus access.

§ 13.11 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 it, nor any of its affiliates, subsidiaries, or its parent company, if any (the "Contractor Companies"), boycott Israel, and Contractor agrees that it and the Contractor Companies will not boycott Israel during the term of the Contract. For purposes of the Contract, the term "boycott" shall mean and include refusing to deal with, terminating business activities with, or otherwise taking any action that is intended to penalize, inflict economic harm on, or limit commercial relations specifically with Israel, or with a person or entity doing business in Israel or in an Israeli-controlled territory, but does not include an action made for ordinary business purposes.

§ 13.12 In accordance with Texas Government Code § 2269.054, the Contract Documents shall not be construed to deny or diminish the right of any person to work because of the person's membership or other relationship status with respect to any organization.

It is expressly understood that this Contract is not written for the benefit of third parties.

§13.12 Certificate of Nonsegregated Facility

§13.12.1 This section is applicable to Contracts and Subcontracts exceeding \$10,000.00 that are not exempt from the provisions of the Equal Opportunity Clause.

§13.12.2 By the signing of this Contract, the Contractor signifies that it does not maintain or provide for its employees any segregated facilities at any of its establishments, and that it does not permit its employees to perform their services at any location, under its control, where segregated facilities are maintained. It certifies further that it will not maintain or provide for its employees any segregated facilities at any of its establishments, and that it will not permit its employees to perform their services at any location, under its control, where segregated facilities are maintained. The undersigned agrees that a violation of this certification constitutes a breach of this Contract. As used in this certification, the term "segregated facilities" means any waiting rooms, Work areas, rest rooms and wash rooms, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees which are segregated on the basis of race, creed, color, or national origin, because of habit, local custom, or otherwise. The Contractor further agrees that (except where it obtained identical certifications from proposed consultants for specific time period) it will obtain identical certifications from proposed Subcontractors prior to the award of a contract exceeding \$10,000.00 that are not exempt from the provisions of the Equal Opportunity Clause; that it will retain such certifications in its files; and that it will forward the following notice to such proposed Subcontractors (except where the proposed Subcontractors have submitted identical certifications for specific time periods): Notice to Prospective Subcontractors of requirement for certification of nonsegregated facilities. A certification of nonsegregated facilities, as required by the May 19, 1967 Order (32 FR 7439, May 19, 1967) on elimination of segregated facilities, by the Secretary of Labor, must be submitted prior to the award of a contract exceeding \$10,000.00 which is not exempt from the provisions of the Equal Opportunity Clause. The certification may be submitted either for each subcontract or for all subcontracts during a period (i.e., quarterly, semiannually, or annually). The penalty for making false statements in offers is prescribed in 18 U.S.C. 1001.11.

§ 13.13 In accordance with Texas Business & Commerce Code § 116.0001, as soon as practicable after beginning construction of the project, Contractor shall visibly post the following information at the entrance to the construction site: (1) the name and contact information of the Contractor; and (2) a brief description of the project.

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 ninety (90) 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 of undisputed sums due on an approved 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, then, after the applicable time period, the Contractor may, upon ten (10) business days' notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed and for proven unrecoverable loss with respect to materials, equipment, tools, and construction equipment and machinery incurred to the date of termination.

§ 14.1.4 If the Work is stopped for a period of ninety (90) 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 material to the progress of the Work, the Contractor may, upon twenty (20) additional business days' written 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, Sub subcontractors or suppliers in accordance with the respective agreements between the Contractor and the Subcontractors, Sub subcontractors or suppliers;
- .3 repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority;
- .4 otherwise is guilty of substantial breach of a provision of the Contract Documents.
- .5 fails to furnish the Owner, upon request, with assurances satisfactory to the Owner, evidencing the Contractor's ability to complete the Work in compliance with all the requirements of the Contract Documents;
- .6 engages in worker misconduct in violation of Article 3.3.2 or engages in conduct that would constitute a violation of state or federal criminal law, including but not limited to, the laws prohibiting certain gifts to public servants, or engages in conduct that would constitute a violation of the Owner's ethics or conflict of interest policies; or
- .7 fails to proceed continuously and diligently with the construction and completion of the Work, except as permitted under the Contract Documents.

§ 14.2.2 When any of the reasons described in Section 14.2.1 exist, and subject to any prior rights of the surety, 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 (7) 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. Any further payment shall be limited to amounts earned to the date of termination.

§ 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 of the Contract Sum, the Contractor and/or its Surety 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 parties hereby agree that: 1) if an order for relief is entered on behalf of the Contractor, pursuant to Chapter 11 of the U.S. Bankruptcy Code; 2) if any other similar order is entered under any debtor relief laws; 3) if Contractor makes an assignment for the benefit of one or more of its creditors; 4) if a receiver is appointed for the benefit of its creditors; or 5) if a receiver is appointed on account of its insolvency, any such event could impair or frustrate Contractor's performance of the Contract. Accordingly, it is agreed that upon occurrence of any such event, Owner shall be entitled to request of Contractor or its successor in interest adequate assurance of future performance in accordance with the terms and conditions of the Contract Documents. Failure to comply with such request within ten (10) days of delivery of the request shall entitle Owner to terminate the Contract and to the accompanying rights set forth in Subparagraphs 14.2.1 through 14.2.6. In all events, pending receipt of adequate assurance of performance and actual performance in accordance with the Contract Documents, Owner shall be entitled to proceed with the Work with Owner's own forces or with other Contractors on a time and material or other appropriate basis, the cost of which will be charged against the Contract Sum.

§ 14.2.6 As required by Texas Government Code Chapter 2253, if a Performance Bond has been furnished and the Contractor is declared by the Owner to be in default under the Contract, then the Surety shall promptly perform the Work, in full accordance with the plans, specifications and Contract Documents. Unless otherwise agreed in writing between the Surety and the Owner, the Surety shall complete the Work by the Surety entering into a Contract acceptable to Owner, with a contractor acceptable to Owner, and shall obtain new Payment and Performance Bonds as required by law.

§ 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 may, by mutual written agreement, 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 may include profit, upon written agreement of the parties. No adjustment shall be made to the extent

- .1 that performance is, was, or would have been, so suspended, delayed, or interrupted, by another cause for which the Contractor is responsible; or
- .2 that an equitable adjustment is made or denied under another provision of the Contract.

§ 14.4 Termination by the Owner for Convenience

§ 14.4.1 The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

§ 14.4.2 Upon receipt of notice from the Owner of such termination for the Owner's convenience, the Contractor shall

- .1 cease operations as directed by the Owner in the notice;
- .2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and
- .3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

§ 14.4.3 In case of such termination for the Owner's convenience, the Owner shall pay the Contractor for Work properly executed and for proven unrecoverable loss with respect to materials, equipment, tools, and construction equipment and machinery incurred to the date of termination. Such payment shall not cause the Contract Sum to be exceeded. Such payment shall not include overhead and profit for Work not executed.

§ 14.4.4 Upon determination by a Court of competent jurisdiction that termination of the Contractor pursuant to Section 14.2 was wrongful, such termination will be deemed converted to a termination for convenience pursuant to Section 14.4, and Contractor's remedy for wrongful termination shall be limited to the recovery of the payments permitted for termination for convenience as set forth in Section 14.4.

§ 14.5 Termination by the Owner for Non-Appropriation

§ 14.5.1 If the Contract is a multi-year contract funded through Owner's current general funds that are not bond funds, the parties agree that the Contract is a commitment of Owner's current revenue only. As such, notwithstanding any contrary provision of the Contract, any payment obligation(s) of Owner created by the Contract shall be conditioned upon the availability of funds that are duly appropriated and allocated for such purpose. If such funds are not available, as determined by Owner in its sole discretion, Owner shall have the right to terminate the Contract, without default, penalty, or further obligation or liability to Contractor, effective at the end of the period for which such funds are available. In the event this provision is exercised, Owner shall provide written notice of non-appropriation, specifying the effective date of termination, to Contractor as soon as is reasonably practicable.

§ 14.5.2 Upon receipt of notice from the Owner of such termination for non-appropriation, 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.

§ 14.5.3 In case of such termination for non-appropriation, to the extent that funds have been duly appropriated and allocated for such purpose and are available, the Owner shall pay the Contractor for Work properly executed and for proven unrecoverable loss with respect to materials, equipment, tools, and construction equipment and machinery incurred to the date of termination. Such payment shall not cause the Contract Sum to be exceeded. Such payment shall not include overhead and profit for Work not executed.

ARTICLE 15 CLAIMS AND DISPUTES OF CONTRACTOR

§ 15.1 Claims

§ 15.1.1 Definition

General: A Claim is a demand or assertion by the Contractor seeking, as a matter of right, payment of money, interpretation of the Contract terms, a change in the Contract Time, or other relief with respect to the terms of the Contract, the Work, or the Project. The responsibility to substantiate Claims shall rest with the Contractor. 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.

§ 15.1.1.1 Claim for Non-Damages Definition: A demand or assertion by the Contractor seeking, as a matter of contractual right, relief such as an increase in the Contract Time, an increase in the Contract Sum, or other contract-based remedies. A Claim does not automatically include a separate cause of action for damages unless specifically stated otherwise.

§ 15.1.1.2 Claim for Damages Definition: Any portion of a Claim in which the Contractor is seeking monetary damages as a legal remedy (i.e., an actual cause of action under applicable law, such as breach of contract), rather than (or in addition to) a Contract adjustment for time or price or some other relief that does not constitute legal damages.

§ 15.1.2 Time Limits on Litigation

The Contractor shall commence all litigation against the Owner 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, if any, and within the period specified by applicable law, but in any

case not more than 8 years after the date of Substantial Completion of the Work, unless extended in accordance with Texas Civil Practice & Remedies Code Section 16.009. The Contractor waives all claims not commenced in accordance with this Section 15.1.2.

§ 15.1.3 Notice of Claims

§ 15.1.3.1 Claim for Non-Damages: Claims for Non-Damages by the 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 written notice to the Owner and to the Architect. Claims by the Contractor under this Section 15.1.3.1 shall be initiated within twenty-one (21) calendar days after occurrence of the event giving rise to such Claim or within twenty-one (21) calendar days after the Contractor first knew or should have known of the condition giving rise to the Claim, whichever is earlier. Claims must be initiated by written notice titled "Notice of Claim for Non-Damages" ("Notice") and sent to the Architect and Owner's designated representative. The Notice shall clearly set out the specific matter of complaint, and the impact or damages which may occur or have occurred as a result thereof, to the extent that the impact or damages can be assessed at the time of the Notice. If the impact or damages cannot be assessed as of the date of the Notice then the Notice shall be amended at the earliest date that is reasonably possible. It is imperative that Owner receive timely specific Notice of any potential problem identified by Contractor in order that the problem can be mitigated or resolved promptly.

§ 15.1.3.2 Claim for Damages: Any claim or portion of a claim for damages by the 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 written notice to the Owner and to the Architect. Claims by the Contractor under this Section 15.1.3.2 shall be initiated within ninety-one (91) calendar days after occurrence of the event giving rise to such Claim or within ninety-one (91) calendar days after the Contractor first knew or should have known of the condition giving rise to the Claim for Damages, whichever is earlier. Claims must be initiated by written notice titled "Notice of Claim for Damages" ("Notice") and sent to the Architect and Owner's designated representative. The Notice shall clearly set out the specific matter of complaint, and the impact or damages which may occur or have occurred as a result thereof, to the extent that the impact or damages can be assessed at the time of the Notice. If the impact or damages cannot be assessed as of the date of the Notice then the Notice shall be amended at the earliest date that is reasonably possible. It is imperative that Owner receive timely specific Notice of any potential problem identified by Contractor in order that the problem can be mitigated or resolved promptly. Any claim or portion of a Claim for Damages by the Contractor that has not been made the specific subject of a Notice within ninety-one (91) days after the occurrence of the event giving rise to such claim or within ninety-one (91) days after the Contractor first knew or should have known of the condition giving rise to the Claim, whichever is earlier, shall be waived. Pursuant to Texas Civil Practices and Remedies Code Section 16.071, Contractor agrees that this is a reasonable notice requirement.

§ 15.1.3.2 Claims by 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 Owner. In such event, no decision by the Initial Decision Maker is required. Such Claims are subject to the definitions and notice requirements in § 15.1.1.1, § 15.1.1.2, § 15.1.3.1 and § 15.1.3.2, including the 21-day notice for Claims for Non-Damages and the 91-day notice for Claims for Damages.

§ 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 undisputed payments for Work performed in accordance with the Contract Documents.

§ 15.1.4.2 The Contract Sum and Contract Time may be adjusted in accordance with the Initial Decision Maker's decision, subject to the right of either party to proceed in accordance with this Article 15. The Architect will issue Certificates for Payment in accordance with the decision of the Initial Decision Maker.

§ 15.1.5 Claims for Additional Cost Or an Increase in the Contract Sum

If the Contractor wishes to make a Claim for additional cost or for an increase in the Contract Sum, notice as provided in Section 15.1.3 shall be given to Owner and Architect. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4. The Architect will promptly investigate such Claim and report findings and a recommended resolution in writing to the Owner and Contractor. If the Claim is approved by Owner's Board of Trustees, or Owner's representative if otherwise delegated and provided for herein, then Contractor shall proceed with the execution of the Work that is the subject matter of the Claim. If the Claim is

rejected by the Owner, then Contractor may pursue alternative dispute resolution or other legal remedies as provided for in the Contract Documents. Under no circumstances shall a claim for additional cost or for an increase in the Contract Sum resulting from supply chain issues or market escalation be approved by Owner.

§ 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, such a Claim shall be documented in accordance with Article 8 and notice as provided in Section 15.1.3 shall be given. The Contractor's Claim shall include an estimate of the 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 Claims for increase in the contract time shall set forth in detail the circumstances that form the basis for the Claim, the date upon which each cause of delay began to affect the progress of the Work, the date upon which each cause of delay ceased to affect the progress of the Work and the number of days increase in the Contract Time claimed as a consequence of each such cause of delay. Additionally, any Claim for additional time based on adverse weather conditions 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.

1. Weather data in the table below shall form the baseline for establishing Anticipated Adverse Weather Days per month associated with the Project schedule duration.

Anticipated Adverse Weather Days	
Month	Total of Weather Days Allowed
January	6
February	6
March	5
April	4
May	6
June	7
July	6
August	6
September	6
October	6
November	6
December	6

- a. The Anticipated Adverse Weather Days shall be submitted with the Contractor's Construction Schedule for documenting future weather events and is considered to be part of the Project duration forming the Contract Time.

2. When the Project requires work in an occupied building, Instruction Days in the table below shall form the baseline for establishing Instruction Days per month associated with the Project schedule duration.

Anticipated Instruction Days	
Month	Total of Instruction Days Allowed
January	0
February	0
March	0

April	4
May	4
June	0
July	0
August	0
September	0
October	0
November	0
December	0

a. The Anticipated Instruction Days shall be submitted with the Contractor's Construction Schedule for documenting future Instruction Days and is considered to be part of the Project duration forming the Contract Time.

3. Submission for Time Extension

a. Although the Contractor is required to document the occurrence and effect of Adverse Weather or Instruction Days on the Work, it does not relieve the Contractor/Architect of its responsibility to investigate and determine if an excusable delay has occurred.

b. The schedule of Anticipated Adverse Weather Days and Instruction Days included in the Contract is established in Work Days. Similarly, actual weather data should be collected and recorded on a Work Day basis. Monthly summaries should be maintained indicating actual Adverse Weather conditions or Instruction Days and the impact on Work activities.

c. To determine if a given month experienced Adverse Weather Days or Instruction Days, the number of actual Adverse Weather Days or Instruction Days is subtracted from the Anticipated Adverse Weather Days or Anticipated Instruction Days. If the number of Adverse Weather Days or Instruction Days is greater than the Anticipated Adverse Weather Days or Anticipated Instruction Days for a given month, then the Contractor has experienced unusually severe weather or Work disruption for the given month. If the number of Adverse Weather Days or Instruction Days is less than the Anticipated Adverse Weather Days or Anticipated Instruction Days for a given month, then the Net Days shall accumulate to the remaining months and shall be treated as float to the Project. Float time contained in the Contractor's Construction Schedule is not for the exclusive benefit of the Contractor or the Owner, but belongs to the Project and may be consumed by either party as needed on a first-used basis.

d. THE DETERMINATION THAT UNUSUALLY SEVERE WEATHER OR INSTRUCTION DAYS OCCURRED DOES NOT AUTOMATICALLY MEAN THAT THE CONTRACTOR RECEIVES A TIME EXTENSION FOR THE DIFFERENCE OF DAYS BETWEEN THE ANTICIPATED AND ACTUAL ADVERSE WEATHER DELAY OR INSTRUCTION DAYS. Further analysis is necessary to determine if the unusually severe weather or Instructional Days delayed Work activities critical to Contract completion. The Contractor's progress schedule must be evaluated to make this determination. If it is found that unusually severe weather or Instructional Days delayed the Contract, a Contract Modification shall be issued.

e. Claims for increase in the Contract Time shall set forth in writing the detail noting the circumstances that form the basis for the claim, the date upon which each cause of delay began to affect the progress of the Work, the date upon which each cause of delay ceased to affect the progress of the Work and the number of days increase in the Contract Time claimed as a consequence of each such cause of delay. The Contractor shall bear the entire economic risk of all weather delays and Instruction Days disruptions and shall not be entitled to any increase in the Contract Price by reason of such delays or disruptions. Requests for an extension of time pursuant to this Subparagraph shall be submitted to the Architect in writing not later than with each Application for Payment and shall include documentation demonstrating the nature and duration of the delays or disruptions. Where appropriate, a revised construction schedule indicating all the activities affected by the circumstances shall be included with the documentation.

f. The parties agree that the reconciliation of the change attributable to Adverse Weather or Instruction Days will occur at the time of Project Final Completion.

§ 15.1.6.3 No extension of time shall be made to the Contractor because of hindrances or delays from any cause which is the fault of Contractor or Contractor's Subcontractors, Sub-subcontractors, or suppliers or otherwise under Contractor's control. Claims for extension of time may only be considered because of Adverse Weather Days, or hindrances or delays which are the fault of Owner and/or under Owner's control, but only to the extent that Substantial Completion of the Project is adjusted beyond the original Substantial Completion date. Claims for extension of time because of hindrances or delays not the fault of either Contractor or Owner shall be considered, but only to the extent that Substantial Completion of the Project exceeds the Substantial Completion date established for the Work. Unless otherwise delegated, Board approval shall be required for any extension of time. Contractor shall only be entitled to time extensions per the terms of the Contract Documents.

§ 15.1.6.4 Notwithstanding any provision herein to the contrary, if the Contractor desires to make a one-time Claim for actual costs directly resulting from permit delays, this Section 15.1.6.4 shall apply. Any Claim for actual costs directly resulting from permit delays ("Permit Delay Days") may only begin accruing ("Commencement Date") following the latter of the following: 1.) when the duration from Notice to Proceed to release of permit exceeds 90 Calendar Days, or 2.) when the anticipated permit release duration stated in the procurement solicitation exceeds 90 Calendar Days. Permit Delay Days cease on the date of permit release ("Release Date"). A Claim under this Section 15.1.6.4 shall be made no sooner than the Release Date and no later than twenty-one (21) calendar days after the Release Date. In making such a one-time Claim for actual costs directly resulting from Permit Delay Days, the Contractor shall be limited to a percentage change rate per day for any claimed actual additional costs, regardless of actual cost to the Contractor or any subcontractor. Claims for Contractor's general conditions will not be allowed. If the Claim is approved, the percentage change rate per day shall be determined as follows: Reference source is the Building Cost Index (BCI) change as reported by Engineering News Record (ENR) at the following link (https://www.enr.com/economics/historical_indices/Dallas). Compute the "benchmark value" by calculating the average BCI for the three (3) months preceding (but not including) the due date of the proposals. Compute the "current value" by calculating the average BCI for the three (3) months preceding (but not including) the Release Date. Divide the current value by the benchmark value, then subtract one; divide the result by the number of elapsed calendar days between Commencement Date and Release Date to determine the daily change limit of any actual costs for Permit Delay Days. Additionally, in making a Claim for additional actual costs under this section, the Contractor agrees that the Owner, Architect, or their respective agents is thereby entitled to review all (related or unrelated to the Claim) bids, proposals, quotes, quantity take-offs, and executed subcontractor agreements for the Project and to contact subcontractors to verify facts pertaining to same. Owner shall be entitled to a credit if the Owner, Architect, or their respective agents' inspection of all bids, proposals, quotes, quantity take-offs, and subcontractor agreements indicate a variance in favor of the Owner. The completion of the Owner's inspection and issuing of a report of the determination of finding relating to a Claim under this section is a precondition to the commencement of time limits for Claims stated in § 15.2. Any Claim under this section 15.1.6.4 shall be subject to the review and approval/rejection procedures outlined in Article 8 and 15.

§ 15.1.7 Waiver of Claims for Consequential Damages

The Contractor waives all Claims against Owner for consequential damages arising out of or relating to this Contract, including, but not limited to, any amount owed as compensation for the increased cost to perform the Work as a direct result of Owner-caused delays or acceleration.

§ 15.2 Resolution of Claims and Disputes

§ 15.2.1 Claims by the Contractor against the Owner, including those alleging an error or omission by the Architect, shall be referred initially to the Architect for written recommendation. An initial recommendation by the Architect shall be required as a condition precedent to mediation or litigation of all Claims by the Contractor arising prior to the date Final Payment is due, unless thirty (30) days have passed after the Claim has been referred to the Architect with no recommendation having been rendered by the Architect.

§ 15.2.2 The Architect will review Claims and within ten (10) days of the receipt of a Claim take one of the following actions: (1) request additional supporting data from the Contractor, or (2) make a written recommendation to the Owner, with a copy to the Contractor.

§ 15.2.3 In evaluating Claims, the Architect 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 Architect in making a written recommendation.

§ 15.2.4 If the Architect requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten (10) days (or in the case of Owner, ten (10) business days) after receipt of the request, and shall either (1) provide a response on the requested supporting data, (2) advise the Architect when the response or supporting data will be furnished, or (3) advise the Architect that no supporting data will be furnished.

§ 15.2.5 Following receipt of the Architect's written recommendation regarding a Claim, the Owner and Contractor shall attempt to reach agreement as to any adjustment to the Contract Sum and/or Contract Time. If no agreement can be reached, then either party may request mediation of the dispute pursuant to Section 15.3.

§ 15.2.6 Upon receipt of a Claim against the Contractor or at any time thereafter, the Architect or 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 Architect or the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

§ 15.3 Alternative Dispute Resolution

§ 15.3.1 Any Claim arising out of or related to the Contract, except Claims relating to aesthetic effect and except those waived under the terms of the Contract Documents, may upon mutual written agreement, after written recommendation by the Architect or thirty (30) days after submission of the Claim to the Architect, be subject to mediation at the request of either party. Owner and Contractor expressly agree that mediation shall not be a condition precedent to the initiation of any litigation arising out of such Claim. Claims for injunctive relief shall not be subject to this Section.

§ 15.3.2 The parties may endeavor to resolve their Claims by mediation. A request for mediation shall be made in writing to the other party to the Contract. Mediation shall be subject to and in accordance with Chapter 154 of the Texas Civil Practice & Remedies Code. Mediation shall be conducted by a mutually-agreed-upon mediator. In the event that the parties are unable to agree on a mediator, then the mediation shall be conducted by the Center for Public Policy Dispute Resolution at the University of Texas School of Law.

§ 15.3.3 The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the county where the Owner's main administrative office is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be reduced to writing, considered for approval by the Owner's Board of Trustees, signed by the parties if approved by the Board of Trustees, and, if signed, shall thereafter be enforceable as provided by the laws of the State of Texas.

§ 15.3.4 Any claim not resolved in mediation shall be subject to litigation pursuant to Section 13.1.

§ 15.4 No Arbitration

Notwithstanding anything to the contrary in the Contract Documents or in any document forming a part hereof, there shall be no mandatory arbitration for any dispute arising hereunder.

§ 15.5 Contractor stipulates that Owner is a political subdivision of the State of Texas, and, as such, enjoys immunities from suit and liability provided by the Constitution and laws of the State of Texas. Nothing in the Contract shall be construed as a waiver or relinquishment of any governmental immunities or defenses on behalf of Owner, its trustees, officers, employees, or agents as a result of the execution of the Contract or performance of the functions or obligations described therein.

§ 15.6 In any adjudication under this Agreement, attorneys' fees may be awarded as provided by law.

ARTICLE 16 ADDITIONAL PROVISIONS

§ 16.1 These general conditions incorporate by reference the following documents:

Exhibit A: Wage Rate Determination

SECTION 00 72 00
GENERAL CONDITION OF THE CONTRACT FOR CONSTRUCTION



EXHIBIT C
Document A201® – 2017

General Conditions of the Contract for Construction

for the following PROJECT:

(Name and location or address)

New District Administration Building
21330 Valley Ranch Pkwy.
New Caney, TX. 77357

THE OWNER:

(Name, legal status and address)

New Caney Independent School District
22784 Hwy 59 S
Building "E".
Porter, Texas 77365

THE ARCHITECT:

(Name, legal status and address)

Glaus, Pyle, Schomer, Burns & DeHaven, Inc. dba GPD Group
2121 Sage Road
Suite 240
Houston, TX 77056

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11	INSURANCE AND BONDS
12	UNCOVERING AND CORRECTION OF WORK
13	MISCELLANEOUS PROVISIONS

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), 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 bid, Instructions to Bidders, sample forms, other information furnished by the Owner in anticipation of receiving bids or proposals, the Contractor's bid or proposal, or portions of Addenda relating to bidding or 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.

§ 1.1.4 The Project

The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner and by Separate Contractors.

§ 1.1.5 The Drawings

The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules, and diagrams.

§ 1.1.6 The Specifications

The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

§ 1.1.7 Instruments of Service

Instruments of Service are representations, in any medium of expression now known or later developed, of the tangible and intangible creative work performed by the Architect and the Architect's consultants under their respective professional services agreements. Instruments of Service may include, without limitation, studies, surveys, models, sketches, drawings, specifications, and other similar materials.

§ 1.1.8 Initial Decision Maker

The Initial Decision Maker is the person identified in the Agreement to render initial decisions on Claims in accordance with Section 15.2. The Initial Decision Maker shall not show partiality to the Owner or Contractor and shall not be liable for results of interpretations or decisions rendered in good faith.

§ 1.2 Correlation and Intent of the Contract Documents

§ 1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

§ 1.2.1.1 The invalidity of any provision of the Contract Documents shall not invalidate the Contract or its remaining provisions. If it is determined that any provision of the Contract Documents violates any law, or is otherwise invalid or unenforceable, then that provision shall be revised to the extent necessary to make that provision legal and enforceable. In such case the Contract Documents shall be construed, to the fullest extent permitted by law, to give effect to the parties' intentions and purposes in executing the Contract.

§ 1.2.2 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.

§ 1.3 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 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 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.

§ 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.

§ 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

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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.

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. The Owner shall designate in writing a representative who shall have express 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. 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.

§ 2.2 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. 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.

§ 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 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.

§ 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 within a ten-day period after receipt of 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 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 cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect, or failure. If current and future payments 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.

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 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.

§ 3.2 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.

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§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.3.4, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

§ 3.2.3 The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, but the Contractor shall promptly report to the Architect any nonconformity discovered by or made known to the Contractor as a request for information in such form as the Architect may require.

§ 3.2.4 If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Architect issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall submit Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, the Contractor shall pay such costs and damages to the Owner, subject to Section 15.1.7, as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or Architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities.

§ 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 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.

§ 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.

§ 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.

§ 3.4 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 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.

§ 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.

§ 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 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 by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, 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.

§ 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.

§ 3.6 Taxes

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.

§ 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.

§ 3.7.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work.

§ 3.7.3 If the Contractor performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

§ 3.7.4 Concealed or Unknown Conditions

If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than 14 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if the Architect determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend that an equitable adjustment be made in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and Contractor, stating the reasons. If either party disputes the Architect's determination or recommendation, that party may submit a Claim as provided in Article 15.

§ 3.7.5 If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall notify the Owner and Architect. Upon receipt of such notice, the Owner shall promptly take any action necessary to obtain governmental authorization required to resume the operations. The Contractor shall continue to suspend such operations until otherwise instructed by the Owner but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 15.

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§ 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, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

§ 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 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 binding as if given to the Contractor.

§ 3.9.2 The Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the name and qualifications of a proposed superintendent. Within 14 days of receipt of the information, the Architect may notify the Contractor, stating whether the Owner or the Architect (1) has reasonable objection to the proposed superintendent or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 3.9.3 The Contractor shall not employ a proposed superintendent to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not change the superintendent without the Owner's consent, which shall not unreasonably be withheld or delayed.

§ 3.10 Contractor's Construction and Submittal Schedules

§ 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 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.

§ 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.

§ 3.10.3 The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner and Architect.

§ 3.11 Documents and Samples at the Site

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.

§ 3.12 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.

§ 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.

§ 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 by the Architect.

§ 3.12.8 The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from the requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples, or similar submittals, unless the Contractor has specifically notified the Architect of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples, or similar submittals, by the Architect's approval 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 of a resubmission shall not apply to such revisions.

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures. The Contractor shall not be required to provide professional services in violation of applicable law.

§ 3.12.10.1 If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will

specify all performance and design criteria that such services must satisfy. The Contractor shall be entitled to rely upon the adequacy and accuracy of the performance and design criteria provided in the Contract Documents. The Contractor shall cause such services or certifications to be provided by an appropriately licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings, and other submittals prepared by such professional. Shop Drawings, and other submittals related to the Work, designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy and accuracy of the services, certifications, and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor the performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review and approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents.

§ 3.12.10.2 If the Contract Documents require the Contractor's design professional to certify that the Work has been performed in accordance with the design criteria, the Contractor shall furnish such certifications to the Architect at the time and in the form specified by the Architect.

§ 3.13 Use of Site

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.

§ 3.14 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.

§ 3.15 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.

§ 3.16 Access to Work

The Contractor shall provide the Owner and Architect with access to the Work in preparation and progress wherever located.

§ 3.17 Royalties, Patents and Copyrights

The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Architect harmless from loss on account thereof, but shall not be responsible for defense or loss when a particular design, process, or product of a particular manufacturer or manufacturers is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications, or other documents prepared by the Owner or Architect. However, if an infringement of a copyright or patent is discovered by, or made known to, the Contractor, the Contractor shall be responsible for the loss unless the information is promptly furnished to the Architect.

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§ 3.18 Indemnification

§ 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.

§ 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.

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.

§ 4.2 Administration of the Contract

§ 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 authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

§ 4.2.2 The Architect 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 progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the 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 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.

§ 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.

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§ 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 has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, 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 Work is fabricated, installed or completed. 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, suppliers, their agents or employees, or other persons or entities performing portions of the Work.

§ 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.

§ 4.2.9 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 The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

§ 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.

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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.

§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

§ 5.2 Award of Subcontracts and Other Contracts for Portions of the Work

§ 5.2.1 Unless otherwise stated in the Contract Documents, the Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the persons or entities proposed for each principal portion of the Work, including those who are to furnish materials or equipment fabricated to a special design. Within 14 days of receipt of the information, the Architect may notify the Contractor whether the Owner or the Architect (1) has reasonable objection to any such proposed person or entity or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.3 If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no reasonable objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

§ 5.2.4 The Contractor shall not substitute a Subcontractor, person, or entity for one previously selected if the Owner or Architect makes reasonable objection to such substitution.

§ 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.

- § 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. 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.

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 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.
- § 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.
- § 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.

§ 6.2 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.

§ 7.1.2 A Change Order shall be based upon agreement among the Owner, Contractor, and Architect. A Construction Change Directive requires agreement by the Owner and Architect and may or may not be agreed to by the Contractor. An order for a minor change in the Work may be issued by the Architect alone.

§ 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.

§ 7.3 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 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;
- .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.

§ 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, and sales, use, or similar taxes, directly related to the change; and
- .5 Costs of supervision and field office personnel directly attributable to the change.

§ 7.3.5 If the Contractor disagrees with the adjustment in the Contract Time, the Contractor may make a Claim in accordance with applicable provisions of Article 15.

§ 7.3.6 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

§ 7.3.7 A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Architect. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for Work completed under the Construction Change Directive in Applications for Payment. The Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Architect determines, in the Architect's professional judgment, to be reasonably justified. The Architect's interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15.

§ 7.3.10 When the Owner and Contractor agree with a determination made by the Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and the Architect will prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

§ 7.4 Minor Changes in the Work

The Architect may order minor changes in the Work that are consistent with the intent of the Contract Documents and do not involve an adjustment in the Contract Sum or an extension of the Contract Time. The Architect's order for minor changes shall be in writing. If the Contractor believes that the proposed minor change in the Work will affect the Contract Sum or Contract Time, the Contractor shall notify the Architect and shall not proceed to implement the change in the Work. If the Contractor performs the Work set forth in the Architect's order for a minor change without prior notice to the Architect that such change will affect the Contract Sum or Contract Time, the Contractor waives any adjustment to the Contract Sum or extension of the Contract Time.

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.

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§ 8.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

§ 8.2 Progress and Completion

§ 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 (1) an act or neglect of the Owner or Architect, of an employee of either, or of a Separate Contractor; (2) by changes ordered in the Work; (3) 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, justify delay, then the Contract Time shall be extended for such reasonable time as the Architect may determine.

§ 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.

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.

§ 9.1.2 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

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.

§ 9.3 Applications for Payment

§ 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.

§ 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 that have been properly authorized by Construction Change Directives, or by interim determinations of the Architect, 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.

§ 9.3.2 Unless otherwise provided in the Contract Documents, payments shall 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 equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage, and transportation to the site, for such materials and equipment stored off the site.

§ 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.

§ 9.4 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 to the Owner, based on the Architect's evaluation of the Work and the data in the Application for Payment, that, to the best of the Architect's knowledge, information, and belief, the Work has progressed to the point indicated, the quality of the Work is in accordance with the Contract Documents, and that the Contractor is entitled to payment in the amount certified. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to 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. However, the issuance of a Certificate for Payment will not be a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work; (2) reviewed construction means, methods, techniques, sequences, or procedures; (3) reviewed copies of requisitions received from Subcontractors and 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 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 opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect 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 in the Architect'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 filed 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 suppliers 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 a Separate Contractor;
- .6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
- .7 repeated failure to carry out the Work in accordance with the Contract Documents.

§ 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.

§ 9.6 Progress Payments

§ 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.

§ 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. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

§ 9.6.3 The Architect will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect and Owner on account of portions of the Work done by such Subcontractor.

§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors and suppliers to ascertain whether they have been properly paid. Neither the Owner nor Architect shall have an obligation to pay, or to see to the payment of money to, a Subcontractor or supplier, except as may otherwise be required by law.

§ 9.6.5 The Contractor's payments to suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

§ 9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 9.6.7 Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors or provided by suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, create any fiduciary liability or tort liability on the part of the Contractor for breach of trust, or entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

§ 9.6.8 Provided the Owner has fulfilled its payment obligations under the Contract Documents, the Contractor shall defend and indemnify the Owner from all loss, liability, damage or expense, including reasonable attorney's fees and litigation expenses, arising out of any lien claim or other claim for payment by any Subcontractor or supplier of any tier. Upon receipt of notice of a lien claim or other claim for payment, the Owner shall notify the Contractor. If approved by the applicable court, when required, the Contractor may substitute a surety bond for the property against which the lien or other claim for payment has been asserted.

§ 9.7 Failure of Payment

If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven 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.

§ 9.8 Substantial Completion

§ 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use.

§ 9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

§ 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.

§ 9.9 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.

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§ 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 the Contractor's 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 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 on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect'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.

§ 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.

§ 9.10.4 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.

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.

§ 10.2 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 implement, 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 the owners and users of adjacent sites and utilities of the safeguards.

§ 10.2.4 When use or storage of explosives or other hazardous materials or 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.

§ 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.

§ 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.

§ 10.3 Hazardous Materials and Substances

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials or substances. 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), 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.

§ 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.

§ 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.

§ 10.4 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

§ 11.1.1 The Contractor shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Contractor shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Owner, Architect, and Architect's consultants shall be named as additional insureds under the Contractor's commercial general liability policy or as otherwise described in the Contract Documents.

§ 11.1.2 The Contractor shall provide surety bonds of the types, for such penal sums, and subject to such terms and conditions as required by the Contract Documents. The Contractor shall purchase and maintain the required bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 11.1.3 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

§ 11.1.4 Notice of Cancellation or Expiration of Contractor's Required Insurance. Within three (3) business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by the Contract Documents, the Contractor shall provide notice to the Owner of such impending or actual cancellation or expiration. Upon receipt of notice from the Contractor, the Owner shall, unless the lapse in coverage arises from an act

or omission of the Owner, have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by the Contractor. The furnishing of notice by the Contractor shall not relieve the Contractor of any contractual obligation to provide any required coverage.

§ 11.2 Owner's Insurance

§ 11.2.1 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.

§ 11.2.2 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.

§ 11.3.2 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.

§ 11.4 Loss of Use, Business Interruption, and Delay in Completion Insurance

The Owner, at the Owner's option, may purchase and maintain insurance that will protect the Owner against loss of use of the Owner's property, or the inability to conduct normal operations, due to fire or other causes of loss. The Owner waives all rights of action against the Contractor and Architect for loss of use of the Owner's property, due to fire or other hazards however caused.

§11.5 Adjustment and Settlement of Insured Loss

§ 11.5.1 A loss insured under the property insurance required by the Agreement shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.5.2. The Owner shall pay the Architect and Contractor their just shares of insurance proceeds received by the Owner, and by appropriate agreements the Architect and Contractor shall make payments to their consultants and Subcontractors in similar manner.

§ 11.5.2 Prior to settlement of an insured loss, the Owner shall notify the Contractor of the terms of the proposed settlement as well as the proposed allocation of the insurance proceeds. The Contractor shall have 14 days from receipt of notice to object to the proposed settlement or allocation of the proceeds. If the Contractor does not object, the Owner shall settle the loss and the Contractor shall be bound by the settlement and allocation. Upon receipt, the Owner shall deposit the insurance proceeds in a separate account and make the appropriate distributions. Thereafter, if no other agreement is made or the Owner does not terminate the Contract for convenience, the Owner and Contractor shall execute a Change Order for reconstruction of the damaged or destroyed Work in the amount allocated for that purpose. If the Contractor timely objects to either the terms of the proposed settlement or the allocation of the proceeds, the Owner may proceed to settle the insured loss, and any dispute between the Owner and Contractor arising out of the settlement or allocation of the proceeds shall be resolved pursuant to Article 15. Pending resolution of any dispute, the Owner may issue a Construction Change Directive for the reconstruction of the damaged or destroyed Work.

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.

§ 12.2.2 After Substantial Completion

§ 12.2.2.1 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.

§ 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

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.

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 Governing Law

The Contract shall be governed by the law of the place where the Project is located, excluding that jurisdiction's choice of law rules. If the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.

§ 13.2 Successors and Assigns

§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns, and legal representatives to covenants, agreements, and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project, if the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate the assignment.

§ 13.3 Rights and Remedies

§ 13.3.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights, and remedies otherwise imposed or available by law.

§ 13.3.2 No action or failure to act by the Owner, Architect, or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed upon in writing.

§ 13.4 Tests and Inspections

§ 13.4.1 Tests, inspections, and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules, and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections, and

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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.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor

§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, for any of the following reasons:

- .1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;
- .2 An act of government, such as a declaration of national emergency, that requires all Work to be stopped;
- .3 Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or
- .4 The Owner has failed to furnish to the Contractor reasonable evidence as required by Section 2.2.

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, repeated suspensions, delays, or interruptions of the entire Work by the Owner as described in Section 14.3, constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, as well as reasonable overhead and profit on Work not executed, and costs incurred by reason of such termination.

§ 14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, or their agents or employees or any other persons or entities performing portions of the Work because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

§ 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may terminate the Contract if the Contractor

- .1 repeatedly refuses or fails to supply enough properly skilled workers or proper materials;
- .2 fails to make payment to Subcontractors or suppliers in accordance with the respective agreements between the Contractor and the Subcontractors or suppliers;
- .3 repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or
- .4 otherwise is guilty of substantial breach of a provision of the Contract Documents.

§ 14.2.2 When any of the reasons described in Section 14.2.1 exist, and upon certification by the Architect that sufficient cause exists to justify such action, the Owner may, without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

- .1 Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;
- .2 Accept assignment of subcontracts pursuant to Section 5.4; and
- .3 Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Initial Decision Maker, upon application, and this obligation for payment shall survive termination of the Contract.

§ 14.3 Suspension by the Owner for Convenience

§ 14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work, in whole or in part for such period of time as the Owner may determine.

§ 14.3.2 The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay, or interruption under Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent

- .1 that performance is, was, or would have been, so suspended, delayed, or interrupted, by another cause for which the Contractor is responsible; or
- .2 that an equitable adjustment is made or denied under another provision of the Contract.

§ 14.4 Termination by the Owner for Convenience

§ 14.4.1 The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

§ 14.4.2 Upon receipt of notice from the Owner of such termination for the Owner's convenience, the Contractor shall

- .1 cease operations as directed by the Owner in the notice;
- .2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and
- .3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

§ 14.4.3 In 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.

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. The Owner and Contractor waive all Claims and causes of action not commenced in accordance with this Section 15.1.2.

§ 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 under this Section 15.1.3.1 shall be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

§ 15.1.3.2 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party. In such event, no decision by the Initial Decision Maker is required.

§ 15.1.4 Continuing Contract Performance

§ 15.1.4.1 Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

§ 15.1.4.2 The Contract Sum and Contract Time shall be adjusted in accordance with the Initial Decision Maker's decision, subject to the right of either party to proceed in accordance with this Article 15. The Architect will issue Certificates for Payment in accordance with the decision of the Initial Decision Maker.

§ 15.1.5 Claims for Additional Cost

If the Contractor wishes to make a Claim for an increase in the Contract Sum, notice as provided in Section 15.1.3 shall be given before proceeding to execute the portion of the Work that is the subject of the Claim. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

§ 15.1.6 Claims for Additional Time

§ 15.1.6.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, notice as provided in Section 15.1.3 shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary.

§ 15.1.6.2 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.

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§ 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 Initial Decision

§ 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, 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.

§ 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 therefor; 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.

§ 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.

§ 15.2.7 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.

§ 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.

§ 15.3 Mediation

§ 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 to resolve their 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 proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by 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.

§ 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

§ 15.4.1 If the parties have selected arbitration as the method for binding dispute resolution in the Agreement, any Claim subject to, but not resolved by, mediation shall be subject to arbitration which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules in effect on the date of the Agreement. The Arbitration shall be conducted in the place where the Project is located, unless another location is mutually agreed upon. A demand for arbitration shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the arbitration. The party filing a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded.

§ 15.4.1.1 A demand for arbitration shall be made no earlier than concurrently with the filing of a request for mediation, but in no event shall it be made after the date when the institution of legal or equitable proceedings based on the Claim would be barred by the applicable statute of limitations. For statute of limitations purposes, receipt of a written demand for arbitration by the person or entity administering the arbitration shall constitute the institution of legal or equitable proceedings based on the Claim.

§ 15.4.2 The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.

§ 15.4.3 The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly consented to by parties to the Agreement, shall be specifically enforceable under applicable law in any court having jurisdiction thereof.

§ 15.4.4 Consolidation or Joinder

§ 15.4.4.1 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may consolidate an arbitration conducted under this Agreement with any other arbitration to which it is a party provided that (1) the arbitration agreement governing the other arbitration permits consolidation, (2) the arbitrations to be consolidated substantially involve common questions of law or fact, and (3) the arbitrations employ materially similar procedural rules and methods for selecting arbitrator(s).

§ 15.4.4.2 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may include by joinder persons or entities substantially involved in a common question of law or fact whose presence is required if complete relief is to be accorded in arbitration, provided that the party sought to be joined consents in writing to such joinder. Consent to arbitration involving an additional person or entity shall not constitute consent to arbitration of any claim, dispute or other matter in question not described in the written consent.

§ 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.

SECTION 00 21 13
INSTRUCTIONS TO BIDDERS



Document A701® – 2018

Instructions to Bidders

for the following Project:
(Name, location, and detailed description)

New District Administration Building
21330 Valley Ranch Pkwy.
New Caney, TX. 77357

THE OWNER:
(Name, legal status, address, and other information)

New Caney Independent School District
22784 Hwy 59 S
Building "E"
Porter, Texas 77365

THE ARCHITECT:
(Name, legal status, address, and other information)

Glaus, Pyle, Schomer, Burns, & Dehaven, Inc. dba GPD Group
2121 Sage Road, Suite 240
Houston, Texas 77056

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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.

FEDERAL, STATE, AND LOCAL LAWS MAY IMPOSE REQUIREMENTS ON PUBLIC PROCUREMENT CONTRACTS. CONSULT LOCAL AUTHORITIES OR AN ATTORNEY TO VERIFY REQUIREMENTS APPLICABLE TO THIS PROCUREMENT BEFORE COMPLETING THIS FORM.

It is intended that AIA Document G612™–2017, Owner's Instructions to the Architect, Parts A and B will be completed prior to using this document.

ARTICLE 1 DEFINITIONS

§ 1.1 Bidding Documents include the Bidding Requirements and the Proposed Contract Documents. The Bidding Requirements consist of the advertisement or invitation to bid, Instructions to Bidders, supplementary instructions to bidders, the bid form, and any other bidding forms. The Proposed Contract Documents consist of the unexecuted form of Agreement between the Owner and Contractor and that Agreement's Exhibits, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, all Addenda, and all other documents enumerated in Article 8 of these Instructions.

§ 1.2 Definitions set forth in the General Conditions of the Contract for Construction, or in other Proposed Contract Documents apply to the Bidding Documents.

§ 1.3 Addenda are written or graphic instruments issued by the Architect, which, by additions, deletions, clarifications, or corrections, modify or interpret the Bidding Documents.

§ 1.4 A Bid is a complete and properly executed proposal to do the Work for the sums stipulated therein, submitted in accordance with the Bidding Documents.

§ 1.5 The Base Bid is the sum stated in the Bid for which the Bidder offers to perform the Work described in the Bidding Documents, to which Work may be added or deleted by sums stated in Alternate Bids.

§ 1.6 An Alternate Bid (or Alternate) is an amount stated in the Bid to be added to or deducted from, or that does not change, the Base Bid if the corresponding change in the Work, as described in the Bidding Documents, is accepted.

§ 1.7 A Unit Price is an amount stated in the Bid as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, as described in the Bidding Documents.

§ 1.8 A Bidder is a person or entity who submits a Bid and who meets the requirements set forth in the Bidding Documents.

§ 1.9 A Sub-bidder is a person or entity who submits a bid to a Bidder for materials, equipment, or labor for a portion of the Work.

ARTICLE 2 BIDDER'S REPRESENTATIONS

§ 2.1 By submitting a Bid, the Bidder represents that:

- .1 the Bidder has read and understands the Bidding Documents;
- .2 the Bidder understands how the Bidding Documents relate to other portions of the Project, if any, being bid concurrently or presently under construction;
- .3 the Bid complies with the Bidding Documents;
- .4 the Bidder has visited the site, become familiar with local conditions under which the Work is to be performed, and has correlated the Bidder's observations with the requirements of the Proposed Contract Documents;
- .5 the Bid is based upon the materials, equipment, and systems required by the Bidding Documents without exception; and
- .6 the Bidder has read and understands the provisions for liquidated damages, if any, set forth in the form of Agreement between the Owner and Contractor.

ARTICLE 3 BIDDING DOCUMENTS**§ 3.1 Distribution**

§ 3.1.1 Bidders shall obtain complete Bidding Documents, as indicated below, from the issuing office designated in the advertisement or invitation to bid, for the deposit sum, if any, stated therein.

(Indicate how, such as by email, website, host site/platform, paper copy, or other method Bidders shall obtain Bidding Documents.)

Refer to Document 00 11 19, Request for Competitive Sealed Proposals

§ 3.1.2 Any required deposit shall be refunded to Bidders who submit a bona fide Bid and return the paper Bidding Documents in good condition within ten days after receipt of Bids. The cost to replace missing or damaged paper documents will be deducted from the deposit. A Bidder receiving a Contract award may retain the paper Bidding Documents, and the Bidder's deposit will be refunded.

§ 3.1.3 Bidding Documents will not be issued directly to Sub-bidders unless specifically offered in the advertisement or invitation to bid, or in supplementary instructions to bidders.

§ 3.1.4 Bidders shall use complete Bidding Documents in preparing Bids. Neither the Owner nor Architect assumes responsibility for errors or misinterpretations resulting from the use of incomplete Bidding Documents.

§ 3.1.5 The Bidding Documents will be available for the sole purpose of obtaining Bids on the Work. No license or grant of use is conferred by distribution of the Bidding Documents.

§ 3.2 Modification or Interpretation of Bidding Documents

§ 3.2.1 The Bidder shall carefully study the Bidding Documents, shall examine the site and local conditions, and shall notify the Architect of errors, inconsistencies, or ambiguities discovered and request clarification or interpretation pursuant to Section 3.2.2.

§ 3.2.2 Requests for clarification or interpretation of the Bidding Documents shall be submitted by the Bidder in writing and shall be received by the Architect at least seven days prior to the date for receipt of Bids.

(Indicate how, such as by email, website, host site/platform, paper copy, or other method Bidders shall submit requests for clarification and interpretation.)

§ 3.2.3 Modifications and interpretations of the Bidding Documents shall be made by Addendum. Modifications and interpretations of the Bidding Documents made in any other manner shall not be binding, and Bidders shall not rely upon them.

§ 3.3 Substitutions

§ 3.3.1 The materials, products, and equipment described in the Bidding Documents establish a standard of required function, dimension, appearance, and quality to be met by any proposed substitution.

§ 3.3.2 Substitution Process

§ 3.3.2.1 Written requests for substitutions shall be received by the Architect at least ten days prior to the date for receipt of Bids. Requests shall be submitted in the same manner as that established for submitting clarifications and interpretations in Section 3.2.2.

§ 3.3.2.2 Bidders shall submit substitution requests on a Substitution Request Form if one is provided in the Bidding Documents.

§ 3.3.2.3 If a Substitution Request Form is not provided, requests shall include (1) the name of the material or equipment specified in the Bidding Documents; (2) the reason for the requested substitution; (3) a complete description of the proposed substitution including the name of the material or equipment proposed as the substitute, performance and test data, and relevant drawings; and (4) any other information necessary for an evaluation. The request shall include a statement setting forth changes in other materials, equipment, or other portions of the Work, including changes in the work of other contracts or the impact on any Project Certifications (such as LEED), that will result from incorporation of the proposed substitution.

§ 3.3.3 The burden of proof of the merit of the proposed substitution is upon the proposer. The Architect's decision of approval or disapproval of a proposed substitution shall be final.

§ 3.3.4 If the Architect approves a proposed substitution prior to receipt of Bids, such approval shall be set forth in an Addendum. Approvals made in any other manner shall not be binding, and Bidders shall not rely upon them.

§ 3.3.5 No substitutions will be considered after the Contract award unless specifically provided for in the Contract Documents.

§ 3.4 Addenda

§ 3.4.1 Addenda will be transmitted to Bidders known by the issuing office to have received complete Bidding Documents.

(Indicate how, such as by email, website, host site/platform, paper copy, or other method Addenda will be transmitted.)

§ 3.4.2 Addenda will be available where Bidding Documents are on file.

§ 3.4.3 Addenda will be issued no later than four days prior to the date for receipt of Bids, except an Addendum withdrawing the request for Bids or one which includes postponement of the date for receipt of Bids.

§ 3.4.4 Prior to submitting a Bid, each Bidder shall ascertain that the Bidder has received all Addenda issued, and the Bidder shall acknowledge their receipt in the Bid.

ARTICLE 4 BIDDING PROCEDURES

§ 4.1 Preparation of Bids

§ 4.1.1 Bids shall be submitted on the forms included with or identified in the Bidding Documents.

§ 4.1.2 All blanks on the bid form shall be legibly executed. Paper bid forms shall be executed in a non-erasable medium.

§ 4.1.3 Sums shall be expressed in both words and numbers, unless noted otherwise on the bid form. In case of discrepancy, the amount entered in words shall govern.

§ 4.1.4 Edits to entries made on paper bid forms must be initialed by the signer of the Bid.

§ 4.1.5 All requested Alternates shall be bid. If no change in the Base Bid is required, enter "No Change" or as required by the bid form.

§ 4.1.6 Where two or more Bids for designated portions of the Work have been requested, the Bidder may, without forfeiture of the bid security, state the Bidder's refusal to accept award of less than the combination of Bids stipulated by the Bidder. The Bidder shall neither make additional stipulations on the bid form nor qualify the Bid in any other manner.

§ 4.1.7 Each copy of the Bid shall state the legal name and legal status of the Bidder. As part of the documentation submitted with the Bid, the Bidder shall provide evidence of its legal authority to perform the Work in the jurisdiction where the Project is located. Each copy of the Bid shall be signed by the person or persons legally authorized to bind the Bidder to a contract. A Bid by a corporation shall further name the state of incorporation and have the corporate seal affixed. A Bid submitted by an agent shall have a current power of attorney attached, certifying the agent's authority to bind the Bidder.

§ 4.1.8 A Bidder shall incur all costs associated with the preparation of its Bid.

§ 4.2 Bid Security

§ 4.2.1 Each Bid shall be accompanied by the following bid security:

(Insert the form and amount of bid security.)

Refer to Document 00 43 13, BID Security Form

§ 4.2.2 The Bidder pledges to enter into a Contract with the Owner on the terms stated in the Bid and shall, if required, furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder. Should the Bidder refuse to enter into such Contract or fail to furnish such bonds if required, the amount of the bid security shall be forfeited to the Owner as liquidated damages, not as a penalty. In the event the Owner fails to comply with Section 6.2, the amount of the bid security shall not be forfeited to the Owner.

§ 4.2.3 If a surety bond is required as bid security, it shall be written on AIA Document A310™, Bid Bond, unless otherwise provided in the Bidding Documents. The attorney-in-fact who executes the bond on behalf of the surety shall affix to the bond a certified and current copy of an acceptable power of attorney. The Bidder shall provide surety bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 4.2.4 The Owner will have the right to retain the bid security of Bidders to whom an award is being considered until (a) the Contract has been executed and bonds, if required, have been furnished; (b) the specified time has elapsed so that Bids may be withdrawn; or (c) all Bids have been rejected. However, if no Contract has been awarded or a Bidder has not been notified of the acceptance of its Bid, a Bidder may, beginning days after the opening of Bids, withdraw its Bid and request the return of its bid security.

§ 4.3 Submission of Bids

§ 4.3.1 A Bidder shall submit its Bid as indicated below:

(Indicate how, such as by website, host site/platform, paper copy, or other method Bidders shall submit their Bid.)

Refer to Document 00 11 19, Request for Competitive Sealed Proposals.

§ 4.3.2 Paper copies of the Bid, the bid security, and any other documents required to be submitted with the Bid shall be enclosed in a sealed opaque envelope. The envelope shall be addressed to the party receiving the Bids and shall be identified with the Project name, the Bidder's name and address, and, if applicable, the designated portion of the Work for which the Bid is submitted. If the Bid is sent by mail, the sealed envelope shall be enclosed in a separate mailing envelope with the notation "SEALED BID ENCLOSED" on the face thereof.

§ 4.3.3 Bids shall be submitted by the date and time and at the place indicated in the invitation to bid. Bids submitted after the date and time for receipt of Bids, or at an incorrect place, will not be accepted.

§ 4.3.4 The Bidder shall assume full responsibility for timely delivery at the location designated for receipt of Bids.

§ 4.3.5 A Bid submitted by any method other than as provided in this Section 4.3 will not be accepted.

§ 4.4 Modification or Withdrawal of Bid

§ 4.4.1 Prior to the date and time designated for receipt of Bids, a Bidder may submit a new Bid to replace a Bid previously submitted, or withdraw its Bid entirely, by notice to the party designated to receive the Bids. Such notice shall be received and duly recorded by the receiving party on or before the date and time set for receipt of Bids. The receiving party shall verify that replaced or withdrawn Bids are removed from the other submitted Bids and not considered. Notice of submission of a replacement Bid or withdrawal of a Bid shall be worded so as not to reveal the amount of the original Bid.

§ 4.4.2 Withdrawn Bids may be resubmitted up to the date and time designated for the receipt of Bids in the same format as that established in Section 4.3, provided they fully conform with these Instructions to Bidders. Bid security shall be in an amount sufficient for the Bid as resubmitted.

§ 4.4.3 After the date and time designated for receipt of Bids, a Bidder who discovers that it made a clerical error in its Bid shall notify the Architect of such error within two days, or pursuant to a timeframe specified by the law of the jurisdiction where the Project is located, requesting withdrawal of its Bid. Upon providing evidence of such error to the reasonable satisfaction of the Architect, the Bid shall be withdrawn and not resubmitted. If a Bid is withdrawn pursuant to this Section 4.4.3, the bid security will be attended to as follows:

(State the terms and conditions, such as Bid rank, for returning or retaining the bid security.)

ARTICLE 5 CONSIDERATION OF BIDS

§ 5.1 Opening of Bids

If stipulated in an advertisement or invitation to bid, or when otherwise required by law, Bids properly identified and received within the specified time limits will be publicly opened and read aloud. A summary of the Bids may be made available to Bidders.

§ 5.2 Rejection of Bids

Unless otherwise prohibited by law, the Owner shall have the right to reject any or all Bids.

§ 5.3 Acceptance of Bid (Award)

§ 5.3.1 It is the intent of the Owner to award a Contract to the lowest responsive and responsible Bidder, provided the Bid has been submitted in accordance with the requirements of the Bidding Documents. Unless otherwise prohibited by law, the Owner shall have the right to waive informalities and irregularities in a Bid received and to accept the Bid which, in the Owner's judgment, is in the Owner's best interests.

§ 5.3.2 Unless otherwise prohibited by law, the Owner shall have the right to accept Alternates in any order or combination, unless otherwise specifically provided in the Bidding Documents, and to determine the lowest responsive and responsible Bidder on the basis of the sum of the Base Bid and Alternates accepted.

ARTICLE 6 POST-BID INFORMATION**§ 6.1 Contractor's Qualification Statement**

Bidders to whom award of a Contract is under consideration shall submit to the Architect, upon request and within the timeframe specified by the Architect, a properly executed AIA Document A305™, Contractor's Qualification Statement, unless such a Statement has been previously required and submitted for this Bid.

§ 6.2 Owner's Financial Capability

A Bidder to whom award of a Contract is under consideration may request in writing, fourteen days prior to the expiration of the time for withdrawal of Bids, that the Owner furnish to the Bidder reasonable evidence that financial arrangements have been made to fulfill the Owner's obligations under the Contract. The Owner shall then furnish such reasonable evidence to the Bidder no later than seven days prior to the expiration of the time for withdrawal of Bids. Unless such reasonable evidence is furnished within the allotted time, the Bidder will not be required to execute the Agreement between the Owner and Contractor.

§ 6.3 Submittals

§ 6.3.1 After notification of selection for the award of the Contract, the Bidder shall, as soon as practicable or as stipulated in the Bidding Documents, submit in writing to the Owner through the Architect:

- .1 a designation of the Work to be performed with the Bidder's own forces;
- .2 names of the principal products and systems proposed for the Work and the manufacturers and suppliers of each; and
- .3 names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for the principal portions of the Work.

§ 6.3.2 The Bidder will be required to establish to the satisfaction of the Architect and Owner the reliability and responsibility of the persons or entities proposed to furnish and perform the Work described in the Bidding Documents.

§ 6.3.3 Prior to the execution of the Contract, the Architect will notify the Bidder if either the Owner or Architect, after due investigation, has reasonable objection to a person or entity proposed by the Bidder. If the Owner or Architect has reasonable objection to a proposed person or entity, the Bidder may, at the Bidder's option, withdraw the Bid or submit an acceptable substitute person or entity. The Bidder may also submit any required adjustment in the Base Bid or Alternate Bid to account for the difference in cost occasioned by such substitution. The Owner may accept the adjusted bid price or disqualify the Bidder. In the event of either withdrawal or disqualification, bid security will not be forfeited.

§ 6.3.4 Persons and entities proposed by the Bidder and to whom the Owner and Architect have made no reasonable objection must be used on the Work for which they were proposed and shall not be changed except with the written consent of the Owner and Architect.

ARTICLE 7 PERFORMANCE BOND AND PAYMENT BOND**§ 7.1 Bond Requirements**

§ 7.1.1 If stipulated in the Bidding Documents, the Bidder shall furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder.

§ 7.1.2 If the furnishing of such bonds is stipulated in the Bidding Documents, the cost shall be included in the Bid. If the furnishing of such bonds is required after receipt of bids and before execution of the Contract, the cost of such bonds shall be added to the Bid in determining the Contract Sum.

§ 7.1.3 The Bidder shall provide surety bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 7.1.4 Unless otherwise indicated below, the Penal Sum of the Payment and Performance Bonds shall be the amount of the Contract Sum.

(If Payment or Performance Bonds are to be in an amount other than 100% of the Contract Sum, indicate the dollar amount or percentage of the Contract Sum.)

§ 7.2 Time of Delivery and Form of Bonds

§ 7.2.1 The Bidder shall deliver the required bonds to the Owner not later than three days following the date of execution of the Contract. If the Work is to commence sooner in response to a letter of intent, the Bidder shall, prior to commencement of the Work, submit evidence satisfactory to the Owner that such bonds will be furnished and delivered in accordance with this Section 7.2.1.

§ 7.2.2 Unless otherwise provided, the bonds shall be written on AIA Document A312, Performance Bond and Payment Bond.

§ 7.2.3 The bonds shall be dated on or after the date of the Contract.

§ 7.2.4 The Bidder shall require the attorney-in-fact who executes the required bonds on behalf of the surety to affix to the bond a certified and current copy of the power of attorney.

ARTICLE 8 ENUMERATION OF THE PROPOSED CONTRACT DOCUMENTS

§ 8.1 Copies of the proposed Contract Documents have been made available to the Bidder and consist of the following documents:

.1 AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor, unless otherwise stated below.
(Insert the complete AIA Document number, including year, and Document title.)

.2 AIA Document A101™–2017, Exhibit A, Insurance and Bonds, unless otherwise stated below.
(Insert the complete AIA Document number, including year, and Document title.)

.3 AIA Document A201™–2017, General Conditions of the Contract for Construction, unless otherwise stated below.
(Insert the complete AIA Document number, including year, and Document title.)

.4 Building Information Modeling Exhibit, if completed:

.5 Drawings

Number	Title	Date
Refer to Document 00 01 15	List of Drawing Sheets	

.6 Specifications

Section	Title	Date	Pages
Refer to Document 00 01 10	Table of Contents		

.7 Addenda:

Number	Date	Pages
TBD		

.8 Other Exhibits:

(Check all boxes that apply and include appropriate information identifying the exhibit where required.)

- ☐ AIA Document E204™–2017, Sustainable Projects Exhibit, dated as indicated below:
(Insert the date of the E204-2017.)

- ☐ The Sustainability Plan:

Title	Date	Pages
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- ☒ Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages
00 22 13	Supplementary Instructions to Bidders		

.9 Other documents listed below:

(List here any additional documents that are intended to form part of the Proposed Contract Documents.)

Additions and Deletions Report for AIA® Document A701® – 2018

This Additions and Deletions Report, as defined on page 1 of the associated document, reproduces below all text the author has added to the standard form AIA document in order to complete it, as well as any text the author may have added to or deleted from the original AIA text. Added text is shown underlined. Deleted text is indicated with a horizontal line through the original AIA text.

Note: This Additions and Deletions Report is provided for information purposes only and is not incorporated into or constitute any part of the associated AIA document. This Additions and Deletions Report and its associated document were generated simultaneously by AIA software at 16:30:12 ET on 11/20/2024.

PAGE 1

New District Administration Building
21330 Valley Ranch Pkwy.
New Caney, TX. 77357

...

New Caney Independent School District
22784 Hwy 59 S
Building "E"
Porter, Texas 77365

...

Glaus, Pyle, Schomer, Burns, & Dehaven, Inc. dba GPD Group
2121 Sage Road, Suite 240
Houston, Texas 77056

PAGE 2

Refer to Document 00 11 19, Request for Competitive Sealed Proposals

PAGE 4

Refer to Document 00 43 13, BID Security Form

PAGE 5

Refer to Document 00 11 19, Request for Competitive Sealed Proposals.

PAGE 7

Refer to Document 00 01 15 List of Drawing Sheets

PAGE 8

Refer to Document 00 01 10 Table of Contents

...

TBD

...

[X] Supplementary and other Conditions of the Contract:

...

00 22 13Supplementary
Instructions to Bidders

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 16:30:12 ET on 11/20/2024 under Order No. 4104243936 from AIA Contract Documents software and that in preparing the attached final document I made no changes to the original text of AIA® Document A701™ – 2018, Instructions to Bidders, other than those additions and deletions shown in the associated Additions and Deletions Report.

(Signed)

(Title)

(Dated)

DOCUMENT 00 31 32
GEOTECHNICAL DATA

1 GENERAL

1.1 GEOTECHNICAL CONSULTANT AND REPORT

- A. The Owner has engaged Terracon Consultants, Inc. to perform a geotechnical investigation of the project site.
- B. Terracon Consultants, Inc. has prepared a geotechnical investigation report for the Project, titled "Report – Geotechnical Investigation – Proposed New District Administration Building dated October 3, 2024. The report is available for viewing as appended to this Document.

1.2 GEOTECHNICAL DATA

- A. This Document 00 31 32, 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. Each bidder shall visit the site and fully acquaint himself with the existing conditions and be prepared to complete all work required by the documents.
- B. This Document 00 31 32, with its referenced attachments, is made available for Bidders' convenience and information, but is not a warranty of existing conditions. This Document 00 31 32 and its attachments are not part of the Contract Documents.
- C. The conditions indicated in this Document with its referenced attachments were known to exist at the locations shown on the dates the tests were performed. There is no guarantee, express or implied, that the soil conditions are uniform between boring locations or that the same conditions will exist at the time of construction.
- D. Soil-boring data for the Project, obtained by Terracon Consultants, Inc., dated October 3, 2024, is available for viewing as appended to this Document. The following pages from the Terracon Consultants, Inc. report dated October 3, 2024 are included for the Contractor's information:
 - 1. Laboratory Test Summary
 - 2. Boring Location Map
 - 3. Description of Boring Log Terms
 - 4. Log of Boring for Boring No. 'B1' through Boring No. 'B10'

New Caney ISD Administration Building

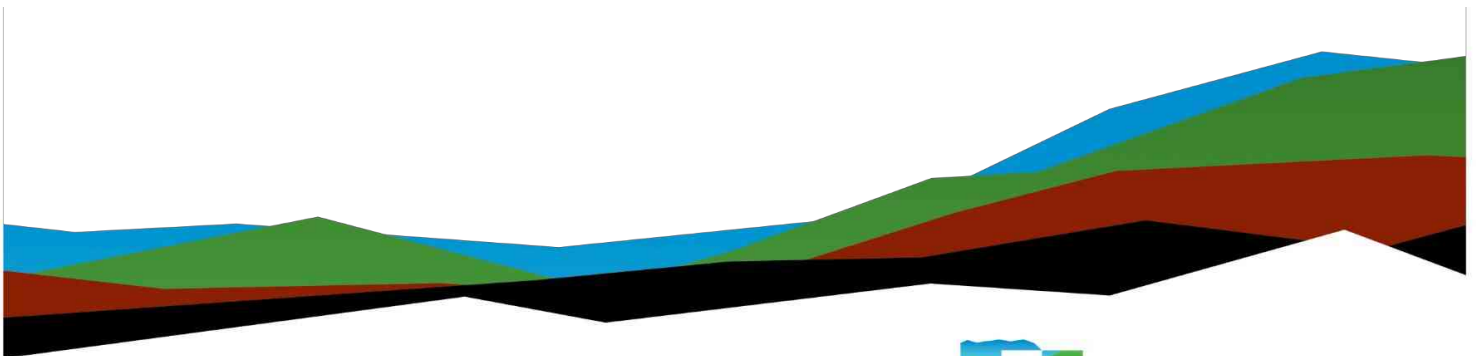
Geotechnical Engineering Report

October 3, 2024 | Terracon Project No. 97245100

New Caney, Texas

Prepared for:

New Caney Independent School
District (NCISD)
22784 Highway 59S, Building
Porter, Texas 77365



Nationwide
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Conroe, Texas 77302
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October 3, 2024

New Caney Independent School District (NCISD)
22784 Highway 59S, Building
Porter, Texas 77365

Attn: Mr. Jesse Lemus – QA/QC Manager
E: ilemus@newcaneyisd.org

Re: Geotechnical Engineering Report
New Caney ISD Administration Building
Valley Ranch Parkway and US 59
New Caney, Texas
Terracon Project No. 97245100

Dear Mr. Lemus:

We have completed the scope of Geotechnical Engineering services for the above referenced project in general accordance with Terracon Document No. P97245100.Revision 1 dated September 2, 2024. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning earthwork and the design and construction of foundations, floor slabs, and pavements for the proposed project.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report or if we may be of further service, please contact us.

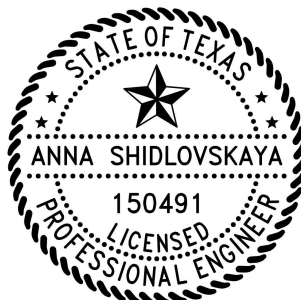
Sincerely,

Terracon

(Texas Firm Registration No. F-3272)

Anna Shidlovskaya

Anna Shidlovskaya, P.E., Ph.D.
Project Engineer



Bobbie Sue Hood

Bobbie Sue Hood, P.E.
Principal/Senior Engineer

Geotechnical Engineering Report
New Caney ISD Administration Building | New Caney, Texas
October 3, 2024 | Terracon Project No. 97245100



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- Exploration and Testing Procedures
- Site Location and Exploration Plans
- Exploration and Laboratory Results
- Supporting Information

Geotechnical Engineering Report

New Caney ISD Administration Building | New Caney, Texas

October 3, 2024 | Terracon Project No. 97245100



Note: This report was originally delivered in a web-based format. **Blue Bold** text in the report indicates a referenced section heading. The PDF version also includes hyperlinks which direct the reader to that section and clicking on the  Terracon logo will bring you back to this page. For more interactive features, please view your project online at client.terracon.com.

Refer to each individual Attachment for a listing of contents.

Geotechnical Engineering Report
New Caney ISD Administration Building | New Caney, Texas
October 3, 2024 | Terracon Project No. 97245100



Introduction

This report presents the results of our subsurface exploration and Geotechnical Engineering services performed for the proposed New Caney Independent School District (New Caney ISD) Administration Building to be located at the northwest corner of Valley Ranch Parkway and US 59 southbound frontage road in New Caney, Texas. The purpose of these services was to provide information and geotechnical engineering recommendations relative to:

- Subsurface soil conditions
- Groundwater conditions
- Seismic site classification per IBC
- Site preparation and earthwork
- Foundation design and construction
- Floor slab design and construction
- Pavement design and construction

The geotechnical engineering Scope of Services for this project included the advancement of ten test borings to depth ranged from about 5 to 25 feet below existing grade, laboratory testing, engineering analysis, and preparation of this report.

Drawings showing the site and boring locations are shown on the [Site Location](#) and [Exploration Plan](#), respectively. The results of the laboratory testing performed on soil samples obtained from the site during our field exploration are included on the boring logs in the [Exploration Results](#) section.

Project Description

Our initial understanding of the project was provided in our proposal and was discussed during project planning. A period of collaboration has transpired since the project was initiated, and our final understanding of the project conditions is as follows:

Item	Description
Information Provided	The site and boring layout along with a site vicinity map were provided by NCISD via email on August 13 and 14, 2024. The topographic plan was provided by NCISD via email on September 30, 2024.

Geotechnical Engineering Report
New Caney ISD Administration Building | New Caney, Texas
October 3, 2024 | Terracon Project No. 97245100



Item	Description
Project Description	The project includes a construction of a two-story administration building, with a footprint approximately 72,000 square feet in size, with associated parking and driveway areas.
Building Construction	We understand the administration building is planned to be steel-frame construction.
Preferred Building Foundation System	Drilled-and-underreamed footings with a grade-supported floor slab.
Finished Floor Elevation (assumed)	Within about 1 to 2 feet above existing grade.
Maximum Loads (assumed)	<ul style="list-style-type: none">■ Columns: 200 to 250 kips■ Floor slabs: 125 pounds per square foot (psf)
Pavements	Concrete pavements are planned for the parking and driveway areas.
Building Code	2018 IBC.

Terracon should be notified if any of the above information is inconsistent with the planned construction, especially the grading limits, as modifications to our recommendations may be necessary.

Site Conditions

The following description of site conditions is derived from our site visit in association with the field exploration and our review of publicly available geologic and topographic maps.

Item	Description
Parcel Information	The project site, about 8.5 acres in size, is located at the northwest corner of Valley Ranch Parkway and the US-59 southbound frontage road in New Caney, Texas. See Site Location
Existing Improvements	The site appears to be vacant at the time of this document. There is an overhead powerline at the north side of the property.
Current Ground Conditions	Grass with scattered trees.
Existing Topography (from USGS map)	Relatively level.



Geotechnical Characterization

Geology

Based on the geologic maps published by the Bureau of Economic Geology, the site for the proposed project is located on the upper Lissie formation, sometimes denoted the Montgomery formation. The upper Lissie formation is heterogeneous, containing interbedded layers of clay, sand and silt. This formation was deposited in mid-Pleistocene time in shallow coastal river channels and flood plains.

The coastal plain in this region has a complex tectonic geology, several major features of which are: Gulf Coastal geosyncline, salt domes, and major sea level fluctuations during the glacial stages, subsidence and geologic faulting activities. Most of these geologic faulting activities have ceased for millions of years, but some are still active. A detailed geologic fault investigation and study of the site geology are beyond the scope of this document.

Subsurface Profile

We have developed a general characterization of the subsurface conditions based upon our review of the subsurface exploration, laboratory data, geologic setting and our understanding of the project. This characterization, termed GeoModel, forms the basis of our geotechnical calculations and evaluation of the site. Conditions observed at each exploration point are indicated on the individual logs. The individual logs can be found in the [Exploration Results](#) and the GeoModel can be found in the [Figures](#) attachment of this report.

As part of our analyses, we identified the following model layers within the subsurface profile. For a more detailed view of the model layer depths at each boring location, refer to the GeoModel.

Model Layer	Layer Name	General Description
1	Silty Sand	Brown, light brown, and tan, very loose to loose, with trace roots
2	Clayey Sand, Sandy Lean Clay, and Sandy Fat Clay	Brown, light brown, light gray, reddish-brown, tan, and light gray, soft to very stiff and very loose to medium dense, with silty sand and clay pockets, trace roots, ferrous nodules
3	Silty Sand	Tan and light gray, loose to medium dense, with clay seams and pockets

Geotechnical Engineering Report
New Caney ISD Administration Building | New Caney, Texas
October 3, 2024 | Terracon Project No. 97245100



Model Layer	Layer Name	General Description
4	Sandy Lean Clay and Sandy Fat Clay	Tan, light gray, and reddish-brown, stiff to very stiff, with sand pockets

Groundwater Conditions

Boring B-1 was advanced using dry drilling techniques to the boring termination depth of approximately 12 feet below existing grade in an effort to evaluate groundwater conditions at the time of our field program. Wet rotary techniques were used thereafter to the termination depth of the borings (about 25 feet below existing grade). Borings B-2 through B-10 were advanced using dry drilling techniques to the boring termination depths of approximately 5 to 25 feet below existing grade. Upon reaching groundwater in Borings B-1 and B-6, drilling was suspended for a period of about 15 minutes to allow the groundwater to rise and the groundwater levels to be recorded. Groundwater was not observed while drilling and immediately upon completion of drilling in Borings B-2 through B-5 and B-7 through B-10.

Additional measurements were taken after approximately 24 hours in Borings B-1 through B-5. At that time, water was observed in Borings B-1 through B-3. The water levels observed in the boreholes can be found on the [Geomodel](#) and [Boring logs](#) and are shown graphically in the [Exploration Results](#) section.

These water level observations provide an approximate indication of the groundwater conditions existing on the site at the time the observations were made. Longer-term observations using cased holes or piezometers, sealed from the influence of surface water, would be required for a better evaluation of the groundwater conditions on this site.

Groundwater level fluctuations occur due to seasonal variations in the amount of rainfall, runoff, and other factors not evident at the time the borings were performed. Therefore, groundwater levels during construction or at other times in the life of the structure may be higher or lower than the levels indicated on the boring logs. Also, trapped or “perched” water could be present within the sand or silt seams within native clay soils and/or in cohesionless soils above lower permeability clay soil layers. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project.

Seismic Site Class

The seismic design requirements for buildings and other structures are based on Seismic Design Category. Site Classification is required to determine the Seismic Design

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Category for a structure. The Site Classification is based on the upper 100 feet of the site profile defined by a weighted average value of either shear wave velocity, standard penetration resistance, or undrained shear strength in accordance with Section 20.4 of ASCE 7 and the International Building Code (IBC). Based on the soil properties observed at the site and as described on the exploration logs and results, our professional opinion is for that a **Seismic Site Classification of D** be considered for the project. Subsurface explorations at this site were extended to a maximum depth of 25 feet. The site properties below the boring depth to 100 feet were estimated based on our experience and knowledge of geologic conditions of the general area. Additional deeper borings or geophysical testing may be performed to confirm the conditions below the current boring depth.

Geotechnical Overview

The surface and near-surface soils at this site include moisture sensitive silty sands which will become wet and weak with elevated moisture contents. If wet and/or soft conditions are present at the time of construction, remedial efforts may be necessary for preparation of the surficial soils in the building and pavement areas to create a working surface. Remedial effort options are discussed in the **Wet Weather/Soft Subgrade** section of this report.

A foundation system consisting of shallow spread/strip footings may be utilized to support the proposed administration building planned at this site provided the upper 4 feet of existing soil is removed and replaced with select fill and the underlying subgrade properly prepared as outlined in **Earthwork** and **Floor Slabs**.

Recommendations are also provided for drilled-and-underreamed footing foundations. However, due to sand layers and relatively shallow groundwater, drilled-and-underreamed footings may not be stable. If drilled-and-underreamed footings are preferred, we strongly recommend that test underreams be constructed prior to design. Terracon should be consulted regarding the location of the test underreams.

In order to provide uniform support for the floor slab, a minimum of 4 feet of existing soil should be removed from the building area and the excavation backfilled with compacted select fill up to design finished grade.

Rigid pavement sections vary from 5.0 to 7.0 inches of reinforced concrete with chemically treated subgrade.

The recommendations contained in this report are based upon the results of field and laboratory testing (presented in the **Exploration Results**), engineering analyses, and our current understanding of the proposed project. The **General Comments** section provides an understanding of the report limitations.

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Earthwork

Earthwork is anticipated to include stripping, excavations, and select fill placement. The following sections provide recommendations for use in the preparation of specifications for the work. Recommendations include critical quality criteria, as necessary, to render the site in the state considered in our geotechnical engineering evaluation for foundations, floor slabs, and pavements.

Site Preparation

Construction areas should be stripped of vegetation, remaining trees, and topsoil and other debris/unsuitable surface material. Roots of trees to be removed within the construction areas should be grubbed to full depths. Care should be taken to replace or recompact all soil removed or loosened by the removal of tree roots and stumps as recommended in subsequent paragraphs. Proper site drainage should be maintained during construction so that ponding of surface runoff does not occur and cause construction delays and/or inhibit site access.

In addition, a minimum of 4 feet of existing weak soil should be removed from the building area and replaced with select fill. Prior to placement of fill, the exposed subgrade should be carefully proofrolled with a 20-ton pneumatic roller or equivalent equipment, such as a fully loaded dump truck, to detect weak zones in the subgrade. Weak areas detected during proofrolling, containing organic matter and/or debris, should be removed and replaced with soils exhibiting similar classification, moisture content, and density as the adjacent in-situ soils. Proofrolling should be performed under the direct observation of the geotechnical engineer or his/her representative and may be waived at the discretion of the geotechnical engineer.

Subsequent to proofrolling, and just prior to placement of fill, the exposed subgrade within the construction area should be evaluated for moisture and density. If the moisture and/or density do not meet the criteria described in **Fill Compaction Requirements** for on-site soils, the subgrade should be scarified to a minimum depth of 6 inches, moisture adjusted, and compacted to at least 95 percent of the Standard Effort (ASTM D 698) maximum dry density.

Fill Material Types

Select fill and on-site soils to be used at this site for grade adjustments should meet the following criteria:



Fill Type	USCS Classification	Acceptable Location for Placement
Select fill soils	CL and/or SC ($10 \leq PI \leq 20$)	Must be used to construct the select fill building pad under the floor slabs and for all grade adjustments within the building area.
On-site soils ¹	Varies	The on-sites soils appear suitable for use as fill within the pavement areas, provided they are free of organics and debris.

1. The utilization of on-site silty sands may present difficulties during construction due to the increased sand and silt content of these soils, especially during and soon after periods of wet weather. If the utilization of the silty sands as fill is planned in the pavement areas, treatment of these soils with lime-flyash should produce a material that would be more suitable for use as fill.

If blended or mixed soils are intended for use to construct the building pad, Terracon should be contacted to provide additional recommendations. Blended or mixed soils do not occur naturally. These soils are a blend of sand and clay and will require mechanical mixing with a pulvimixer at the site. If these soils are not mixed thoroughly to break down the clay clods and blend-in the sand to produce a uniform soil matrix, the fill material may be detrimental to the slab performance. If blended soils are used, we recommend that additional samples of the blended soils, as well as the clay clods, be obtained prior to and during earthwork operations to evaluate if the blended soils can be used in lieu of select fill. The actual type and amount of mechanical mixing at the site will depend on the amount of clay and sand, and properties of the clay.

Fill Compaction Requirements

Select fill and on-site soils should meet the following compaction requirements.

Item	Description
Fill lift thickness	The fill soils should be placed on prepared surfaces in lifts not to exceed 8 inches loose measure.
Compaction Requirements	<ul style="list-style-type: none">■ The select fill and on-site soils placed below 4 feet of final grade should be compacted to at least 100 percent of the Standard Effort (ASTM D 698) maximum dry density.■ The select fill and on-site soils placed within 4 feet of final grade should be compacted to at least 95 percent of the Standard Effort (ASTM D 698) maximum dry density.■ The select fill and on-site soils should be moisture adjusted to within 2 percent of the optimum moisture content.

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Prior to any filling operations, samples of the proposed borrow and on-site materials should be obtained for laboratory moisture-density testing. The tests will provide a basis for evaluation of fill compaction by in-place density testing. A qualified soil technician should perform sufficient in-place density tests during the filling operations to evaluate that proper levels of compaction, including dry unit weight and moisture content, are being attained.

Utility Trench Backfill

Utility trenches are a common source of water infiltration and migration. Utility trenches penetrating beneath the building should be effectively sealed to restrict water intrusion and flow through the trenches, which could migrate below the building. We recommend constructing an effective "trench plug" that extends at least 5 feet out from the face of the building exterior. The plug material should consist of low permeability cementitious flowable fill or low permeability clay. The plug material should consist of clay compacted at a water content at or above the soils optimum water content. The clay fill should be placed to completely surround the utility line and be compacted in accordance with recommendations in this report.

Grading and Drainage

All grades must provide effective drainage away from the building during and after construction and should be maintained throughout the life of the structure. Water retained next to the building can result in soil movements greater than those discussed in this report. Greater movements can result in unacceptable differential floor slab and/or foundation movements, cracked slabs and walls, and roof leaks. The roof should have gutters/drains with downspouts that discharge onto splash blocks at a distance of at least 10 feet from the building.

Exposed ground should be sloped and maintained at a minimum 5 percent away from the building for at least 10 feet beyond the perimeter of the building. Locally, flatter grades may be necessary to transition ADA access requirements for flatwork. After building construction and landscaping, final grades should be verified to document effective drainage has been achieved. Grades around the structure should also be periodically inspected and adjusted as necessary as part of the structure's maintenance program.

Planters located within 10 feet of the proposed building should be self-contained to prevent water accessing the building and pavement subgrade soils. Locate sprinkler mains and spray heads a minimum of 5 feet away from the building lines. Low-volume, drip-style landscaped irrigation should not be used near the building. Collect roof runoff in drains or gutters. Discharge roof drains and downspouts onto pavements and/or flatworks which slope away from the proposed building or extend down spouts a minimum of 10 feet away from building.

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Flatworks and pavements will be subject to post construction movement. Maximum grades practical should be used for paving and flatwork to prevent water from ponding. Allowances in final grades should also consider post-construction movement of flatwork, particularly if such movement would be critical. Where paving or flatwork abuts the building, effectively seal and maintain joints to prevent surface water infiltration.

Wet Weather/Soft Subgrade Considerations

The surficial soils at this site include silty sandy soils which are extremely moisture-sensitive. These soils will become wet and weak with elevated moisture contents. Due to the high silt and sand content and low plasticities of these soils, proper compaction may be difficult to achieve. In addition, construction during and soon after wet weather periods may encounter difficulties due to wet and soft surficial soils becoming a general hindrance to equipment as a result of rutting and/or pumping of the soil surface. If the subgrade cannot be adequately compacted to the minimum densities as described above, one of the following methods should be used to improve the soils: 1) removal and replacement with select fill, 2) chemical treatment of the soil to dry the subgrade, or 3) drying by natural means if the schedule allows.

Based on our experience with similar soils, chemical treatment is an efficient and effective method to increase the supporting value of wet and soft subgrade such as that observed at this site. Chemical treatment may be necessary to depths of approximately one to two feet or greater of the near-surface silty/sandy soils, depending on the condition of the subgrade at the time of construction. We suggest that a cost be included in the construction budget for chemical treatment of the soils using a lime-flyash mixture to aid drying and improve the condition of the soil if the soil is wet and/or soft at the time of construction. We recommend that this cost be in the form of a contingency or allowance to be used if needed. Terracon should be contacted for additional recommendations if chemical treatment of the soils is planned due to soft and/or wet subgrade.

Shallow Foundations

A foundation system consisting of shallow spread/strip footings may be utilized to support the proposed administration building planned at this site provided the upper 4 feet of existing soil is removed and replaced with select fill and the underlying subgrade properly prepared as outlined in **Earthwork** and **Floor Slabs**. Recommendations for this type of foundation system are provided in the following sections.

Recommendations are also provided for drilled-and-underreamed footing foundation. However, due to sand pockets and layers and relatively shallow groundwater, drilled-and-underreamed footings may not be stable. If drilled-and-underreamed footings are

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preferred, we strongly recommend that test underreams be constructed prior to design. Terracon should be consulted regarding the location of the test underreams.

If the site has been prepared in accordance with the requirements noted in [Earthwork](#), the following design parameters are applicable for shallow foundations.

Design Recommendations – Shallow Spread/Strip Footings

Item	Description
Minimum embedment depth¹	3 feet below final grade
Allowable bearing pressures (individual footings)²	Net dead plus sustained live load – 2,000 psf Net total load – 3,000 psf
Allowable bearing pressures (strip footing)³	Net dead plus sustained live load – 1,600 psf Net total load – 2,400 psf
Approximate post-construction settlement⁴	Approximately one inch
Estimated post-construction differential settlement⁵	Approximately ½ of post-construction settlement
Allowable passive pressure⁶	750 psf
Allowable frictional resistance⁷	250 psf
Uplift resistance⁸	Foundation Weight (150 pcf) & Soil Weight (120 pcf)

1. The footings should bear upon the properly placed and compacted select fill soils.
2. Whichever condition yields a larger bearing area.
3. Defined as a footing at least twice as long as it is wide.
4. This estimated post-construction settlement of the shallow footings is without considering the effect of stress distribution from adjacent foundations and assuming proper construction practices are followed. A clear distance between footings of one footing size of the larger of the two footings should not produce overlapping stress distributions and would essentially behave as independent foundations.
5. The post-construction differential settlements may result from variances in subsurface conditions, loading conditions, and construction procedures. The settlement response of the footings will be more dependent upon the quality of construction than upon the response of the subgrade to the foundation loads.
6. The passive pressure along the exterior face of the footings should be neglected within the upper 4 feet due to surface effects unless pavement is provided up to the edge of the structures. For interior footings, the allowable passive pressure may be used for the entire depth of the footing.
7. To be utilized on the base of the footings.
8. Structural uplift loads on the shallow footings may be resisted by the weight of the foundation plus the weight of any soil directly above the foundation. The ultimate uplift capacity of shallow footings should be reduced by an appropriate factor of safety to compute allowable uplift capacity.

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Construction Considerations – Shallow Spread/Strip Footings

Excavations for shallow footings should be performed with equipment capable of providing a relatively clean bearing area. The bottom 6 inches of the foundation excavations should be completed with a smooth-mouthed bucket or by hand labor. The excavations should be neatly excavated and properly formed. Debris in the bottom of the excavation should be removed prior to steel placement. Based on the groundwater observations obtained during our field program (refer to **Groundwater Conditions**), significant groundwater seepage is not anticipated for shallow footings at the recommended bearing depth. However, water should not be allowed to accumulate at the bottom of the foundation excavations. To reduce the potential for groundwater seepage into the excavations and to minimize disturbance to the bearing area, we recommend that concrete and steel be placed as soon as possible after the excavations are completed. Excavations should not be left open overnight. The bearing surface of the shallow footings should be evaluated immediately prior to placing concrete or a seal slab.

A thin seal slab of lean concrete (approximately 2 to 4 inches thick) should be placed at the bottom of the footing excavation to protect the bearing surface of the footings from disturbance and/or infiltration of ground/surface water if the footing cannot be poured within the same day of excavation.

Design Recommendations – Drilled-and-underreamed Footings

Item	Description
Embedment elevation ¹	100 feet
Allowable bearing pressures ²	Net dead plus sustained live load – 2,800 psf Net total load – 4,300 psf
Maximum underream-to-shaft diameter ratio	2.5:1
Approximate post-construction settlement ³	one inch or less
Estimated differential settlement ⁴	Approximately ½ of post-construction settlement
Allowable passive pressure ⁵	750 psf
Uplift resistance ⁶	Foundation Weight (150 pcf) & Soil Weight (120 pcf)

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Item	Description
1.	The footings should extend through the fill soils and bear within the native undisturbed sandy lean clay. Ground elevations were obtained from a topographic plan provided by NCISD.
2.	Whichever condition yields a larger bearing area.
3.	This estimated post-construction settlement of the drilled-and-underreamed footings is without considering the effect of stress distribution from adjacent foundations and assuming proper construction practices are being followed. A clear distance between the footings of one underream diameter of the larger footing should be provided between the underreams to develop the recommended bearing pressures and to control settlements. If a clearance of one diameter cannot be maintained in every case, the above bearing capacities should be reduced by 20 percent for a clearance between one half and one underream diameters. Underreams closer than a clearance of one half of an underream diameter are not recommended.
4.	The differential settlement will result from variances in subsurface conditions, loading conditions and construction procedures, such a cleanliness of the bearing area or flowing water in the shaft.
5.	For footings placed against an undisturbed vertical face of the in-situ soils. Lateral resistance of the drilled-and-underreamed footings is primarily developed by passive resistance of the soils against the side of the footing. Due to surface effects and the presence of fill and expansive soils, the lateral resistance of the upper 4 feet of the soils at the surface for exterior footings should be neglected unless area paving is provided up to the edge of the building.
6.	Structural uplift loads on the drilled-and-underreamed footings will be resisted by the dead weight of the footings and supported structure plus the weight of a soil wedge above the footing. The soil wedge can be assumed to extend upward from the bottom of the underream at a slope of 4 vertical to 1 horizontal.

Construction Considerations – Drilled-and-Underreamed Footings

Drilled excavations to a depth of 7 to 8 feet below existing grade will be necessary for installation of drilled-and-underreamed footings for the proposed administration building planned at this site. The excavations should be performed with equipment capable of providing a relatively clean bearing area. The presence of very sandy soil layers and sand pockets can cause sloughing during footing excavation. Thus, the drilling contractor should have casing available in the event that sloughing causes improperly formed shafts.

Based on our groundwater observations (refer to **Groundwater Conditions**), groundwater may be a concern during construction. Depending on climatic conditions, groundwater levels may vary from the levels observed during our field program. Water must not be allowed to accumulate in the bottom of the footing excavations. The contractor should be prepared to remove water from the drilled footings, if necessary. To reduce the potential for water seepage into the footing excavation and to minimize disturbance to the bearing area, we recommend that concrete and steel be placed as soon as possible after footing excavations are completed. Preferably, footing excavations should be backfilled with concrete within about 2 to 4 hours of completion of the drilling

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and in no case should an excavation be left open overnight. The concrete placed in the excavations should have a 6-inch slump with a plus or minus one inch tolerance. The bottom of each footing excavation should be free of all loose materials and/or water, and the bearing surface should be evaluated immediately prior to placing concrete.

Additionally, the subgrade soils tend to become very silty/sandy below a depth of about 8 to 10 feet below existing grade at Borings B-1 and B-3. If underreams were attempted below the recommended bearing elevation, they would likely become unstable. In addition, significant groundwater seepage could occur. Thus, we recommend the footing depths not be lowered below the recommended bearing elevation without discussion and consideration of the consequences. The contractor should not auger the shaft deeper than the recommended bearing elevation under any circumstances without contacting us.

Based on the available field and laboratory data, the underreams constructed as described in this report should remain stable for a short period of time. However, if underreams are marginally stable due to water seepage and/or the presence of sloughing soils, successful construction of underreamed footings may be possible by performing the sequence of construction without interruption, that is, each footing drilled, underreamed, and backfilled with concrete in one continuous operation. The contractor must coordinate the operation very closely to have concrete on site at the time each footing is drilled and underreamed so that no shaft or underream is drilled without concrete standing by, ready to be placed. Additional measures to reduce the potential for caving of the underream would be to limit the underream-to-shaft diameter ratio to 2:1 or to install straight shaft footings in isolated problem areas. If straight-shaft footings are planned at the site, Terracon should be contacted for additional recommendations.

Grade Beams – Drilled-and-Underreamed Footings

Grade beams associated with the drilled-and-underreamed footings should be designed to span between the footings without subgrade support. Backfill against the outside face of the grade beams should consist of select fill used to prepare the building pad. The select fill should be uniformly compacted to at least 95 percent of the Standard Effort (ASTM D698) maximum dry density at a moisture content within 2 percent of optimum moisture content.

Foundation Construction Monitoring

The performance of the foundation system for the proposed structure will be highly dependent upon the quality of construction. Thus, we recommend that fill pad compaction and foundation installation be observed full time by an experienced Terracon soil technician under the direction of our geotechnical engineer. During foundation installation, the base of the foundations should be observed to evaluate the condition of

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the subgrade. We would be pleased to develop a plan for compaction and foundation installation observation to be incorporated in the overall quality control program.

Floor Slabs

Planned finished grades for the proposed administration building were not available at the time of this report. We anticipate that the finished floor elevation of the proposed building is planned to be within about one to two feet above the existing grade. If the grading is planned to be altered from what has been previously described, Terracon should be notified to review and/or modify our recommendations given in this subsection.

The near surface soils observed within the area of the proposed administration building generally exhibit a low to medium expansion potential. Based on the information developed from our field and laboratory programs and on method TEX-124-E in the Texas Department of Transportation (TxDOT) Manual of Testing Procedures, we estimate that the subgrade soils at this site exhibit a Potential Vertical Rise (PVR) of up to approximately one inch.

However, the near-surface soils are wet and weak. We recommend a minimum of 4 feet of existing weak soil be removed from the building area and replaced with select fill up to design finished grade. Prior to placement of fill, the exposed soil should be proofrolled as recommended in [Earthwork](#).

The building pad should extend a minimum of 3 feet beyond the edge of the proposed building area. The final exterior grade adjacent to the structures should be sloped to promote effective drainage away from the building.

Select fill should be utilized for all grade adjustments within the proposed building area. The subgrade and select fill soils should be prepared as outlined in [Earthwork](#), which contains material and placement requirements for select fill, as well as other subgrade preparation recommendations.

Pavements

It is our understanding that rigid concrete paving is planned for this project. The subgrade should be prepared as outlined in the [Earthwork](#) section such that it can be proofrolled without undue deflection or rutting, then the chemical treatment should be applied to the top 6 inches of the subgrade underlying the pavement as described subsequently. If the soils are reworked to a depth greater than 6 inches, or if replacement fill is used, the disturbed soil or fill should be compacted as described in [Fill](#)

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Compaction Requirements. Terracon should observe the subgrade soils after grading to evaluate the appropriate chemical treatment for the soils exposed.

Detailed traffic loads and frequencies were not available. However, we anticipate that traffic will consist primarily of passenger vehicles in the parking areas and passenger vehicles combined with school buses, garbage trucks, and large multi-axle delivery trucks from time-to-time in driveway areas. If heavier traffic loading is expected or other traffic information is available, Terracon should be provided with the information and allowed to review the pavement sections provided herein.

Tabulated in the following table are the assumed traffic frequencies and loads used to design pavement sections for this project. If actual traffic conditions become available, Terracon should be contacted to review the information to consider a need for revision of the pavement designs and related recommendations.

Pavement Area	Traffic Design Index ¹	Description
Automobile Parking Areas	DI-1	Light traffic (Few vehicles heavier than passenger cars, no regular use by heavily loaded two axle trucks.) (EAL ² < 6)
Driveways (Light Duty)	DI-2	Medium to light traffic (Similar to DI-1 including not over 50 loaded two axle trucks or lightly loaded larger vehicles per day. No regular use by heavily loaded trucks with three or more axles.) (EAL = 6-20)
Driveways and Truck/Bus Traffic Areas (Medium Duty)	DI-3	Medium traffic (Including not over 300 heavily loaded two axle trucks/buses plus lightly loaded trucks with three or more axles and no more than 30 heavily loaded trucks with more than three axles per day.) (EAL = 21-75)

- 1. Based on NSSGA traffic design indices.
- 2. Equivalent daily 18-kip single-axle load applications.

The top 6 inches of the finished subgrade soils directly beneath the pavements should be chemically treated with lime or a mixture of lime and flyash. Chemical treatment will increase the supporting value of the subgrade and decrease the effect of moisture on subgrade soils. These 6 inches of treatment is a required part of the pavement design and is not a part of the site and subgrade preparation for wet/soft subgrade conditions.

Listed below are pavement component thicknesses, which may be used as a guide for pavement systems at the site for the traffic classifications stated herein. These systems were derived based on general characterization of the subgrade. Specific testing (such

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as CBR’s, resilient modulus tests, etc.) was not performed for this project to evaluate the support characteristics of the subgrade.

Rigid Pavement Section			
Component	Material Thickness, Inches		
	DI-1	DI-2	DI-3
Reinforced concrete	5.0	6.0	7.0
Treated subgrade	6.0	6.0	6.0

Waste dumpster areas and bus driveways should be constructed of at least 7 inches of reinforced concrete pavement. The concrete pad areas should be designed so that the vehicle wheels of the collection truck are supported on the concrete while the dumpster is being lifted to support the large wheel loading imposed during waste collection.

Presented below are our recommended material requirements for the various pavement sections.

Reinforced Concrete Pavement – The materials and properties of reinforced concrete pavement should meet applicable requirements in the ACI Manual of Concrete Practice. The portland cement concrete mix should have a minimum 28-day compressive strength of 3,500 psi.

If river gravel is planned to be utilized in the Portland cement concrete mix, Terracon should be contacted for additional services. The presence of river gravel in the portland cement concrete mix can result in excessive cracking and distress to the concrete pavement.

Reinforcing Steel – ACI recommendations indicate that distributed steel reinforcement is not necessary when the pavement is properly jointed to form short panel lengths that will help reduce intermediate cracking. Provided the concrete pavement is designed and constructed as stated herein, the installation of reinforcing steel is optional and should be evaluated by the design team. Proper layout and installation of the joints within the pavement is critical to help control intermediate cracking.

If reinforcing steel is planned to be utilized in the concrete pavement by the design team, the following amount of reinforcing steel should be used as a guideline:

- DI-1: #3 bars spaced at 18 inches or #4 bars spaced at 24 inches on centers in both directions.
- DI-2: #3 bars spaced at 12 inches or #4 bars spaced at 18 inches on centers in both directions.
- DI-3: #4 bars spaced at 18 inches on centers in both directions.

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Control Joint Spacing – ACI recommendations indicate that control joints should be spaced at a maximum spacing of 30 times the thickness of the pavement for unreinforced parking lot pavements. Furthermore, ACI recommends a maximum control joint spacing of 12.5 feet for 5-inch pavements and a maximum control joint spacing of 15 feet for 6-inch or thicker pavements. Sawcut control joints should be cut within 4 to 12 hours of concrete placement to help control the formation of plastic shrinkage cracks as the concrete cures. The depth of the joint should be at least one-quarter of the slab depth when using a conventional saw or one inch when using early entry saws. The width of the cut should be in accordance with the joint sealant manufacturer recommendations.

Expansion Joint Spacing – ACI recommendations indicate that regularly spaced expansion joints may be deleted from concrete pavements. Therefore, the installation of expansion joints is optional and should be evaluated by the design team.

Construction Joints – When concrete is planned to be placed at different times, we recommend the use of a construction joint between paving areas. The construction joint should consist of a butt joint (not a keyway joint).

Concrete Curing Compound – A concrete curing compound, such as a Type 2 membrane curing compound conforming to TxDOT DMS-4650, "Hydraulic Cement Concrete Curing Materials and Evaporation Retardants" or equivalent, should be applied to the concrete surface immediately after placement of the concrete in accordance with TxDOT 2014 Standard Specifications Item 360.

Dowels at Expansion/Construction Joints – The dowels at expansion/construction joints should be spaced at 12-inch centers and consist of the following:

DI-1: 5/8-inch diameter, 12-inches long with 5-inch embedment.

DI-2: 3/4-inch diameter, 14-inches long with 6-inch embedment.

DI-3: 7/8-inch diameter, 14-inches long with 6-inch embedment.

Lime-Flyash Treated Subgrade – The on-site silt/sand soils and low plasticity soils ($PI \leq 20$) should be treated with lime-flyash in accordance with TxDOT 2014 Standard Specifications Item 265. Based on the classification test results, we recommend about 3 percent lime and 7 percent flyash by dry weight be used for estimating and planning. The percentages are given as application by dry weight and are typically equivalent to about 15 pounds of lime and 35 pounds of flyash per square yard per 6-inch depth. Lime-flyash is also available pre-mixed, typically in percentages of 30 percent lime and 70 percent flyash. These pre-mixed products may be used if preferred at a rate of 50 pounds per square yard per 6-inch depth. The actual quantity of lime-flyash should be determined at the time of construction based on laboratory testing conducted using bulk samples of the subgrade soils. The subgrade should be compacted to at least 95 percent of the Standard Effort (ASTM D 698) maximum dry density at a moisture content within 2 percent of the optimum moisture content.

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Lime Treated Subgrade –The on-site medium to high plasticity soils ($PI > 20$) should be treated with lime in accordance with the TXDOT 2014 Standard Specifications Item 260. The amount of lime should be determined for subgrade soils by conducting laboratory tests just prior to construction. Based on the classification test results, we anticipate that about 6 to 8 percent lime by dry weight may be used for estimating and planning. The percentages are given as application by dry weight and are typically equivalent to about 30 to 40 pounds of lime per square yard per 6-inch depth. The pulverization, mixing and curing of the lime treated subgrade is of particular importance in clay soils. The subgrade should be compacted to a minimum of 95 percent of the Standard Effort (ASTM D 698) maximum dry density at a moisture content between optimum and 4 percent wet of the optimum moisture content.

Preferably, traffic should be kept off the treated subgrade for 7 days to facilitate curing of the soil-chemical mixture. In addition, the subgrade is not suitable for heavy construction traffic prior to paving.

The pavement design methods described above are intended to provide structural sections with adequate thickness over a particular subgrade such that wheel loads are reduced to a level the subgrade can support. The support characteristics of the subgrade for pavement design do not account for shrink/swell movements of an expansive clay subgrade such as the soils observed at various locations at the site. Thus, the pavement may be adequate from a structural standpoint, yet still experience cracking and deformation due to shrink/swell related movement of the subgrade. Post-construction subgrade movements and some cracking of pavements are not uncommon for clay subgrade conditions such as those observed at this site. Reducing moisture changes in the subgrade is important to reduce shrink/swell movements. Although chemical treatment will help to reduce such movement/cracking, this movement/cracking cannot be economically eliminated.

Related civil design factors such as subgrade drainage, shoulder support, cross-sectional configurations, surface elevations and environmental factors which will significantly affect the service life must be included in the preparation of the construction drawings and specifications. Normal periodic maintenance will be required.

Long-term pavement performance will be dependent upon several factors, including maintaining subgrade moisture levels and providing for preventative maintenance. The following recommendations should be implemented to help promote long-term pavement performance:

- The subgrade and the pavement surface should be designed to promote proper surface drainage, preferably at a minimum grade of 2 percent;
- Install joint sealant and seal cracks immediately;

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- Extend curbs into the treated subgrade for a depth of at least 4 inches to help reduce moisture migration into the subgrade soils beneath the pavement section; and
- Place compacted, low permeability clayey backfill against the exterior side of the curb and gutter.

Preventative maintenance should be planned and provided for the pavements at this site. Preventative maintenance activities are intended to slow the rate of pavement deterioration, and consist of both localized maintenance (e.g. crack and joint sealing and patching) and global maintenance (e.g. surface sealing). Prior to implementing any maintenance, additional engineering observations are recommended to determine the type and extent of preventative maintenance.

General Comments

Our analysis and opinions are based upon our understanding of the project, the geotechnical conditions in the area, and the data obtained from our site exploration. Variations will occur between exploration point locations or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. Terracon should be retained as the Geotechnical Engineer, where noted in this report, to provide observation and testing services during pertinent construction phases. If variations appear, we can provide further evaluation and supplemental recommendations. If variations are noted in the absence of our observation and testing services on-site, we should be immediately notified so that we can provide evaluation and supplemental recommendations.

Our Scope of Services does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

Our services and any correspondence are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices with no third-party beneficiaries intended. Any third-party access to services or correspondence is solely for information purposes to support the services provided by Terracon to our client. Reliance upon the services and any work product is limited to our client and is not intended for third parties. Any use or reliance of the provided information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made.

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Site characteristics as provided are for design purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly effect excavation cost. Any parties charged with estimating excavation costs should seek their own site characterization for specific purposes to obtain the specific level of detail necessary for costing. Site safety and cost estimating including excavation support and dewatering requirements/design are the responsibility of others. Construction and site development have the potential to affect adjacent properties. Such impacts can include damages due to vibration, modification of groundwater/surface water flow during construction, foundation movement due to undermining or subsidence from excavation, as well as noise or air quality concerns. Evaluation of these items on nearby properties are commonly associated with contractor means and methods and are not addressed in this report. The owner and contractor should consider a preconstruction/precondition survey of surrounding development. If changes in the nature, design, or location of the project are planned, our conclusions and recommendations shall not be considered valid unless we review the changes and either verify or modify our conclusions in writing.

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Figures

Contents:

GeoModel (two pages)

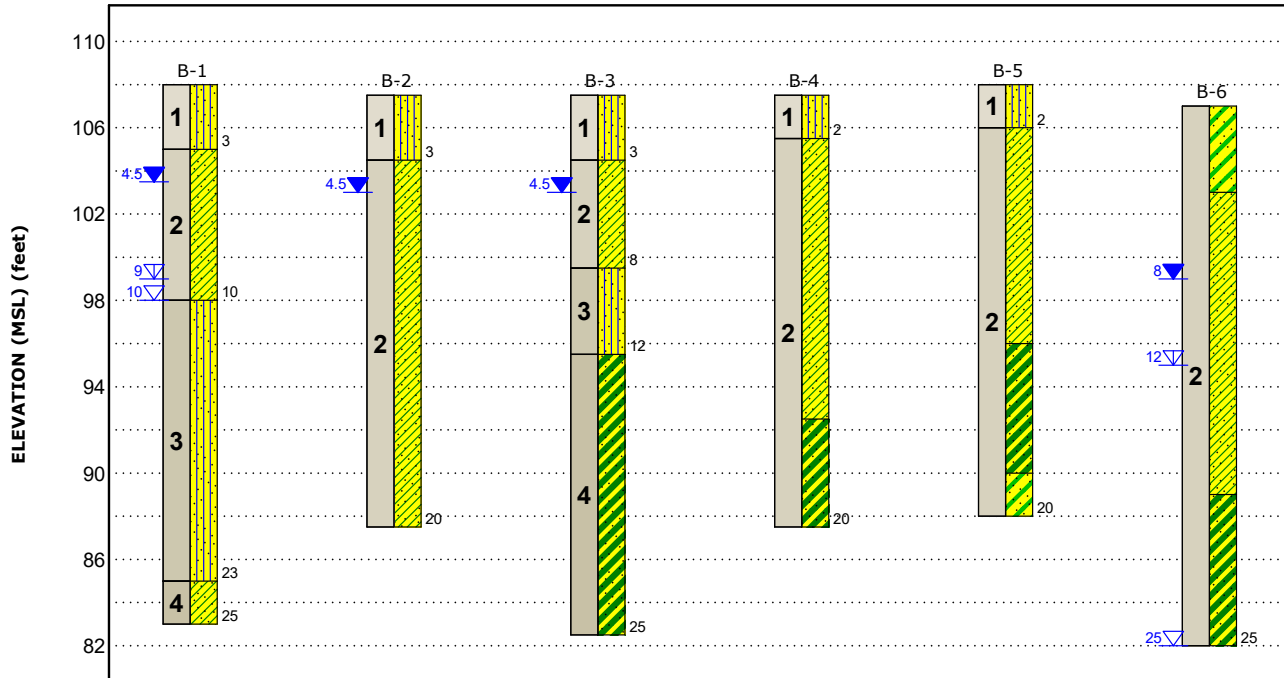
SECTION 00 31 32

New Caney ISD Administration Building
24400 Loop 494 | Porter, Texas
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GEOTECHNICAL DATA

Terracon
11133 Interstate 45 S Ste T
Conroe, TX

GeoModel



This is not a cross section. This is intended to display the Geotechnical Model only. See individual logs for more detailed conditions.

Model Layer	Layer Name	General Description	Legend	
1	Silty Sand	Brown, light brown, and tan, very loose to loose, with trace roots	Silty Sand	Sandy Lean Clay
2	Clayey Sand, Sandy Lean Clay, and Sandy Fat Clay	Brown, light brown, light gray, reddish-brown, tan, and light gray, soft to very stiff and very loose to medium dense, with silty sand and clay pockets, trace roots, ferrous nodules	Sandy Fat Clay	Clayey Sand
3	Silty Sand	Tan and light gray, loose to medium dense, with clay seams and pockets		
4	Sandy Lean Clay and Sandy Fat Clay	Tan, light gray, and reddish-brown, stiff to very stiff, with sand pockets		

- First Water Observation
- Second Water Observation
- Third Water Observation

Groundwater levels are temporal. The levels shown are representative of the date and time of our exploration. Significant changes are possible over time.

Water levels shown are as measured during and/or after drilling. In some cases, boring advancement methods mask the presence/absence of groundwater. See individual logs for details.

NOTES:

Layering shown on this figure has been developed by the geotechnical engineer for purposes of modeling the subsurface conditions as required for the subsequent geotechnical engineering for this project. Numbers adjacent to soil column indicate depth below ground surface.

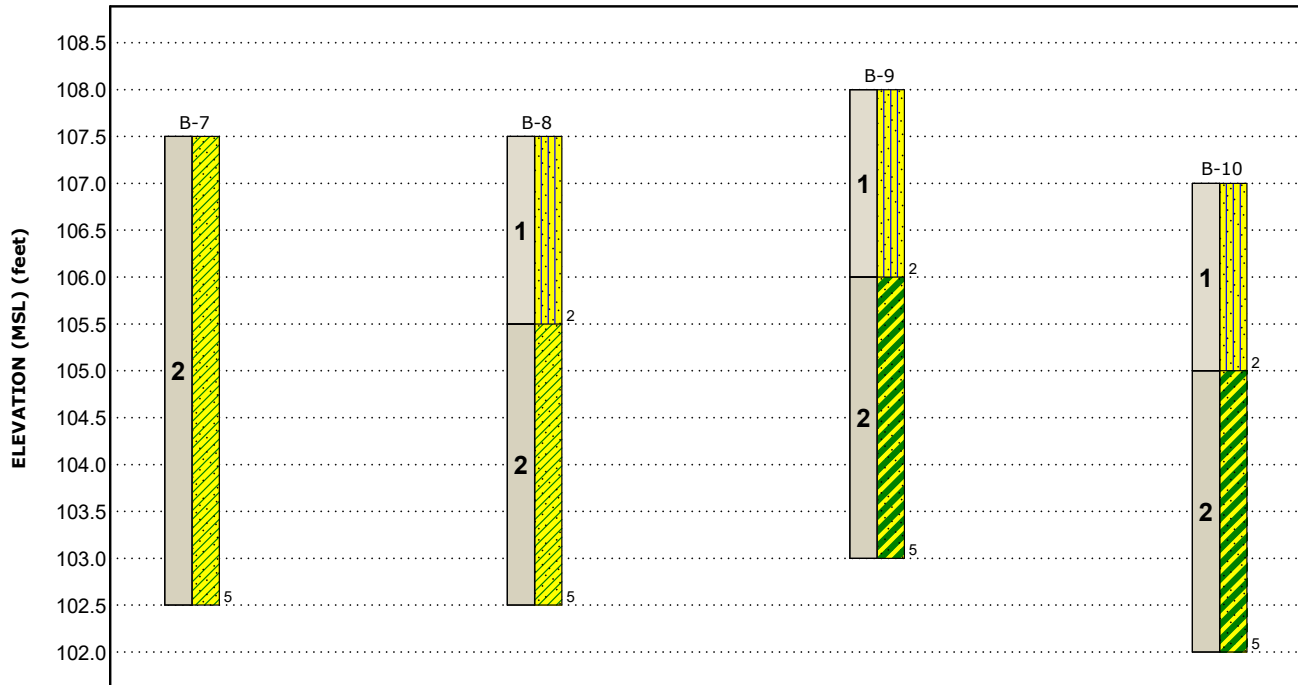
GEOTECHNICAL DATA

New Caney ISD Administration Building
24400 Loop 494 | Porter, Texas
Terracon Project No. 97245100

SECTION 00 31 32



GeoModel



This is not a cross section. This is intended to display the Geotechnical Model only. See individual logs for more detailed conditions.

Model Layer	Layer Name	General Description	Legend	
1	Silty Sand	Brown, light brown, and tan, very loose to loose, with trace roots	Sandy Lean Clay	Silty Sand
2	Clayey Sand, Sandy Lean Clay, and Sandy Fat Clay	Brown, light brown, light gray, reddish-brown, tan, and light gray, soft to very stiff and very loose to medium dense, with silty sand and clay pockets, trace roots, ferrous nodules	Sandy Fat Clay	
3	Silty Sand	Tan and light gray, loose to medium dense, with clay seams and pockets		
4	Sandy Lean Clay and Sandy Fat Clay	Tan, light gray, and reddish-brown, stiff to very stiff, with sand pockets		

- ▽ First Water Observation
- ▽ Second Water Observation
- ▽ Third Water Observation

Groundwater levels are temporal. The levels shown are representative of the date and time of our exploration. Significant changes are possible over time.

Water levels shown are as measured during and/or after drilling. In some cases, boring advancement methods mask the presence/absence of groundwater. See individual logs for details.

NOTES:

Layering shown on this figure has been developed by the geotechnical engineer for purposes of modeling the subsurface conditions as required for the subsequent geotechnical engineering for this project. Numbers adjacent to soil column indicate depth below ground surface.

SECTION 00 31 32

GEOTECHNICAL DATA

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Attachments



Exploration and Testing Procedures

Field Exploration

Number of Borings	Boring Number	Approximate Boring Depth (feet) ^{1,2}	Location ³
3	B-1, B-3, and B-6	25	Administration building
3	B-2, B-4, and B-5	20	
4	B-7 through B-10	5	Pavement

- 1. Below ground surface.
- 2. Total drilling footage was 155 feet.
- 3. The boring locations are shown on the attached **Exploration Plan**.

Boring Layout and Elevations: Terracon personnel provided the boring layout using handheld GPS equipment (estimated horizontal accuracy of about ±20 feet) and referencing existing site features. The boring depths were measured from the existing ground surface at the time of our field activities.

Subsurface Exploration Procedures: We advanced the borings with a truck-mounted rotary drill rig using continuous flight augers.

Six samples were obtained in the upper 12 feet of each boring and at intervals of 5 feet thereafter. In the thin-walled tube sampling procedure, a thin-walled, seamless steel tube with a sharp cutting edge was pushed hydraulically into the soil to obtain a relatively undisturbed sample. In the split-barrel sampling procedure, a standard 2-inch outer diameter split-barrel sampling spoon was driven into the ground by a 140-pound automatic hammer falling a distance of 30 inches. The number of blows required to advance the sampling spoon the last 12 inches of a normal 18-inch penetration is recorded as the Standard Penetration Test (SPT) resistance value. The SPT resistance values, also referred to as N-values, are indicated on the boring logs at the test depths. We observed and recorded groundwater levels during drilling and sampling. For safety purposes, all borings were backfilled with auger cuttings after their completion.

We also observed the boreholes while drilling and at the completion of drilling for the presence of groundwater. The groundwater levels are shown on the attached boring logs.

The sampling depths, penetration distances, and other sampling information was recorded on the field boring logs. The samples were placed in appropriate containers and taken to our soil laboratory for testing and classification by a Geotechnical Engineer. Our

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exploration team prepared field boring logs as part of the drilling operations. These field logs included visual classifications of the materials observed during drilling and our interpretation of the subsurface conditions between samples. Final boring logs were prepared from the field logs. The final boring logs represent the Geotechnical Engineer's interpretation of the field logs and include modifications based on observations and tests of the samples in our laboratory.

Laboratory Testing

The project engineer reviewed the field data and assigned laboratory tests. The laboratory testing program included the following types of tests:

- Moisture Content
- Dry Unit Weight
- Unconfined Compression
- Atterberg Limits
- Percent passing No. 200 sieve

The laboratory testing program included examination of soil samples by an engineer. Based on the results of our field and laboratory programs, we described and classified the soil samples in accordance with the Unified Soil Classification System.

Samples not tested in the laboratory will be stored for a period of 30 days subsequent to submittal of this report and will be discarded after this period unless we are notified otherwise.

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Site Location and Exploration Plan

Contents:

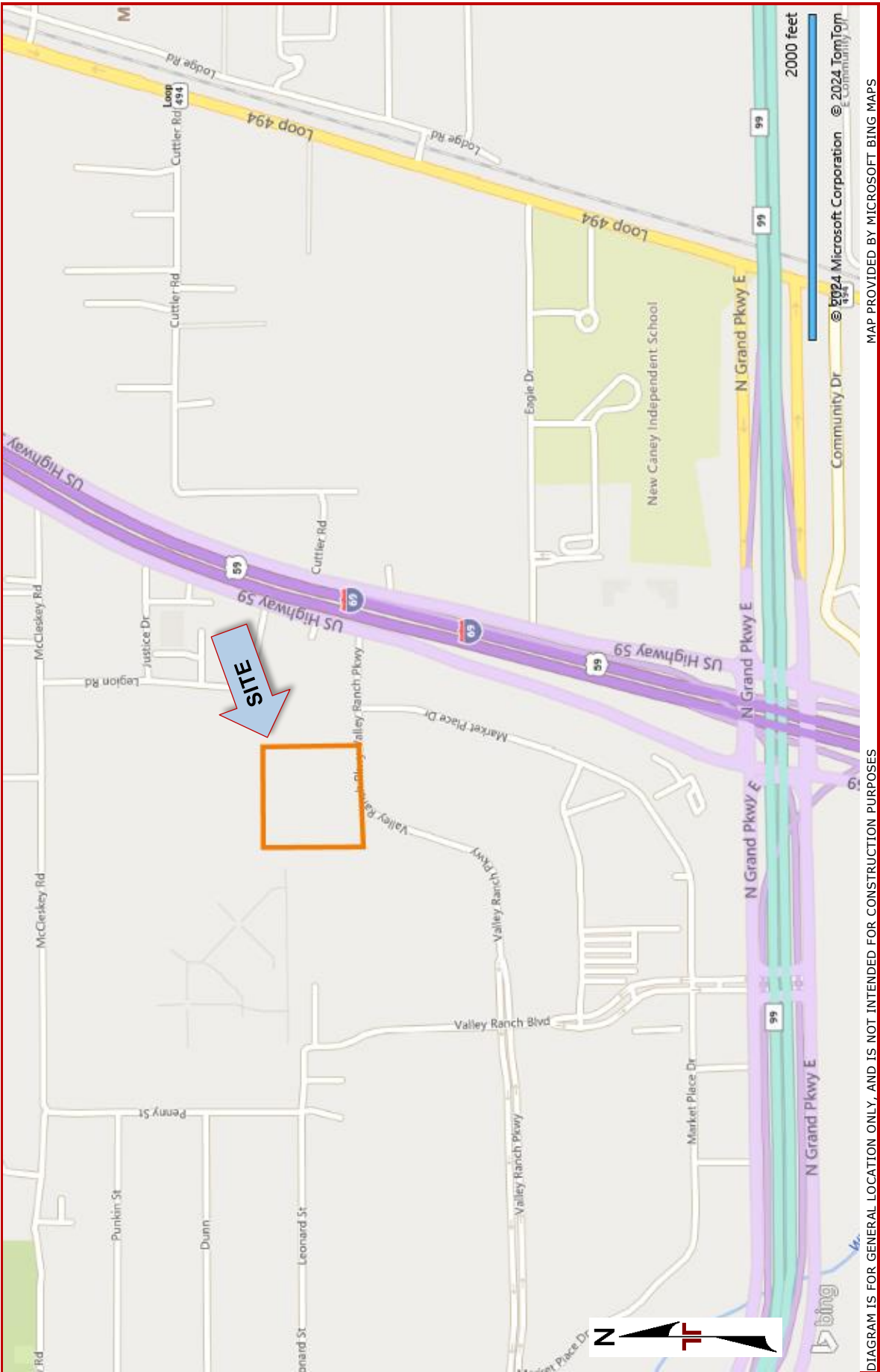
Site Location
Exploration Plan

Note: All attachments are one page unless noted above.

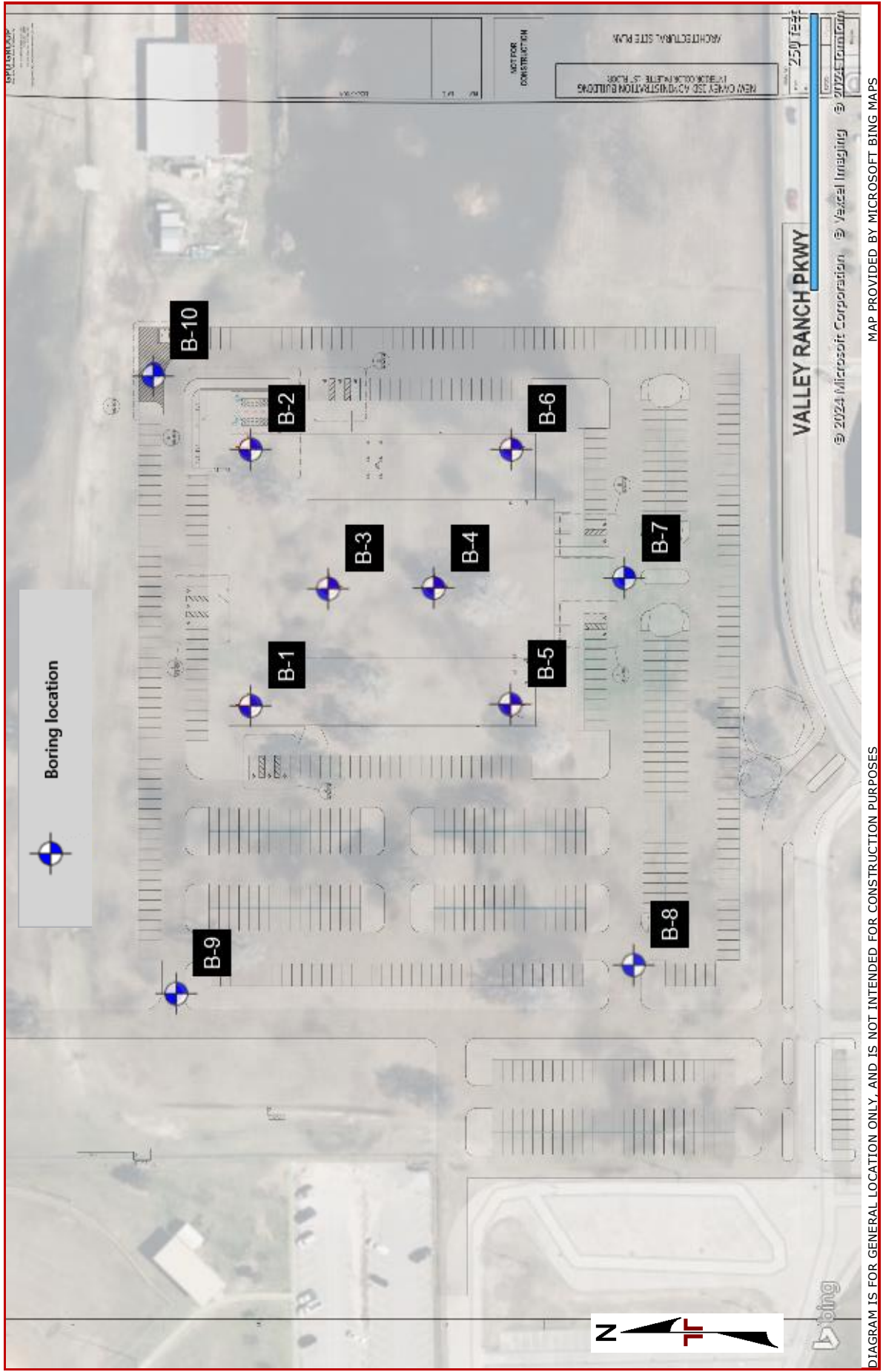


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Site Location



Exploration Plan



Geotechnical Engineering Report

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Exploration and Laboratory Results

Contents:

Boring Logs (B-1 through B-10)

Note: All attachments are one page unless noted above.




Boring Log No. B-1

Model Layer	Graphic Log	Location: See Exploration Plan Latitude: 30.1380° Longitude: -95.2305° Depth (Ft.) Elevation.: 108 (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Strength Test			Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits	Percent Fines
							Test Type	Compressive Strength (tsf)	Strain (%)			LL-PL-PI	
1		SILTY SAND (SM) , brown, very loose to loose	3.0			1-2-2 N=4							
2		SANDY LEAN CLAY (CL) , brown and light gray, soft to very stiff, with sand pockets - brown, light gray, and reddish-brown, 4 to 6 feet - tan and light gray, 6 to 10 feet	10.0			2-2-3 N=5							
			5			0.5 (HP)				18.0		28-15-13	51
						1.0 (HP)				17.0			
			10			3.0 (HP)	UC	2.26	13.2	14.5	117	37-14-23	
3		SILTY SAND (SM) , tan and light gray, loose to medium dense - with clay seams and pockets, 13 to 15 feet	15			3-4-4 N=8							
						3-4-6 N=10				20.6			17
			20			4-4-7 N=11							
4		SANDY LEAN CLAY (CL) , tan and reddish-brown, stiff, with sand pockets	23.0			4-6-7 N=13							
		Boring Terminated at 25 Feet	25.0										

See **Exploration and Testing Procedures** for a description of field and laboratory procedures used and additional data (If any).

See **Supporting Information** for explanation of symbols and abbreviations.

Water Level Observations

-  While drilling
-  After 5 minutes
-  After 24 hours

Drill Rig

Truck

Hammer Type

Automatic

Driller

East Texas Drilling

Notes**Advancement Method**

Dry augered 0 to 12 feet; wet rotary 12 to 25 feet

Abandonment Method

Boring backfilled with auger cuttings upon completion.

Logged by

G. Hernandez

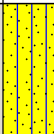
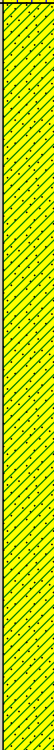
Boring Started

09-16-2024

Boring Completed

09-16-2024

Boring Log No. B-2


Model Layer	Graphic Log	Location: See Exploration Plan Latitude: 30.1380° Longitude: -95.2298° Depth (Ft.) Elevation.: 107.5 (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Strength Test			Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits	Percent Fines
							Test Type	Compressive Strength (tsf)	Strain (%)			LL-PL-PI	
1		SILTY SAND (SM) , brown, very loose to loose, with trace roots 3.0 104.5											
2		SANDY LEAN CLAY (CL) , brown and light gray, soft to very stiff, with sand pockets - tan and light gray, 4 to 13 feet 											

See **Exploration and Testing Procedures** for a description of field and laboratory procedures used and additional data (If any).

See **Supporting Information** for explanation of symbols and abbreviations.

Water Level Observations

Groundwater was not observed while drilling

 After 24 hours

Drill Rig

Hammer Type
Automatic

Driller
East Texas Drilling

Logged by
G. Hernandez

Boring Started
09-16-2024

Boring Completed
09-16-2024

Advancement Method

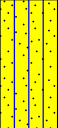




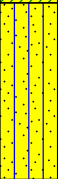







Dry augered to 20 feet

Abandonment Method

Boring backfilled with auger cuttings upon completion.

Notes

Boring Log No. B-3

Model Layer	Graphic Log	Location: See Exploration Plan Latitude: 30.1378° Longitude: -95.2302° Depth (Ft.) Elevation.: 107.5 (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Strength Test			Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits	Percent Fines
							Test Type	Compressive Strength (tsf)	Strain (%)			LL-PL-PI	
1		SILTY SAND (SM) , brown, loose	3.0			2-3-4 N=7							
2		SANDY LEAN CLAY (CL) , brown and light gray, medium stiff to very stiff - tan and light gray, 4 to 8 feet - with silty sand pockets, 6 to 8 feet	8.0			2-2-3 N=5	UC	1.12	9.4	15.6	117	30-14-16	
3		SILTY SAND (SM) , tan and light gray, loose, with clay pockets	12.0			2.0 (HP)				15.3		26-14-12	50
4		SANDY FAT CLAY (CH) , light gray, stiff to very stiff	15.0			1.0 (HP)							
5		SANDY FAT CLAY (CH) , light gray, stiff to very stiff	20.0			2.5 (HP)	UC	1.19	5.2	19.7	108	41-17-24	
6		SANDY FAT CLAY (CH) , light gray, stiff to very stiff	25.0			3.0 (HP)							
		Boring Terminated at 25 Feet	25										

See **Exploration and Testing Procedures** for a description of field and laboratory procedures used and additional data (If any).

See **Supporting Information** for explanation of symbols and abbreviations.

Water Level Observations

Groundwater was not observed while drilling

After 24 hours

Drill Rig

Hammer Type
Automatic

Driller
East Texas Drilling

Logged by
G. Hernandez

Boring Started
09-16-2024

Boring Completed
09-16-2024

Advancement Method



Dry augered to 25 feet

Abandonment Method

Boring backfilled with auger cuttings upon completion.

Notes

Boring Log No. B-4

Model Layer	Graphic Log	Location: See Exploration Plan Latitude: 30.1375° Longitude: -95.2302° Depth (Ft.) Elevation.: 107.5 (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Strength Test			Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits	Percent Fines
							Test Type	Compressive Strength (tsf)	Strain (%)			LL-PL-PI	
1		SILTY SAND (SM) , light brown, very loose, with trace roots	2.0			2-2-2 N=4							
		SANDY LEAN CLAY (CL) , light brown, soft to very stiff - with trace roots, 2 to 4 feet - with sand pockets, 2 to 7 feet - tan and light gray, 4 to 15 feet	105.5			1-1-2 N=3				17.6		37-14-23	
2			5			1.0 (HP)							
						4.0 (HP)							
			10			2.0 (HP)	UC	1.41	8.1	15.1	116	31-14-17	
						3.5 (HP)	UC	2.09	4.2	18.9	111		
		- with silty sand pockets, 13 to 15 feet	15			2.0 (HP)							
		SANDY FAT CLAY (CH) , tan and light gray, very stiff	15										
			20			3.0 (HP)							
		Boring Terminated at 20 Feet	20										

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (If any).

See [Supporting Information](#) for explanation of symbols and abbreviations.

Water Level Observations

Groundwater was not observed while drilling

Drill Rig

Hammer Type
Automatic

Driller
East Texas Drilling

Notes**Advancement Method**

Dry augered to 20 feet

Abandonment Method

Boring backfilled with auger cuttings upon completion.

Logged by
G. Hernandez

Boring Started
09-16-2024

Boring Completed
09-16-2024

Boring Log No. B-5

Model Layer	Graphic Log	Location: See Exploration Plan Latitude: 30.1373° Longitude: -95.2305° Depth (Ft.) Elevation.: 108 (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Strength Test			Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits	Percent Fines
							Test Type	Compressive Strength (tsf)	Strain (%)			LL-PL-PI	
1		SILTY SAND (SM) , tan, very loose to loose, with trace roots	2.0			2-4-4 N=8							
2		SANDY LEAN CLAY (CL) , tan, light gray, and reddish-brown, very soft to very stiff - with sand pockets, 8 to 10 feet - light gray and tan, 9 to 12 feet	106			3-1-1 N=2				17.2		38-13-25	58
			5			3.5 (HP)							
						4.5 (HP)							
						1.5 (HP)							
			10			3.0 (HP)	UC	2.85	15	22.4	106	48-18-30	
		SANDY FAT CLAY (CH) , light gray and tan, very stiff	12.0										
						3.5 (HP)							
			15										
		CLAYEY SAND (SC) , light gray, medium dense	18.0										
						2.5 (HP)							
			20.0										
		Boring Terminated at 20 Feet	20										

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (If any).

See [Supporting Information](#) for explanation of symbols and abbreviations.

Water Level Observations

Groundwater was not observed while drilling

Drill Rig

Hammer Type
Automatic

Driller
East Texas Drilling

Notes**Advancement Method**

Dry augered to 20 feet

Abandonment Method

Boring backfilled with auger cuttings upon completion.

Logged by
G. Hernandez

Boring Started
09-16-2024

Boring Completed
09-16-2024

Boring Log No. B-6

Model Layer	Graphic Log	Location: See Exploration Plan Latitude: 30.1373° Longitude: -95.2298° Depth (Ft.) Elevation.: 107 (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Strength Test			Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits	Percent Fines	
							Test Type	Compressive Strength (tsf)	Strain (%)			LL-PL-PI		
2		CLAYEY SAND (SC) , tan, very loose to loose - with trace roots, 0 to 2 feet												
			4.0	103			1.5 (HP)			17.2		28-15-13		
		SANDY LEAN CLAY (CL) , light gray and tan, stiff to very stiff - with sand pockets, 4 to 7 feet		5			2.0 (HP)							
						4.5 (HP)								
						4.5 (HP)								
		- with ferrous nodules, 10 to 15 feet		10			3.0 (HP)							
							1.5 (HP)	UC	1.59	15	19.2	111	34-16-18	
		18.0	89											
	SANDY FAT CLAY (CH) , light gray and tan, very stiff					3.0 (HP)								
			20											
						3.5 (HP)								
		25.0	82											
		Boring Terminated at 25 Feet	25											

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (If any).

See [Supporting Information](#) for explanation of symbols and abbreviations.

Water Level Observations

- ▼ While drilling
- ▼ After 5 minutes
- ▼ After 15 minutes

Drill Rig

Hammer Type
Automatic

Driller
East Texas Drilling

Logged by
G. Hernandez

Boring Started
09-17-2024

Boring Completed
09-17-2024




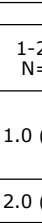
Notes**Advancement Method**

Dry augered to 25 feet

Abandonment Method

Boring backfilled with auger cuttings upon completion.

Boring Log No. B-7

Model Layer	Graphic Log	Location: See Exploration Plan Latitude: 30.1371° Longitude: -95.2301° Depth (Ft.) Elevation.: 107.5 (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Strength Test			Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits	Percent Fines
							Test Type	Compressive Strength (tsf)	Strain (%)			LL-PL-PI	
2		SANDY LEAN CLAY (CL) , light gray and tan, medium stiff to stiff				1-2-3 N=5				14.8			58
						1.0 (HP)							
						2.0 (HP)							
		5.0 102.5 Boring Terminated at 5 Feet	5										

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (If any).
See [Supporting Information](#) for explanation of symbols and abbreviations.

Water Level Observations
Groundwater was not observed while drilling

Drill Rig

Hammer Type
Automatic
Driller
East Texas Drilling





Notes

Advancement Method
Dry augered to 5 feet

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Logged by
G. Hernandez
Boring Started
09-17-2024
Boring Completed
09-17-2024

Boring Log No. B-8

Model Layer	Graphic Log	Location: See Exploration Plan Latitude: 30.1370° Longitude: -95.2312° Depth (Ft.) Elevation.: 107.5 (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Strength Test			Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits	Percent Fines
							Test Type	Compressive Strength (tsf)	Strain (%)			LL-PL-PI	
1		SILTY SAND (SM) , light brown, very loose	2.0 105.5			2-1-1 N=2							
2		SANDY LEAN CLAY (CL) , light gray, tan, and reddish-brown, stiff to very stiff	5.0 102.5			2.0 (HP) 2.5 (HP)				16.1		44-14-30	
Boring Terminated at 5 Feet													

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (If any).
See [Supporting Information](#) for explanation of symbols and abbreviations.

Water Level Observations
Groundwater was not observed while drilling

Drill Rig

Hammer Type
Automatic
Driller
East Texas Drilling

Notes

Advancement Method
Dry augered to 5 feet

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Logged by
G. Hernandez
Boring Started
09-17-2024
Boring Completed
09-17-2024

Boring Log No. B-9

Model Layer	Graphic Log	Location: See Exploration Plan Latitude: 30.1382° Longitude: -95.2313° Depth (Ft.) Elevation.: 108 (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Strength Test			Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits	Percent Fines
							Test Type	Compressive Strength (tsf)	Strain (%)			LL-PL-PI	
1		SILTY SAND (SM) , light brown, very loose	2.0		X	2-2-2 N=4							
2		SANDY FAT CLAY (CH) , light gray, tan, and reddish-brown, medium stiff to stiff - with silty sand pockets, below 4 feet	106 103		X	2-5-7 N=12				19.4		66-18-48	
		Boring Terminated at 5 Feet	5			1.0 (HP)							

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (If any).

See [Supporting Information](#) for explanation of symbols and abbreviations.

Water Level Observations

Groundwater was not observed while drilling

Drill Rig

Hammer Type
Automatic

Driller
East Texas Drilling

Notes**Advancement Method**

Dry augered to 5 feet

Abandonment Method

Boring backfilled with auger cuttings upon completion.

Logged by
G. Hernandez

Boring Started
09-17-2024

Boring Completed
09-17-2024

Boring Log No. B-10

Model Layer	Graphic Log	Location: See Exploration Plan Latitude: 30.1382° Longitude: -95.2296° Depth (Ft.) Elevation.: 107 (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Strength Test			Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits	Percent Fines
							Test Type	Compressive Strength (tsf)	Strain (%)			LL-PL-PI	
1		SILTY SAND (SM) , light brown, very loose	2.0		X	1-1-2 N=3				18.9			44
2		SANDY FAT CLAY (CH) , light gray and tan, soft to stiff - with silty sand pockets, 4 to 5 feet	5.0			1.5 (HP) 0.5 (HP)							
Boring Terminated at 5 Feet													

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any). See Supporting Information for explanation of symbols and abbreviations.	Water Level Observations Groundwater was not observed while drilling	Drill Rig Hammer Type Automatic Driller East Texas Drilling
	Notes	Advancement Method Dry augered to 5 feet Abandonment Method Boring backfilled with auger cuttings upon completion.

Geotechnical Engineering Report

New Caney ISD Administration Building | New Caney, Texas

October 3, 2024 | Terracon Project No. 97245100



Supporting Information

Contents:

General Notes







Unified Soil Classification System

Note: All attachments are one page unless noted above.

New Caney ISD Administration Building
24400 Loop 494 | Porter, Texas
Terracon Project No. 97245100



General Notes

Sampling	Water Level	Field Tests
 Shelby Tube  Standard Penetration Test	 Water Initially Encountered  Water Level After a Specified Period of Time  Water Level After a Specified Period of Time  Cave In Encountered <p>Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.</p>	N Standard Penetration Test Resistance (Blows/Ft.) (HP) Hand Penetrometer (T) Torvane (DCP) Dynamic Cone Penetrometer UC Unconfined Compressive Strength (PID) Photo-Ionization Detector (OVA) Organic Vapor Analyzer

Descriptive Soil Classification

Soil classification as noted on the soil boring logs is based Unified Soil Classification System. Where sufficient laboratory data exist to classify the soils consistent with ASTM D2487 "Classification of Soils for Engineering Purposes" this procedure is used. ASTM D2488 "Description and Identification of Soils (Visual-Manual Procedure)" is also used to classify the soils, particularly where insufficient laboratory data exist to classify the soils in accordance with ASTM D2487. In addition to USCS classification, coarse grained soils are classified on the basis of their in-place relative density, and fine-grained soils are classified on the basis of their consistency. See "Strength Terms" table below for details. The ASTM standards noted above are for reference to methodology in general. In some cases, variations to methods are applied as a result of local practice or professional judgment.

Location And Elevation Notes

Exploration point locations as shown on the Exploration Plan and as noted on the soil boring logs in the form of Latitude and Longitude are approximate. See Exploration and Testing Procedures in the report for the methods used to locate the exploration points for this project. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

Strength Terms

Relative Density of Coarse-Grained Soils (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance		Consistency of Fine-Grained Soils (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance		
Relative Density	Standard Penetration or N-Value (Blows/Ft.)	Consistency	Unconfined Compressive Strength Qu (tsf)	Standard Penetration or N-Value (Blows/Ft.)
Very Loose	0 - 3	Very Soft	less than 0.25	0 - 1
Loose	4 - 9	Soft	0.25 to 0.50	2 - 4
Medium Dense	10 - 29	Medium Stiff	0.50 to 1.00	4 - 8
Dense	30 - 50	Stiff	1.00 to 2.00	8 - 15
Very Dense	> 50	Very Stiff	2.00 to 4.00	15 - 30
		Hard	> 4.00	> 30

Relevance of Exploration and Laboratory Test Results

Exploration/field results and/or laboratory test data contained within this document are intended for application to the project as described in this document. Use of such exploration/field results and/or laboratory test data should not be used independently of this document.

Geotechnical Engineering Report

New Caney ISD Administration Building | New Caney, Texas

October 3, 2024 | Terracon Project No. 97245100



Unified Soil Classification System

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests ^A				Soil Classification	
				Group Symbol	Group Name ^B
Coarse-Grained Soils: More than 50% retained on No. 200 sieve	Gravels: More than 50% of coarse fraction retained on No. 4 sieve	Clean Gravels: Less than 5% fines ^C	$Cu \geq 4$ and $1 \leq Cc \leq 3$ ^E	GW	Well-graded gravel ^F
			$Cu < 4$ and/or [$Cc < 1$ or $Cc > 3.0$] ^E	GP	Poorly graded gravel ^F
		Gravels with Fines: More than 12% fines ^C	Fines classify as ML or MH	GM	Silty gravel ^{F, G, H}
	Sands: 50% or more of coarse fraction passes No. 4 sieve	Clean Sands: Less than 5% fines ^D	$Cu \geq 6$ and $1 \leq Cc \leq 3$ ^E	SW	Well-graded sand ^I
			$Cu < 6$ and/or [$Cc < 1$ or $Cc > 3.0$] ^E	SP	Poorly graded sand ^I
		Sands with Fines: More than 12% fines ^D	Fines classify as ML or MH	SM	Silty sand ^{G, H, I}
Fine-Grained Soils: 50% or more passes the No. 200 sieve	Silts and Clays: Liquid limit less than 50	Inorganic:	PI > 7 and plots above "A" line ^J	CL	Lean clay ^{K, L, M}
			PI < 4 or plots below "A" line ^J	ML	Silt ^{K, L, M}
		Organic:	$\frac{LL \text{ oven dried}}{LL \text{ not dried}} < 0.75$	OL	Organic clay ^{K, L, M, N} Organic silt ^{K, L, M, O}
	Silts and Clays: Liquid limit 50 or more	Inorganic:	PI plots on or above "A" line	CH	Fat clay ^{K, L, M}
			PI plots below "A" line	MH	Elastic silt ^{K, L, M}
		Organic:	$\frac{LL \text{ oven dried}}{LL \text{ not dried}} < 0.75$	OH	Organic clay ^{K, L, M, P} Organic silt ^{K, L, M, Q}
Highly organic soils:	Primarily organic matter, dark in color, and organic odor			PT	Peat

^A Based on the material passing the 3-inch (75-mm) sieve.

^B If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

^C Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

^D Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay.

$$^E Cu = D_{60}/D_{10} \quad Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$$

^F If soil contains $\geq 15\%$ sand, add "with sand" to group name.

^G If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

^H If fines are organic, add "with organic fines" to group name.

^I If soil contains $\geq 15\%$ gravel, add "with gravel" to group name.

^J If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

^K If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

^L If soil contains $\geq 30\%$ plus No. 200 predominantly sand, add "sandy" to group name.

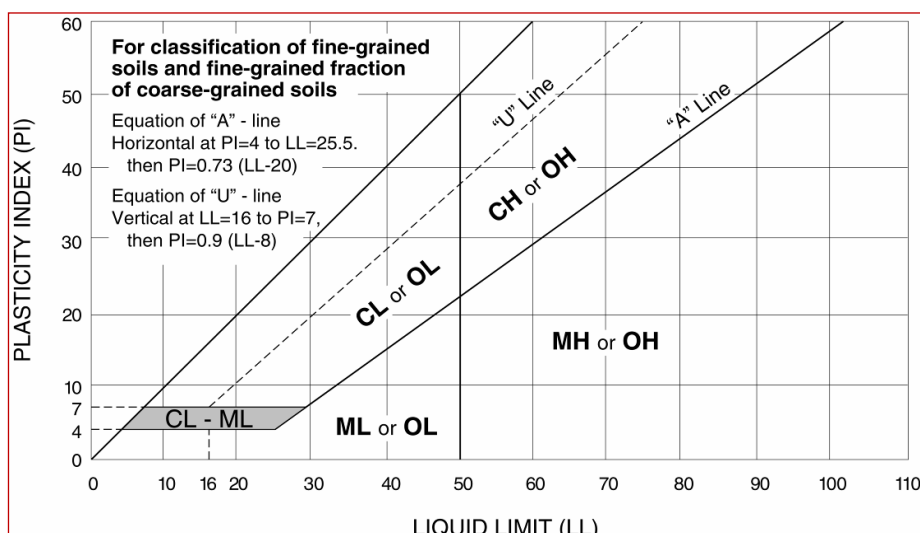
^M If soil contains $\geq 30\%$ plus No. 200, predominantly gravel, add "gravelly" to group name.

^N PI ≥ 4 and plots on or above "A" line.

^O PI < 4 or plots below "A" line.

^P PI plots on or above "A" line.

^Q PI plots below "A" line.



END OF DOCUMENT 00 31 32

SECTION 00 62 09
Certification of Criminal History Record Information Review by Contractor

**CE - CERTIFICATION OF CRIMINAL HISTORY RECORD INFORMATION
CONTRACTOR**

Background: Texas Education Code Chapter 22 requires entities that contract with school districts, and their subcontractors, 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 New Caney ISD that they have complied and must obtain similar certifications from their subcontractors [See Subcontractor Certification Form].

Definitions:

Covered employees: Employees who: **(1) have or will have continuing duties related to the service to be performed at a school district, and (2) have or will have direct contact with students.** What qualifies as a covered employee shall be determined by New Caney ISD.

Public Works Exception to Covered Employees: Covered employees do not include employees of a contracting or subcontracting entity that is providing engineering, architectural, or construction services on a project to design, construct, alter, or repair a public work if: (1) the public work does not involve the construction, alteration, or repair of an instructional facility as defined by Texas Education Code Section 46.001; (2) the employee's duties will be completed more than seven (7) days before a new instructional facility will be used for instruction; or (3) for an existing instructional facility, the work area contains sanitary facilities separated from all areas used by students by a fence at least six (6) feet high, and the Contractor adopts, informs employees of, and enforces a policy prohibiting employees and any subcontractor's employees from interacting with students or entering areas used by students.

Disqualifying criminal history: (1) a conviction or other criminal history information designated by New Caney ISD; (2) a felony or misdemeanor offense that would prevent a person from being employed under Texas Education Code § 22.085(a), that is: if at the time of the offense, the victim was under 18 or was enrolled in a public school: (a) a felony offense under Title 5, Texas Penal Code; (b) an offense on conviction for which a defendant is required to register as a sex offender under Chapter 62, Texas Code of Criminal Procedure; or (c) an offense under federal law or the laws of another state that is equivalent to (a) or (b).

Types of Criminal History Record Information:

- For employees hired by Contractor before January 1, 2008—Any law enforcement or criminal justice agency;
- For employees hired by Contractor on or after January 1, 2008—National criminal history information from the Texas Department of Public Safety criminal history clearinghouse.

On behalf of _____ ("Contractor"), I the undersigned authorized representative of Contractor, certify to New Caney Independent School District that [check one]:

[] None of Contractor's employees are covered employees, as defined above. I further certify that Contractor has taken precautions or imposed conditions to ensure that its employees will not become covered employees during the term of this contract.

Or

[] Some or all of Contractor's employees are covered employees. I further certify that:

- (1) Contractor has obtained all required criminal history record information regarding its covered employees. None of the covered employees has a disqualifying criminal history.

- (2) If Contractor receives information that a covered employee subsequently has a reported criminal history, Contractor will immediately remove the covered employee from contract duties and notify New Caney ISD in writing within 3 business days.
- (3) Upon request, Contractor will provide New Caney ISD with the name and any other requested information of covered employees so that New Caney ISD may obtain criminal history record information on the covered employees.

If New Caney ISD objects to the assignment of a covered employee on the basis of the covered employee’s criminal history record information, Contractor agrees to discontinue using that covered employee to provide services at New Caney ISD.

I also certify to New Caney ISD on behalf of Contractor that Contractor will obtain certifications from its subcontractors of compliance with Texas Education Code, Chapter 22.

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

Signature

Title

Date

Additions and Deletions Report for AIA® Document A201® – 2017

This Additions and Deletions Report, as defined on page 1 of the associated document, reproduces below all text the author has added to the standard form AIA document in order to complete it, as well as any text the author may have added to or deleted from the original AIA text. Added text is shown underlined. Deleted text is indicated with a horizontal line through the original AIA text.

Note: This Additions and Deletions Report is provided for information purposes only and is not incorporated into or constitute any part of the associated AIA document. This Additions and Deletions Report and its associated document were generated simultaneously by AIA software at 15:28:31 ET on 11/22/2024.

PAGE 1

New District Administration Building
21330 Valley Ranch Pkwy.
New Caney, TX. 77357

...

New Caney Independent School District
22784 Hwy 59 S
Building "E".
Porter, Texas 77365

(Name, legal status and address)

Glaus, Pyle, Schomer, Burns & DeHaven, Inc. dba GPD Group
2121 Sage Road
Suite 240
Houston, TX 77056

PAGE 11

The parties shall agree upon ~~written~~ protocols governing the transmission and use of, ~~and reliance on, 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.

...

Any use of, or reliance on, all or a portion of a building information model without agreement to ~~written~~ 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.

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 15:28:31 ET on 11/22/2024 under Order No. 4104243936 from AIA Contract Documents software and that in preparing the attached final document I made no changes to the original text of AIA® Document A201™ – 2017, General Conditions of the Contract for Construction, other than those additions and deletions shown in the associated Additions and Deletions Report.

(Signed)

(Title)

(Dated)

SECTION 00 73 00

SUPPLEMENTARY CONDITIONS

The following supplements modify the *General Conditions of the Contract for Construction*, AIA Document A201, Sixteenth Edition, 2017 (refer to Document 00 72 00, General Conditions). Where a portion of the General Conditions is modified or deleted by these Supplementary Conditions, the unaltered portions of the General Conditions shall remain in effect. As appropriate, for purposes of this Request for Proposal, the term "Bid" shall mean "Proposal" and the term "Bidder" shall mean "Offeror", wherever they appear in the Construction Documents.

ARTICLE 1 GENERAL PROVISIONS

§ 1.1 Basic Definitions

Delete § 1.1.1 in its entirety and substitute the following:

§ 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).

To the extent any provision in the Supplementary Conditions to these AIA Document A201-2017 General Conditions, issued by Owner, conflicts with any provision in the Supplementary Conditions issued by the Architect; the Supplementary Conditions to these AIA Document A201-2017 General Conditions issued by Owner shall control.

§ 1.1.3 The Work

Add the following sentence at the end of § 1.1.3:

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.

§ 1.2 Correlation And Intent of the Contract Documents

Add § 1.2.1.2 and § 1.2.1.3, as follows:

§ 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 Supplementary Conditions
- .4** The General Conditions of the Contract for Construction
- .5** Addenda, with those of later date having precedence over those of earlier date
- .6** Drawings and Specifications

Should these Documents disagree in themselves, the Architect and Owner will select the appropriate method for performing the Work, to facilitate avoiding increase in the Contract cost.

§ 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.

§ 1.6 Notice

Delete § 1.6.1 in its entirety and substitute the following:

§ 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 it 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.

Delete § 1.6.2 in its entirety.

Add § 1.9 as follows:

§ 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 including Anticipated Weather Days which is established in the Contract Documents for Substantial Completion of the Work. This period of time is subject to authorized adjustments for Unanticipated Weather Days and other Calendar Day extensions of time 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: 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 Anticipated Weather Days: An allowance of Regular Work Days, established as probable days lost due to weather delays; said allowance to be included in the Contractor's proposed Completion Time on his Bid Form.
- .5 Weather Days: Regular Work Days when rain, flooding, snow, unusually high winds, excessively wet grounds, or similar circumstances prevent progress on major or critical portions of the Work. The Contractor will be entitled to an extension of the Contract Time for the net additional time, if any, which result from deducting the amount of Anticipated Weather Days from the total amount of Weather Days.
- .6 Net Weather Days: The difference in working days between Anticipated Weather Days and Weather Days.

§ 1.9.10 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.

§ 1.9.11 Provide

Whenever the word "provide" is used in these documents, it shall mean the same as "furnish and install".

§ 1.9.12 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.

§ 1.9.13 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**

Delete § 2.1.1 in its entirety and substitute the following:

§ 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.

Delete § 2.1.2 in its entirety.

§ 2.2 Evidence of the Owner's Financial Arrangements

After the first sentence § 2.2.1, delete the remainder of § 2.2.1 in its entirety.

Delete § 2.2.2 and § 2.2.3 in their entirety.

§ 2.3 Information and Services Required of the Owner

Delete § 2.3.6 in its entirety and replace it with the following:

§ 2.3.6 The Contractor will be furnished free of charge 25 copies of the Drawings and 25 copies of the Project Manual. These copies may have been used during the Bid/Proposal process and it is the Contractor's responsibility to determine their completeness and to request replacement of any missing portions. Additional new copies will be furnished at the cost of reproduction, postage, and handling.

Delete § 2.5 in its entirety and substitute the following:

§ 2.5 Owner's Right to Carry Out the Work

If the Contractor defaults or neglects to carry out the work in accordance with the Contract Documents and fails, after receipt of written notice from the Owner, to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such deficiencies. In such case, an appropriate Change Order shall be issued deducting from payments then or thereafter due the Contractor the actual cost of correcting such deficiencies, including the Owner's expenses and compensation for the Architect's 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.

Add § 2.6 and § 2.7 as follows:

§ 2.6 Owner's Lack of Liability to Third Party

The Owner is not responsible for the acts and/or omissions of, or contractually involved with, any subcontractors, suppliers of labor or materials, and/or their respective employees or agents or any other third-party claimants. Such claimants shall not constitute third party beneficiaries under this contract. The Contractor and/or his Surety solely shall deal with, take responsibility for, and be liable to such parties under this Contract. Contractor will indemnify and defend the Owner from any legal actions against Owner for unpaid bills of subcontractors.

§ 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**

Add § 3.1.4 as follows:

§ 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

Delete the last sentence of § 3.2.4 in its entirety and substitute the following:

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.

Add § 3.2.5, § 3.2.6 and § 3.2.7 as follows:

§ 3.2.5 The Contractor shall make a reasonable attempt to interpret the Contract Documents before asking the Architect for assistance in interpretation. 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 of 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.

§ 3.2.6 If, in the opinion of the Architect, 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 § 3.2.5, § 3.2.6, and § 3.2.7 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.

§ 3.3 Supervision And Construction Procedures

Delete the last sentence of § 3.3.1 in its entirety and substitute the following:

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.

Add § 3.3.4, § 3.3.5, and § 3.3.6 as follows:

§ 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.

§ 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.

§ 3.4 Labor and Materials

Delete § 3.4.2 in its entirety and replace it with the following:

§ 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 **§ 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.

Add § 3.4.3.1, § 3.4.3.2, § 3.4.3.3, § 3.4.3.4, and § 3.4.3.5, as follows:

- .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.

Delete **§ 3.5.1** in its entirety and substitute the following:

§ 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.

*Add **§ 3.5.3**, **§ 3.5.4**, and **§ 3.5.5** as follows:*

§ 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.

*Delete **§ 3.6** in its entirety and substitute the following:*

§ 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 Compliances with Laws

*Add **§ 3.7.1.1**, **§ 3.7.1.2**, **§ 3.7.1.3**, and **§ 3.7.1.4**, as follows:*

- .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 The Contractor shall pay all SWPPP related costs.

Delete § 3.8 in its entirety and substitute the following:

§ 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.

§ 3.9 Superintendent

Delete § 3.9.1 in its entirety and substitute the following:

§ 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 **§ 3.1.1**, communications given to the superintendent or project manager shall be binding as if given to the Contractor.

§ 3.10 Contractor's Construction and Submittal Schedules

Delete § 3.10.1 and substitute the following:

§ 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.

Add the following to § 3.10.2:

§ 3.10.2 Requirements for the submittal schedule are outlined in 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.

Add § 3.10.4 as follows:

§ 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. The Contractor shall take whatever action necessary to assure that the project completion schedule is met.

§ 3.11 DOCUMENTS AND SAMPLES AT THE SITE

Add § 3.11.1 as follows:

§ 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

Add § 3.12.5.1 and § 3.12.5.2 as follows:

- .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.

At § 3.12.7, correct the word "approved" in the last line to read "accepted".

At § 3.12.8, correct "Architect's approval" in the last line to read "Architect's acceptance".

At § 3.12.9, correct "Architect's approval" in the last line to read "Architect's acceptance" and add § 3.12.9 as follows:

- .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.

Add § 3.12.11, § 3.12.12, and § 3.12.13 as follows:

§ 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.

§ 3.14 Cutting and Patching

Add § 3.14.3 as follows:

§ 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

Add § 3.15.3 as follows:

§ 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.

§ 3.18 Indemnification

Delete § 3.18.1 and § 3.18.2 in their entirety and replace them with the following:

§ 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 § 3.18 to indemnify or hold harmless 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.

Add § 3.18.3 as follows:

§ 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.

Add **§ 3.19**, **§ 3.20**, and **§ 3.21** as follows:

§ 3.19 Prevailing Wage Rates

§ 3.19.1 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.

§ 3.19.2 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.

§ 3.19.3 Determination of prevailing wages shall not be construed to prohibit payment of more than the rates identified.

§ 3.20 Antitrust Violations

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.

§ 3.21 Third-Party Beneficiary

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

§ 4.2 Administration of the Contract

Delete § 4.2.2 in its entirety and substitute the following:

§ 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, nor 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.

Delete § 4.2.6 in its entirety and substitute the following:

§ 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.

Add § 4.2.8.1 as follows:

§ 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.

Delete § 4.2.13 in its entirety and substitute the following:

§ 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.

ARTICLE 5 SUBCONTRACTORS

§ 5.1 Definitions

Add the following sentence at the end of § 5.1.1:

Wherever relevant, the term "Subcontractor" shall also include a person, or entity who supplies material or equipment for the Project.

Add the following sentence at the end of § 5.2.4:

Prior to such change the Contractor shall notify the Architect of his intent and reasons for such proposed changes.

§ 5.4 Contingent Assignment of Subcontracts

Delete the last sentence of § 5.4.1 in its entirety and substitute the following:

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.

Delete the last sentence of § 5.4.3 in its entirety.

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 General

Delete the text of § 7.1.2 in its entirety and substitute the following:

§ 7.1.2 A Change Order shall be based on agreement among the Owner, Contractor, and Architect, except when the Contract balance is amended as a result of Owner's Right to Carry out the Work under § 2.4.1 or the Owner's assessment of liquidated damages as allowed by the Contract Documents. 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.

Add § 7.5 as follows:

§ 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 or 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.

ARTICLE 8 TIME

§ 8.1 Definitions

At § 8.1.4, add the following sentence:

See further definition of "Day" in **§ 1.9.10**.

§ 8.3 Delays and Extensions of Time

Delete § 8.3.1 in its entirety and substitute the following:

§ 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.

Add § 8.3.4, § 8.3.5, § 8.3.6, § 8.3.7, § 8.3.8, and § 8.3.9 as follows:

§ 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 One Thousand Dollars (\$1,000.00) 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 ninety (90) 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 Five Hundred Dollars (\$500.00), per phase, for each and every Calendar Day beyond the 90-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 ninety (90) 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.

§ 8.3.6 Extensions of time granted for causes described herein will be granted on the basis of 1.4 Calendar Days extension for each Regular Working Day lost, except as modified by the provisions contained herein related to Anticipated Inclement Weather days.

§ 8.3.7 Each Bidder shall include in his proposed Contract Time an allowance of anticipated Inclement Weather Days in accordance with the following schedule:

Number of Anticipated inclement Weather Days to be included in Bid Completion Time (These are regular working days)

January	3	April	2	July	4	October	3
February.....	4	May.....	5	August	4	November	5
March.....	4	June.....	6	September.....	4	December.....	4

§ 8.3.8 Weather days shall be defined in Section 1.9.9.5. If such situations occur in more than the number of anticipated Inclement Weather Days included in the Bid Completion Time and if those additional days prevent the Contractor from performing major or critical portions of the scheduled Work during the

time the Project would be subject to such weather delays, extensions of time caused by inclement weather may be requested, based on the number of days beyond this number.

§ 8.3.9 Monthly, concurrent with the application for Payment, the Contractor shall submit a status report showing the status of Weather Days for the particular month.

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 Contract Sum

Add § 9.1.1.1 as follows:

§ 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.

§ 9.2 Schedule of Values

Add § 9.2.1, § 9.2.2, § 9.2.3, § 9.2.4, § 9.2.5, and § 9.2.6 as follows:

§ 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.

§ 9.3 Applications for Payment

Delete § 9.3.1 and § 9.3.2 in their entirety and replace them with the following:

§ 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 **§ 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.

§ 9.3.2 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.

Add **§ 9.3.4** as follows:

§ 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.

§ 9.6 Progress Payments

Delete **§ 9.6.1** in its entirety and substitute the following:

§ 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.

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:

- .1 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 (subject to the conditions listed in Article 9.3.2 of the Supplementary Conditions to the Contract for Construction), 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.
- .2 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.

*At **§ 9.6.2**, insert the following sentence between the first and second sentence:*

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 subcontractors.

§ 9.7 Failure of Payment

Delete the phrase "or awarded by binding dispute resolution" and replace all references to "seven days" to "ten days."

§ 9.8 Substantial Completion

At § 9.8.2, add the following sentence at the end:

Should the Architect determine that the Contractor's List of Items to be Completed or Corrected lacks sufficient detail or requires extensive supplementation, the list will be returned to the Contractor for revision, and inspection for determining the Date of Substantial Completion will be delayed until the List submitted is a reasonable representation of the work to be done.

Add § 9.8.6 and § 9.8.7 as follows:

§ 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.

At a minimum, the following requirements must be met **prior** to establishing 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 is evidenced by the Certificate of Substantial Completion, the Contractor will be allowed a period of time within which to correct all deficiencies attached to the Certificate of Substantial Completion as outlined in **§ 8.3.4** of these supplementary conditions. Failure of the Contractor to complete such corrections within the stipulated time will be reported to the contractor's surety. In this report, the Contractor and surety will be informed that, should correction remain incomplete for fifteen (15) days, the Owner may initiate action to complete corrective work out of the remaining Contract funds in accordance with **§ 14.2**.

- .1 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 the Contract funds remaining unpaid to the Contractor.

§ 9.10 Final Completion and Final Payment

Add § 9.10.6 as follows:

§ 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.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.2 Safety of Persons and Property

Add § 10.2.9 and § 10.2.10 as follows:

§ 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.

§ 10.3 Hazardous Materials and Substances

Delete §10.3.1 in its entirety and substitute the following:

§ 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 **§ 10.3.2**.

Delete the text of § 10.3.3, § 10.3.4, and § 10.3.5 in their entirety.

Delete the text of § 10.3.6 in its entirety and substitute the following:

§ 10.3.6 If, without negligence on the part of the Contractor, the Contractor is held liable by a governmental 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 indemnify the Contractor for all costs and expenses thereby incurred, but only to the extent provided by law.

Add § 10.3.7 as follows:

§ 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.

ARTICLE 11 INSURANCE AND BONDS

Delete § 11.1 through § 11.5 in their entirety, and substitute the following Sections:

§ 11.1 Contractor's Liability Insurance

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.

§ 11.2 The Owner requires the following minimum insurance coverages:

<u>Types of Coverage</u>	<u>Limits of Liability</u>
Commercial General Liability	General Aggregate \$2,000,000.00
	Products / Completed Operations/Aggregate \$1,000,000.00
	Bodily Injury and Property Damage (each) \$1,000,000.00
	Contractual \$1,000,000.00
	Personal and Advertising Injury \$1,000,000.00
	Fire Damage \$500,000.00
	Medical Expense \$5,000.00

§ 11.2.1 The Owner shall be named as an additional insured on a primary and non-contributory basis using form CG 2010 10 01 or similar endorsement providing equal or greater coverage in favor of the Owner. Coverage shall include the following:

- .1 Premises operations;
- .2 Blanket Contractual Liability;
- .3 Pollution;
- .4 Products/Completed Operations;
- .5 Broad Form Property Damage;
- .6 Independent Contractors;
- .7 Per project aggregate limit;
- .8 Provide a statement of claims against the aggregate limit with each renewal certificate;
- .9 X, C, U exclusions to be removed when underground work is performed; and
- .10 Waivers of subrogation in favor of Owner and its officers, directors, representatives, agents and employees shall be provided.

§ 11.2.2 Automobile Liability Combined Single Limit \$1,000,000.00

- .1 Comprehensive Automobile Liability Insurance to cover all vehicles owned by, hired by, or used on behalf of Contractor.
- .2 Owner and its officers, directors, representatives, agents and employees shall be endorsed as Additional Insureds, as their interests may appear.
- .3 Waivers of subrogation in favor of Owner and its officers, directors, representatives, agents and employees shall be provided.

§ 11.2.3 Workers' Compensation Statutory Limits

- .1 Coverage at Statutory Limits with All States Endorsement
- .2 Employer's Liability

Each Accident	\$1,000,000.00
Disease (Policy Limit)	\$1,000,000.00
Disease (Each Employee)	\$1,000,000.00
- .3 Waivers of subrogation in favor of Owner and its officers, directors, representatives, agents and employees shall be provided.

§ 11.2.4 Excess or Umbrella Insurance (provides coverage in excess of primary Commercial General Liability, Automobile Liability, and Worker's Compensation Coverage B limits)

- .1 Minimum coverage for the Contractor shall be one (1) times the Contract amount, subject to a minimum limit of \$1,000,000.00 and a maximum limit of \$25,000,000.00. Limits for primary policies may differ from those shown above when Excess (Umbrella) Insurance coverage is provided.
- .2 Owner and its officers, directors, representatives, agents and employees shall be endorsed as Additional Insureds, as their interests may appear.
- .3 Waivers of subrogation in favor of Owner and its officers, directors, representatives, agents and employees shall be provided.

§ 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 Insureds, 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 and 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 Coverage

§ 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.

§ 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 sections (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.

§ 11.6 Owner's Insurance

§ 11.6.1 The Owner shall purchase and maintain property 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.

§ 11.6.2 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.

§ 11.6.3 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.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.2.1 Prior to Substantial Completion

Add § 12.2.1.1 as follows:

§ 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.

§ 12.2.2 After Substantial Completion

Add § 12.2.2.1 as follows:

§ 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.

§ 12.3 Acceptance of Nonconforming Work

Number the existing provision as § 12.3.1, and add § 12.3.2 as follows:

§ 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

Add **§ 13.7**, **§ 13.8** and **§ 13.9** as follows:

§ 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 New Caney 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 further 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.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

Delete **§ 14.1.3** in its entirety, and substitute the following:

§ 14.1.3 If one of the reasons described in **§ 14.4.1** or **§ 14.4.2** exists, the Contractor may, upon seven day's written notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed as of the date of the notice, plus costs of demobilization.

§ 14.4 Termination by the Owner for Convenience

Delete **§ 14.4.3** in its entirety, and substitute the following:

§ 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**

Delete § 15.1.1 in its entirety, and substitute the following:

§ 15.1.1 Definition

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, adjustment or interpretation of contract terms, payment of money, extension of 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, Architect, and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim. Nothing herein shall require the Owner to make or file a Claim in order to assess liquidated damages provided for in the Contract Documents.

§ 15.1.2 Time Limits on Claims

Delete the last sentence of § 15.1.2 in its entirety.

§ 15.1.3 Notice of Claims

Delete the second sentence of § 15.1.3 in its entirety, and substitute the following:

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.

§ 15.1.6 Claims for Additional Time

Delete § 15.1.6.2 in its entirety, and substitute the following:

§ 15.1.6.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented and listed in accordance with Article 8.

§ 15.1.7 Claims for Consequential Damages

Delete § 15.1.7 in its entirety.

§ 15.2 Initial Decision

Delete § 15.2.1 in its entirety, and substitute the following:

§ 15.2.1 Claims, excluding those alleging an error or omission by the Architect or those arising after expiration of the period for correction of the Work, 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.

Delete § 15.2.5 in its entirety, and substitute the following:

§ 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.

Delete the text of § 15.2.6 and § 15.2.6.1 in their entirety.

Add **§ 15.2.9** as follows.

§ 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

Delete the text of **§ 15.3.1** in its entirety.

Delete **§ 15.3.2** in its entirety, and substitute the following:

§ 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.

§ 15.4 Arbitration

Delete **§ 15.4.1** through **§ 15.4.3** in their entirety.

Delete **§ 15.4.4.1** through **§ 15.4.4.3** in their entirety.

END OF SECTION 00 73 00

SECTION 01 11 00

SUMMARY OF WORK

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, 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 SUMMARY

- A. Section Includes: Project information, work covered by Contract Documents, work under separate contracts, Owner-furnished, Contractor-installed products, access to site, work restrictions, and specification and drawing conventions.
- B. Related Requirements:
 - 1. Section 01 21 00, Allowances
 - 2. Section 01 31 00, Project Management and Coordination
 - 3. Section 01 50 00, Temporary Facilities and Controls

1.3 PROJECT INFORMATION

- A. Project Identification: New Caney ISD New Administration Building
 - 1. Project Location: The project is located at 21330 Valley Ranch Parkway New Caney, Texas 77357
- B. Owner:
 - New Caney Independent School District
 - 22784 Hwy 59 S
 - Porter, Texas 77365
 - Telephone: (281) 557-8600
 - Fax:
- C. Architect:
 - GPD Group.
 - 2121 Sage Road, Suite 240
 - Houston, Texas 77056
 - Telephone: (713) 622-1448
 - Fax: (713) 622-1455
 - www.gpdgroup.com
- D. Architect's Consultants: The Architect has retained the design professionals listed below to prepare designated portions of the Contract Documents.
 - 1. Civil Engineer:
 - Dally + Associates, Inc.
 - 9800 Richmond Ave. #460
 - Houston, Texas 77042
 - Telephone: (713) 337-8881
 - 2. Structural Engineer:
 - Dally + Associates, Inc.
 - 9800 Richmond Ave. #460
 - Houston, Texas 77042
 - Telephone: (713) 337-8881

3. MEP Engineer:
Salas O'Brien
10930 W. Sam Houston Pkwy. #900
Houston, Texas 77064
Telephone: (281) 664-1933
Fax:
4. Landscape Architect:
Mary L. Goldsby Associates
112 Northwood Street
Houston, Texas 77009
Telephone: (713) 802-2799
Fax: (713) 802-2788
5. Technology Consultant:
Salas O'Brien
10930 W. Sam Houston Pkwy. #900
Houston, Texas 77064
Telephone: (281) 664-1933
- E. The Owner has retained the firms listed below to perform various services related to the Project.
 1. Surveyor:
West Belt Surveying, Inc
21020 Park Row
Katy, Texas 77449
Telephone: (281) 599-8288
Fax: (281) 492-6206
 2. Geotechnical Engineer:
Alpha Testing
15811 Tuckerton Rd.
Houston, TX. 77095
Telephone: (713) 360-0460
Fax:
 3. Testing, Balancing and Adjusting (TAB) of Environmental Systems:

Telephone:
Fax:
 4. Materials Testing Laboratory:

Telephone:
Fax:
 5. Building Commissioning:

Telephone:
Fax:
- F. Project Web Site: A project Web site administered by the Owner will be used for purposes of managing communication and documents during the construction stage. Refer to Section 01 31 00, Project Management and Coordination, for requirements for using the Project Web site.

1.4 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of Project is defined by the Contract Documents and consists of the following:
1. Generally, the project consists of the construction of a new 135,000 square feet two story administration building adjacent to Randall Reed Stadium with a new connecting road to McCleskey rd. along with a new ramp at Randall Reed Stadium extending from bleachers down to main drive sidewalk behind score board at the south entrance.
 2. Sitework includes grading, storm drainage, reinforced concrete parking and driveways, fencing, and landscaping and irrigation.
 3. The structural systems include biscuit footings, concrete grade beams, concrete slab on grade, and a steel frame.
 4. Exterior walls are masonry veneer and composite panels with steel stud backup.
 5. Interior partitions are of CMU and gypsum board on steel studs.
 6. Finishes include carpet, resilient flooring, ceramic tile, natural stone, solid surface counters, paint, and suspended acoustical ceilings.
 7. Glass dry marker boards, Interactive Panels, Screens, toilet partitions, acoustical panels, residential appliances, commercial ice machine, projectors, motorized screens, plastic shelving, stainless steel tables on casters, casework, and motorized shades are also a part of the Work.
 8. The project also includes new HVAC systems, electrical systems, plumbing systems, fire sprinkler system, BDA systems, fire alarm systems, cameras, back-up generator and transformer.
- B. Type of Contract: The Project will be constructed under a single prime contract.

1.5 CONSTRUCTION AND SCHEDULING

- A. Anticipated Project Scheduling Timeline:
1. Proposals Due (2:00 pm).....Tuesday, June 10, 2025
 2. Contract Negotiation and Preparation.....June 10, 2025 – June 16, 2025
 3. Board Meeting Approval of Contract.....Monday, June 16, 2025
 4. NTP to ContractorFriday, June 20, 2025
 5. Early Procurement
(Generators, Transformers, Switchgear, Chillers) ...July 24, 2025 – August, 2025
 6. Pre-Construction ConferenceWeek of June 23, 2025
 7. Begin On Site ConstructionAugust, 2025
 8. Shop Drawings and Submittals.....July 24 - December 1, 2025
 9. Substantial Completion - Building.....October 24, 2026 (16 Months)
 10. Close OutJune 1 - March 12, 2026
 11. NCISD Move to New BuildingNovember 2, 2026
 12. Warranty PhaseOctober 2026-2027
 13. 11 Month Walkthrough.....October 2027

1.6 WORK UNDER SEPARATE CONTRACTS

- A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract or other contracts. Coordinate the Work of this Contract with work performed under separate contracts.
- B. Concurrent Work: Provide site access, space, scheduling, scheduling coordination, coordination of work forces, and coordination of technical requirements with contractors that may be selected and employed by the Owner to perform work simultaneously and in conjunction with the Work. Contractors performing concurrent work may include, but shall not be limited to those listed in paragraph 1.3 E above.

1.7 OWNER-FURNISHED PRODUCTS

- A. Owner will furnish products indicated. The Work includes receiving, unloading, handling, storing, protecting, and installing Owner-furnished products. Contractor shall designate the required delivery dates of Owner furnished products in the Construction Progress Schedule.
- B. Owner-Furnished Products:

1. Soap dispensers.
2. Toilet paper holders.
3. Paper towel holders.

1.8 ACCESS TO SITE

- A. General: Contractor shall have full use of Project site for construction operations during construction period. Contractor's use of Project site is limited only by Owner's right to perform work or to retain other contractors on portions of Project.
- B. Maintenance/Use of Access Roads: Access roads to the site are to be kept free of dirt, mud, and other construction debris and be cleaned on a daily basis.
- C. Use of Site: Limit use of Project site to work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
- D. Limits: Confine construction operations to areas permitted by law, ordinances, permits, and the Contract Documents.
- E. Limits: Limit site disturbance, including earthwork and clearing of vegetation, to areas shown on the drawings. Do not disturb areas to be protected with vehicle traffic or construction debris.

1.9 COORDINATION WITH OCCUPANTS

- A. Owner Limited Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed portions of the Work, prior to Substantial Completion of the Work, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and limited occupancy shall not constitute acceptance of the total Work.
 1. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied prior to Owner acceptance of the completed Work.
 2. Obtain a Certificate of Occupancy from authorities having jurisdiction before limited Owner occupancy.
 3. Before limited Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of Work.
 4. Before limited Owner occupancy, all emergency and life safety systems shall be fully operational and required tests and inspections shall be successfully completed. Emergency and life safety systems include, but are not limited to, fire sprinkler systems, fire alarm systems, and emergency egress devices. For emergency exiting purposes, the path of travel shall be clearly delineated, free of obstructions, and functional. Temporary barricades shall separate construction activities from occupied spaces as allowed by authorities having jurisdiction. On occupancy, Owner will operate and maintain emergency and life safety systems serving occupied portions of Work.
 5. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of Work.

1.10 WORK RESTRICTIONS

- A. Work Restrictions, General: Comply with restrictions on construction operations.
 1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.
- B. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:
 1. Notify Architect and Owner not less than 48 hours in advance of proposed utility interruptions.
 2. Obtain Architect and Owner's written permission before proceeding with utility interruptions.
- C. Controlled Substances: Use of tobacco products, alcoholic beverages, and other controlled substances is not permitted in the building or on the Project site.

- D. Employee Screening: Comply with Owner's requirements for background screening of Contractor personnel working on Project site.
 - 1. Maintain list of approved screened personnel with Owner's representative.

1.11 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 - 1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
 - 2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.
- C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
 - 1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
 - 2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard and scheduled on Drawings.
 - 3. Keynoting: Materials and products are identified by reference keynotes referencing notes found on Drawings.

2 PRODUCTS (NOT USED)**3 EXECUTION (NOT USED)**

END OF SECTION 01 11 00

SECTION 01 23 00

ALTERNATES

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, 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 SUMMARY

- A. Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS

- A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if 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 net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

- A. The Owner may accept or reject any or all alternates upon completion of bidding.
- B. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project. 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.
- C. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated revisions to alternates.
- D. Execute accepted alternates under the same conditions as other work of the Contract.
- E. Schedule: A schedule of alternates with a brief description of each alternate is included at the end of this Section. Refer to the Drawings and Specifications to determine the requirements for providing the work described under each alternate.

2 PRODUCTS (NOT USED)**3 SCHEDULE OF ALTERNATES****3.1 ALTERNATE NO. 1A – AIR COOLED CHILLERS BY DAIKIN**

- A. This alternate shall establish the amount the Base Bid is increased depending on which chillers are provided. **There are no chillers provided in the base bid.**

3.2 ALTERNATE NO. 1B – AIR COOLED CHILLERS BY JCI/YORK

- A. This alternate shall establish the amount the Base Bid is increased depending on which chillers are provided. **There are no chillers provided in the base bid.**

3.3 ALTERNATE NO. 2 – DRILLED BELLED PIERS

- A. This alternate shall establish the amount the Base Bid is increased/decrease depending on the foundation type established in the size comparison located in the biscuit footing schedule on S301 and the shaft reinforcing and bearing depth shown in the "Alternate Drilled Pier Schedule" on S301.

END OF SECTION 01 23 00

SECTION 01 25 00

SUBSTITUTION PROCEDURES

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, 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 SUMMARY

- A. Section includes administrative and procedural requirements for substitutions.
- B. Related Requirements
 - 1. Section 01 21 00, Allowances
 - 2. Section 01 23 00, Alternates

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 or Owner.

1.4 ACTION SUBMITTALS

- A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles. For procurement substitution requests related to work indicated on documents prepared by one of the Architect's consultants, submit one copy of the request directly to the consultant.
 - 1. Substitution requests made prior to receipt of proposals must be submitted not less than 5 days prior to receipt of proposals. Substitution requests received less than 5 days prior to receipt of proposals will not be considered.
 - 2. Use Substitution Request Form found on last page of this Section 01 25 00.
 - 3. 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 revisions 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
 - h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated
 - i. Research reports evidencing compliance with building code in effect for Project.
 - 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.
 - l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
 - m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results
4. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
- a. Forms of Acceptance
 - 1) Prior to Award of Contract: Addendum
 - 2) After Award of Contract: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work
 - b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.5 QUALITY ASSURANCE

- A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.6 PROCEDURES

- A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

2 PRODUCTS

2.1 SUBSTITUTIONS

- A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 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.
- B. Substitutions for Convenience: Requests for substitutions for convenience **may** be considered solely at the discretion of the Architect.
- 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 Owner must 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.
 - e. Requested substitution will 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.

3 EXECUTION (NOT USED)

SUBSTITUTION REQUEST FORM**New Caney ISD New Administration Building**

GPD Group Project No. 2023159.00

We hereby submit for your consideration the following product instead of the specified item for the above project:

Section and ParagraphSpecified Item

Proposed Substitution:

Attached data includes product description, specifications, drawings, photographs, performance and test data adequate for evaluation of the request; applicable portions of the data are clearly identified.

Attached data also includes a description of changes to the Contract Documents that the proposed substitution will require for its proper installation.

The undersigned certifies that the following paragraphs, unless modified by attachments, are correct:

1. The proposed substitution does not affect dimensions shown on Drawings.
2. The undersigned will pay for changes to the building design, including engineering design, detailing and construction costs caused by the requested substitution.
3. The proposed substitution will have no adverse effect on other trades, the construction schedule, or specified warranty requirements.
4. Maintenance and service parts will be locally available for the proposed substitution.

The undersigned further states that the function, appearance and quality of the proposed substitution are equivalent or superior to the specified item.

SUBMITTED BY:

(Signature)

(Company Name)

(Printed Name and Title)

(Street Address)

(Telephone No.)

(City, State and Zip Code)

(E-mail Address)

*(Fax No.)***END OF SECTION 01 25 00**

SECTION 01 29 00

PAYMENT PROCEDURES

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, 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 SUMMARY

- A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.
- B. Related Requirements
 - 1. Section 01 21 00, Allowances
 - 2. Section 01 22 00, Unit Prices
 - 3. Section 01 32 00, Construction Progress Documentation
 - 4. Section 01 77 00, Closeout Procedures

1.3 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.
 - 1. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:
 - a. Application for Payment forms with continuation sheets
 - b. Submittal schedule
 - c. Items required to be indicated as separate activities in Contractor's construction schedule
 - 2. Submit the schedule of values to Architect at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
- B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least two line items (one each for labor and materials) for each Specification Section.
 - 1. Identification: Include Project name, name of Architect, Contractor's name and address, and date of submittal on the schedule of values:
 - 2. Arrange schedule of values consistent with format of AIA Document G703.
 - 3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual table of contents. Provide multiple line items for principal subcontract amounts in excess of two percent of the Contract Sum.
 - a. Include a separate line item under Contractor in an amount totaling 0.5 percent of the Contract Sum for Project closeout requirements.
 - b. Include a separate line item for each subcontract in excess of \$100,000 for Project closeout requirements.
 - 4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
 - 5. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
 - 6. Allowances: Provide a separate line item in the schedule of values for each allowance.
 - 7. Provide separate line items in the schedule of values for bonds, insurance, permits, mobilization, supervision, temporary facilities, trench safety systems, temporary erosion- and sedimentation-control measures, fee, profit, general overhead expense, and other similar expenses.

1.4 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
 - 1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.
- B. Payment Application Times: Submit Application for Payment to Architect by the 25th of the month. The period covered by each Application for Payment is one month, ending on the last day of the month.
 - 1. Submit draft copy of Application for Payment five days prior to due date for review by Architect.
- C. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 or similar forms acceptable to the Architect and Owner. Submit alternate forms for approval with initial submittal of schedule of values.
- D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Incomplete applications will be returned without action.
 - 1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
 - 2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
 - 3. Include amounts of Allowance Expenditure Authorizations, Change Orders and Construction Change Directives issued before last day of construction period covered by application.
- E. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.
 - 1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
 - 2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
 - 3. Provide summary documentation for stored materials indicating the following:
 - a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
 - b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
 - c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.
- F. Transmittal: Submit **four** signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.
 - 1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
- G. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
 - 1. List of subcontractors
 - 2. Schedule of values
 - 3. Contractor's construction schedule
 - 4. Submittal schedule
 - 5. Copies of building permits
- H. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
 - 1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.

2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- I. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted.

2 PRODUCTS (NOT USED)**3 EXECUTION (NOT USED)****END OF SECTION 01 29 00**

SECTION 01 29 73

SCHEDULE OF VALUES

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, Instructions to Bidders and 00 22 13 Supplementary 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 DESCRIPTION

- A. Refer to Section 01 25 00 – Substitution Procedures for substitutions.
- B. Work Included: Provide a detailed breakdown of the agreed Contract Sum showing values allocated to each of the various parts of the work, as specified herein and in other provisions of the Contract Documents.
- C. Related Work:
 - 1. Documents affecting work of this section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.

1.3 QUALITY ASSURANCE

- A. Use required means to assure arithmetical accuracy of the sums described. When so required by the Architect, provide copies of the subcontracts or other data acceptable to the Architect, substantiating the sums described.
- B. The Schedule of Values shall be broken down into costs for each specification section as labor and materials at a minimum.
 - 1. The contractor is encouraged to make the schedule of values very detailed in order to facilitate review and approval of requested percentages complete on pay applications.
 - 2. Where breakdown is vague, or includes multiple / combined assemblies, stages, tasks, etc., Architect's review shall be conservative in favor of the Owner regarding approval of Pay Applications.

1.4 APPLICATION FOR PAYMENT SCHEDULE OF VALUES

- A. The schedule of values, once approved shall be transferred to columns B and C of AIA G702/G703 – Application for Payment to be used for all progress payments.
- B. Once AIA G702/G703 – Application for Payment has been submitted for payment, individual line item amounts in column C must remain unchanged throughout the progress of the work.
 - 1. In the beginning stages of the construction, total amounts for entire divisions may be used if complete breakdowns are not available; and shall be line item populated as soon as practical.
 - 2. No payments will be approved in divisions that do not have a line item breakdown.
- C. Allowances shall be shown, and remain throughout construction, as a single line item on the master application for payment in amount(s) as stipulated in the Contract Documents.
 - 1. For each Allowance, expenditures and accounting shall be included on a separate, attached spread sheet of the same format as the master application for payment.
 - 2. The master application for payment shall reflect only the summary of each allowance; and shall not contain individual allowance activity(s).

1.5 MULTIPLE PHASES / BUILDINGS

- A. For projects consisting of multiple phases, separate each phase on the Application for Payment and include separate division 2 through 26 line items for each phase.
- B. For projects consisting of multiple buildings, separate each building on the Application for Payment and include separate division 2 through 26 line items for each building.

1.6 SUBMITTALS

- A. Prior to the first Application for Payment, submit a proposed schedule of values to the Architect, as outlined below.
- B. Meet with the Architect and determine additional data, if any, is required to be submitted.
- C. Secure the Architect's approval of the schedule of values prior to submitting the first Application for Payment.

2 PRODUCTS**2.1 SCHEDULE OF VALUES**

- A. Schedule of values for division 2 through 26 shall be broken down for each separate section of work, and include multiple items covered where appropriate.
 - 1. Each item of work shall be broken down by material and labor at a minimum.
 - 2. Where payment for shop drawings, submittals, record drawings and similar are expected, the items must be included as a separate item on the schedule of values.
- B. Schedule of Values – The following shall represent the minimum breakdown of line items; and shall include material and labor for each item where applicable:

DIVISION 1 – GENERAL REQUIREMENTS

- 01 Building Permits
- 02 Bonds
- 03 Insurance
- 04 General Contractor's Fee
- 05 General Contractor's Overhead
- 06 Supervision
- 07 Mobilization
- 08 Temporary Facilities
- 09 Final Cleaning
- 10 Allowances (list each separately)
- 11 Close-Out Documents / Manuals
- 12 Record Drawings

DIVISION 2 – EXISTING CONDITIONS

- 01 Selective Site Demolition

DIVISION 3 - CONCRETE

- 01 Concrete Ramp and Sidewalks
 - a. Formwork
 - b. Reinforcement
 - c. Concrete
 - d. Placement

DIVISION 4 –MASONRY

- 01 Masonry Ties
- 02 Brick Veneer – Exterior
- 03 Stone Veneer - Exterior
- 04 Cast stone Masonry
- 05 CMU
- 06 Masonry Cleaning
- 07 Water Repellant

DIVISION 5 – METALS

- 01 Steel Shop Drawings
- 02 Structural Steel
- 03 Structural Steel Erection
- 04 Steel Joists
- 05 Steel Decking (each level)
- 06 Light Gage Steel Framing
- 07 Metal fabrications
- 08 Metal Stairs
- 09 Pipe and Tube Railing

DIVISION 6 – WOOD AND PLASTICS

- 10 Rough Carpentry
- 11 Finish Carpentry
- 12 Millwork

DIVISION 7 – THERMAL AND MOISTURE PROTECTION

- 01 Foam Board Insulation
- 02 Elastomeric Sheet Waterproofing
- 03 Shower Stall Waterproofing
- 04 Building Insulation
- 05 Roofing (list each type separately)
- 06 Sheetmetal Flashing
- 07 Roof Accessories
- 08 Relief Vents
- 09 Roof Hatches and Vents
- 10 Penetration Firestopping
- 11 Fireproofing
- 12 Joint Sealants

DIVISION 8 – OPENINGS

- 01 Hollow Metal Frames
- 02 Hollow Metal Doors
- 03 Aluminum Doors and Frames
- 04 Plastic Laminate-Faced Wood Doors
- 05 Access Doors and Frames
- 06 Overhead Coiling Doors
- 07 Overhead Coiling Grilles
- 08 Sectional Doors
- 09 Finish Hardware
- 10 Glazed Systems – Framing

- 11 Glazed Systems – Glazing
- 12 Louvers and Vents

DIVISION 9 – FINISHES

- 01 02 Gypsum Board Assemblies – Walls
 - a. Metal Framing
 - b. Gypsum Board
 - c. Taping and Floating
- 02 Metal Framing – Ceilings
- 03 Metal Framing
- 04 Gypsum Board
- 05 Taping and Floating
- 06 Ceramic Tile
- 07 Quarry Tile
- 08 Porcelain Tile
- 09 Acoustical Ceilings
- 10 Slip Resistant Coatings
- 11 Concrete Floor Sealer
- 12 Resilient Tile Flooring
- 13 Seamless Epoxy Flooring
- 14 Carpet
- 15 Wall Coverings
- 16 Painting
- 17 Column Covers
- 18 Elastomeric Coatings

DIVISION 10 – SPECIALTIES

- 01 Miscellaneous Specialties
- 02 Multi-Media Board and Tack Board
- 03 Display Cases
- 04 Exterior Signage
- 05 Interior Signage
- 06 Toilet Partitions
- 07 Cubicle Curtain and Track
- 08 Operable Partition System
- 09 Corner Guards
- 10 Toilet and Bath Accessories
- 11 Fire Extinguishers and Cabinets
- 12 Aluminum Walkway Covering
- 13 Flagpole

DIVISION 11 – EQUIPMENT

- 01 Residential Appliances
- 02 Food Service Equipment
- 03 Stage Curtains and Controls
- 04 Theater Sound Equipment
- 05 Gym Equipment

DIVISION 12 – FURNISHINGS

- 01 Horizontal Blinds

02 Manufactured Plastic-Laminate-Clad Casework

DIVISION 14 – CONVEYING SYSTEMS

01 Hydraulic Passenger Elevators

DIVISION 22 - PLUMBING

01 Under Slab Sanitary

02 Above Slab Sanitary

03 Above Slab Water

04 Plumbing Fixtures

05 Plumbing Trim-Out

DIVISION 23 – HEATING VENTILATING AND AIR CONDITIONING

06 Rigid Ductwork

07 Flexible Ductwork

08 Grilles and Diffusers

09 Mechanical Trim Out

10 Air Handlers

11 Condensing Units

DIVISION 26 –ELECTRICAL

01 Panelboards

02 Transformers

03 Generator

04 Site Underground Electrical

05 Site Lighting

06 Under Slab Electrical

07 Electrical Rough-in – Power

08 Electrical Rough-in – Lighting

09 Power Devices

10 Light Fixtures

11 Electrical Trim Out

DIVISION 27 - TECHNOLOGY

01 Data and Technology

02 Communication System

03 A/V Systems

04 Security System – Video

05 Security System - Intrusion

06 CATV System

DIVISION 28 - ELECTRONIC SAFETY AND SECURITY

01 Electronic Access Control System

02 Fire Detection and Alarm System

03 Emergency Radio and Communication System

DIVISION 31 – EARTHWORK

01 Site Clearing

02 Excavation, Fill and Earthwork

03 Site Drainage / Erosion Control

- 04 Rough Grading
- 05 Finish Grading
- 06 Termite Control
- 07 Lime Stabilization
- 08 Drilled Concrete Piers and Shafts

DIVISION 32 – EXTERIOR IMPROVEMENTS

- 01 Concrete Paving
- 02 New Approaches at Public Streets
- 03 Sidewalks / Miscellaneous Concrete Flatwork
- 04 Screen Wall Foundation
- 05 Chain Link Fencing
- 06 Ornamental Fencing
- 07 Site Signage
- 08 Marquee Sign

Division 33 - UTILITIES

- 01 Manholes and Structures
- 02 Precast Concrete Utility Structures
- 03 Concrete for Utility Construction
- 04 Polyvinyl Chloride (PVC) Pipe
- 05 Ductile Iron Pipe and Fittings
- 06 HDPE Solid and Profile Wall Pipe
- 07 Reinforced Concrete Pipe
- 08 Water Utility Distribution Piping
- 09 Tapping Sleeves and Valves
- 10 Wet Connections
- 11 Water Utility Distribution Valves
- 12 Water Utility Distribution Fire Hydrants
- 13 Valve Boxes, Meter Boxes, and Meter Vaults
- 14 Disinfecting of Water Utility Distribution
- 15 Hydrostatic Testing of Pipelines
- 16 Sanitary Utility Sewerage Piping
- 17 Storm Utility Drainage Piping
- 18 Storm Drainage, Manholes, Frames and Covers

- C. The following work shall be listed as a separate line item if the sub-contractor anticipates invoicing separately for the work:

- 01 Sub-Contractor temporary facilities.
- 02 Sub-contractor bonds.
- 03 Submittals
- 04 Rough-in
- 05 Fixtures / equipment
- 06 Trim-out
- 07 Shop drawings.
- 08 Close-out documents / record drawings

END OF SECTION 01 29 73

SECTION 01 31 00
PROJECT MANAGEMENT AND COORDINATION

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, 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 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, general coordination procedures, coordination drawings, Requests for Information (RFI), Project Web site, and Project meetings.
- B. Related Requirements
 - 1. Section 01 32 00, Construction Progress Documentation
 - 2. Section 01 77 00, Closeout Procedures

1.3 DEFINITIONS

- A. RFI: Request from Contractor seeking information required by or clarifications of the Contract Documents.

1.4 INFORMATIONAL SUBMITTALS

- A. 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. Use CSI Form 1.5A, or similar form that includes 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
- B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.
 - 1. Post copies of list in project meeting room, in temporary field office, on Project Web site, and by each temporary telephone. Keep list current at all times.

1.5 GENERAL COORDINATION PROCEDURES

- 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. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
- C. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.
 - 1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

1.6 COORDINATION DRAWINGS

- A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
 - 1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
 - a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
 - b. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
 - c. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
 - d. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
 - e. Indicate required installation sequences.
 - f. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
- B. Coordination Drawing Organization: Organize coordination drawings as follows:
 - 1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
 - 2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
 - 3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
 - 4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
 - 5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
 - 6. Mechanical and Plumbing Work: Show the following:
 - a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems
 - b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment
 - c. Fire-rated enclosures around ductwork

7. Electrical Work: Show the following:
 - a. Runs of vertical and horizontal conduit 1¼ inches in diameter and larger
 - b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations
 - c. Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations
 - d. Location of pull boxes and junction boxes, dimensioned from column center lines
8. Fire-Protection System: Show the following:
 - a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads
9. Review: Architect will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make changes as directed and resubmit.
- C. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:
 1. File Submittal Format: Submit or post coordination drawing files using Portable Data File (PDF) format.
 2. Architect will furnish Contractor one set of digital data files of Drawings for use in preparing coordination digital data files.
 - a. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.
 - b. Digital Data Software Program: Drawings are available in AutoCAD.
 - c. Contractor shall execute a data licensing agreement in the form of Agreement form acceptable to Owner and Architect.

1.7 REQUESTS FOR INFORMATION (RFI)

- 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.
 1. Architect will return RFI submitted to Architect by other entities controlled by Contractor with no response.
 2. Coordinate and submit RFI in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
- 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 suggested resolution 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 with substantially the same content as indicated above, acceptable to Architect.

1. Attachments shall be electronic files in Adobe Acrobat PDF format.
- D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven working days for Architect's response for each RFI. RFI received by Architect after 1:00 p.m. will be considered as received the following working day.
 1. The following Contractor-generated RFI will be returned without action:
 - a. Requests for approval of submittals
 - b. Requests for approval of substitutions
 - c. Requests for approval of Contractor's means and methods
 - d. Requests for coordination information already indicated in the Contract Documents
 - e. Requests for adjustments in the Contract Time or the Contract Sum
 - f. Requests for interpretation of Architect's actions on submittals
 - g. Incomplete RFI or inaccurately prepared RFI
 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 RFI that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal.
 - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10 days of receipt of the RFI response.
- E. RFI Log: Use software log that is acceptable to the Owner and Architect to generate RFI Log for weekly review.
- F. 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 three days if Contractor disagrees with response or believes response is inadequate.

1.8 PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.
 1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
 3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.
- B. Preconstruction Conference: Architect will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect.
 1. Conduct the conference to review responsibilities and personnel assignments
 2. Attendees: Authorized representatives of Owner, Owner's Commissioning Authority, Architect, Architect's consultants, Contractor and its superintendent; major subcontractors; suppliers; 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 the following:
 - a. Tentative construction schedule
 - b. Phasing
 - c. Critical work sequencing and long-lead items
 - d. Designation of key personnel and their duties
 - e. Lines of communications
 - f. Procedures for processing field decisions and Change Orders
 - g. Procedures for RFI
 - h. Procedures for testing and inspecting
 - i. Procedures for processing Applications for Payment
 - j. Distribution of the Contract Documents
 - k. Submittal procedures
 - l. Preparation of record documents

- m. Use of the premises
 - n. Work restrictions
 - o. Working hours
 - p. Owner's occupancy requirements
 - q. Responsibility for temporary facilities and controls
 - r. Procedures for moisture and mold control
 - s. Procedures for disruptions and shutdowns
 - t. Construction waste management and recycling
 - u. Parking availability
 - v. Office, work, and storage areas
 - w. Equipment deliveries and priorities
 - x. First aid
 - y. Security
 - z. Progress cleaning
- 4. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
 - 5. Attendees: Authorized representatives of Owner, Owner's Commissioning Authority, Architect, and their consultants; Contractor and its superintendent and LEED coordinator; major subcontractors; suppliers; 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.
 - 6. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
- C. Preinstallation Conferences: Conduct a preinstallation 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 Architect and Owner's Commissioning Authority 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:
 - a. Contract Documents
 - b. Options
 - c. Related RFI
 - d. Related Change Orders
 - e. Purchases
 - f. Deliveries
 - g. Submittals
 - h. Review of mockups
 - i. Possible conflicts
 - j. Compatibility requirements
 - k. Time schedules
 - l. Weather limitations
 - m. Manufacturer's written instructions
 - n. Warranty requirements
 - o. Compatibility of materials
 - p. Acceptability of substrates
 - q. Temporary facilities and controls
 - r. Space and access limitations
 - s. Regulations of authorities having jurisdiction
 - t. Testing and inspecting requirements
 - u. Installation procedures
 - v. Coordination with other work
 - w. Required performance results
 - x. Protection of adjacent work

- y. Protection of construction and personnel
- 3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
- 4. Reporting: 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. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 90 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 Commissioning Authority, 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:
 - a. Preparation of record documents
 - b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance
 - c. Submittal of written warranties
 - d. Requirements for preparing operations and maintenance data
 - e. Requirements for delivery of material samples, attic stock, and spare parts
 - f. Requirements for demonstration and training
 - g. Preparation of Contractor's punch list
 - h. Procedures for processing Applications for Payment at Substantial Completion and for final payment
 - i. Submittal procedures
 - j. Owner's partial occupancy requirements
 - k. Installation of Owner's furniture, fixtures, and equipment
 - l. Responsibility for removing temporary facilities and controls
 - 4. Minutes: Entity conducting meeting will record and distribute meeting minutes.
- E. Progress Meetings: Conduct progress meetings at weekly intervals.
 - 1. Attendees: In addition to representatives of Owner, Owner's Commissioning Authority, and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities 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.
 - 2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. 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.
 - 1) Review schedule for next period.
 - b. Review present and future needs of each entity present, including the following:
 - 1) Interface requirements
 - 2) Sequence of operations
 - 3) Status of submittals
 - 4) Deliveries

- 5) Off-site fabrication
 - 6) Access
 - 7) Site utilization
 - 8) Temporary facilities and controls
 - 9) Progress cleaning
 - 10) Quality and work standards
 - 11) Status of correction of deficient items
 - 12) Field observations
 - 13) Status of RFI
 - 14) Status of supplemental instructions
 - 15) Status of proposal requests
 - 16) Pending changes
 - 17) Status of Allowance Expenditure Authorizations (AEA) and allowance balances
 - 18) Status of Change Orders
 - 19) Pending claims and disputes
 - 20) Documentation of information for payment requests
3. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.

2 PRODUCTS (NOT USED)**3 EXECUTION (NOT USED)****END OF SECTION 01 31 00**

SECTION 01 31 29

NOTIFICATION OF ARCHITECT REQUIREMENTS

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, 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 NOTIFICATION OF ARCHITECT REQUIREMENTS - GENERAL

- A. In general, the Contractor shall notify the Architect and / or Architect's Consultants whenever there is need of clarification of interpretation of the Contract Documents.
- B. Additionally, the Contractor shall notify the Architect and / or Architect's Consultants at specific phases of the Work in order to observe work in progress.
- C. The Project Superintendent shall notify the Architect's and Consultant's Field Representative on a regular basis of the ongoing work.

2 NOTIFICATIONS

2.1 NOTIFICATIONS

- A. The Contractor shall notify the Architect and / or Architect's Consultant a minimum 48 hours in advance of certain stages of construction to observe and verify work is being installed in accordance with the Contract Documents.
 - 1. Notification shall be sent by email or other written means.
 - 2. For notices less than 48 hours in advance, Architect / Consultant shall endeavor to accommodate the request; however, Contractor assumes all responsibility for schedule delays resulting from untimely notification.
- B. These stages shall include, but not necessarily be limited to the following:
 - 1. 01 50 00 – Mobilization
 - 2. 02 41 XX – Start of full or partial demolition.
 - 3. 31 11 00 - Clearing of site / Stripping of top soil
 - 4. 31 20 00 - Placing of each lift of select fill material
 - 5. 31 23 33, Div. 22, Div. 26 – Installation and cover of underground utilities.
 - 6. 03 30 00 – Installation of drilled footings
 - 7. 03 30 00 – Excavation of grade beams
 - 8. 03 30 00 - Placing of all concrete
 - 9. 03 47 13 – Raising concrete tilt-wall panels.
 - 10. 03 52 16 – Installation of lightweight insulating concrete
 - 11. 04 20 00 - Installation of concrete masonry units.
 - 12. 04 20 00 – Installation of masonry veneer
 - 13. 05 12 00 – Completion of structural steel erection.
 - 14. 05 31 00 – Installation of metal decking.
 - 15. 07 11 13 – Installation of dampproofing
 - 16. 07 21 00 – Installation and concealment of insulation
 - 17. Div. 07 – Installation of roofing.
 - 18. 07 62 XX – Installation and concealment of sheet metal work / flashing
 - 19. 07 65 26 – Installation of self-adhered sheet flashing.
 - 20. 07 92 00 - Installation of building and glazing sealants.
 - 21. 08 11 13 – Installation of hollow metal frames.

22. 08 80 00 – Installation of exterior glazing framing and glass.
 23. 09 21 13 – Installation of plaster assemblies.
 24. 09 51 13 - Installation of ceiling grid.
 25. Div. 09 - Installation of each type of finish flooring.
 26. 09 91 00 - Painting and staining - each coat.
 27. 10 73 26 - Installation of walkway covers.
 28. 11 40 00 – Installation of Food Service Equipment; also notify Food Service Consultant.
 29. Div. 22 - Completion of plumbing rough-in.
 30. Div. 22 - Installation of plumbing fixtures
 31. Div. 23 - Installation of HVAC equipment
 32. Div. 23 - Completion of rigid duct installation
 33. Div. 26 - Completion of electrical rough-in
 34. Div. 26 - Installation of all electrical fixtures
 35. Any and all testing specified for equipment, mechanical, electrical and plumbing systems.
- C. In addition to notifying the Architect, the General Contractor shall also notify the Civil Engineer prior to the following stages:
1. Installation and cover of underground site utilities.
 2. Installation and cover of manholes and other drainage structures.
- D. In addition to notifying the Architect, the General Contractor shall also notify the Structural Engineer prior to the following stages:
1. Installation of drilled footings
 2. Pouring of grade beams
 3. Placing of all building concrete
 4. Structural steel framing completion
- E. In addition to notifying the Architect, the General Contractor shall also notify the MEP Engineer prior to the following stages:
1. Installation of underground service ductbank(s)
 2. Installation and cover of underground site electrical.
 3. Installation of ceiling grid and cover-up.
 4. Completion of plumbing rough-in.
 5. Installation of plumbing fixtures
 6. Installation of HVAC equipment
 7. Completion of rigid duct installation
 8. Completion of electrical rough-in
 9. Installation of all electrical fixtures
 10. Any and all testing specified for equipment, mechanical, electrical and plumbing systems.
 11. Refer to MEP specifications for additional information and requirements.
- F. In addition to the above requirements, Architect and Consultant(s) shall be notified of all equipment testing, startup procedures, and Owner demonstrations / training sessions.

END OF SECTION 01 31 29

SECTION 01 32 16

CONSTRUCTION PROGRESS SCHEDULE

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, 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 SUMMARY

- A. Section includes administrative and procedural requirements for the Contractor's construction schedule.
- B. Related Requirements
 - 1. Section 01 11 00, Summary of Work
 - 2. Section 01 33 00, Submittal Procedures

1.3 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
 - 1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
 - 2. Predecessor Activity: An activity that precedes another activity in the network.
 - 3. Successor Activity: An activity that follows another activity in the network.

1.4 INFORMATIONAL SUBMITTALS

- A. Format for Submittals: Submit required submittals in the following format:
 - 1. Working electronic copy of schedule file, where indicated.
 - 2. PDF electronic file
 - 3. Two paper copies
- B. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.

1.5 COORDINATION

- A. Coordinate Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, payment requests, and other required schedules and reports.
 - 1. Secure time commitments for performing critical elements of the Work from entities involved.
 - 2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

2 PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. Time Frame: Extend schedule from date established for the Notice to Proceed to date of final completion.
 - 1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
- B. Activities: Treat each story or separate area as a separate numbered activity for each main element of the Work. Comply with the following:

1. Activity Duration: Define activities so no activity is longer than 15 days, unless specifically allowed by Architect.
 2. Procurement Activities: Include procurement process activities for long lead items and major items, requiring a cycle of more than 45 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
 3. Submittal Review Time: Include review and resubmittal times indicated in Section 01 33 00, Submittal Procedures, in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
 4. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
 5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
 6. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.
- C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
1. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Section 01 10 00, Summary. Delivery dates indicated stipulate the earliest possible delivery date.
 2. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
 - a. Subcontract awards
 - b. Submittals
 - c. Purchases
 - d. Mockups
 - e. Fabrication
 - f. Sample testing
 - g. Deliveries
 - h. Installation
 - i. Tests and inspections
 - j. Adjusting
 - k. Curing
 3. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:
 - a. Structural completion
 - b. Temporary enclosure and space conditioning
 - c. Permanent space enclosure
 - d. Completion of mechanical installation
 - e. Completion of electrical installation
 - f. Substantial Completion
- D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion.
- E. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
1. Unresolved issues
 2. Unanswered Requests for Information
 3. Rejected or unreturned submittals
 4. Notations on returned submittals
 5. Pending modifications affecting the Work and Contract Time

- F. Recovery Schedule: When periodic update indicates the Work is 15 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.
- G. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE (GANTT CHART)

- A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's construction schedule within 30 days of date established for the Notice to Proceed. Base schedule on the startup construction schedule and additional information received since the start of Project.
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.
 - 1. For construction activities that require three months or longer to complete, indicate an estimated completion percentage in 20 percent increments within time bar.

3 EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue updated schedules 48 hours before each regularly scheduled progress meeting.
 - 1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
 - 2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
 - 3. As the Work progresses, indicate final completion percentage for each activity.
- B. Distribution: Distribute copies of approved schedule to Architect, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
 - 1. Post copies in Project meeting rooms and temporary field offices.
 - 2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 01 32 16

SECTION 01 33 00

SUBMITTAL PROCEDURES

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, 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 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 Requirements:
 - 1. Section 01 29 00, Payment Procedures
 - 2. Section 01 32 16, Construction Progress Schedule
 - 3. Section 01 78 23, Operation and Maintenance Data
 - 4. Section 01 78 39, Project Record Documents
 - 5. Section 01 79 00, Demonstration and Training

1.3 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Architect'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 do 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. 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 revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.
 - 1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
 - 2. Submit concurrently with Contractor's construction schedule. Highlight those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
 - 3. Arrange scheduled date for first submittal, Specification Section number and title, Submittal category (action or informational), name of subcontractor, description of the Work covered, scheduled date for Architect's final release or approval, scheduled date of fabrication, scheduled dates for purchasing, and scheduled dates for installation in a tabular format.

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Architect will make available to the Contractor one set of digital data drawing files of the Contract Drawings for use in preparing submittals and Project record drawings.

1. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
2. Digital Drawing Software Program: The Contract Drawings are available in Autodesk Revit.
3. Contractor shall execute a data licensing agreement in the form of, Agreement form acceptable to Owner and Architect.
- B. 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, informational submittals, and samples 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. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
 5. Submit all action submittals and samples requiring selection of colors by the Architect in adequate time to allow preparation of a complete selection schedule. Generally, all submittals requiring color selection shall be submitted within four weeks of receipt of the Notice to Proceed.
- C. Processing Time: Allow time for submittal review, including time for resubmittals. 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 30 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 21 days for review of each resubmittal.
 4. Sequential Review: Where sequential review of submittals by Owner, or other parties is required, allow 30 days for initial review of each submittal.
 5. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 30 days for review of each submittal. Submittal will be returned to Architect before being returned to Contractor.
- D. Assign a unique Submittal number to each Submittal.
- E. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:
 1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
 2. Name file with submittal number or other unique identifier, including revision identifier.
 3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.
 4. Transmittal Form for Electronic Submittals: Use form acceptable to Owner, containing Project name, date, destination (To:), source (From:), name and address of Architect, name of Contractor, Specification Section number and title, submittal and transmittal distribution record, and remarks.
- F. Options: Identify options requiring selection by Architect.

- G. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.
- H. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
- I. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- J. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

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. Submit electronic submittals via email as PDF electronic files.
 - a. Where review of submittal by Architect's consultant is indicated (e.g., hardware, casework, structural, HVAC, electrical, plumbing, food service equipment, and utilities), address the email to the consultant and include Architect on the distribution list.
 - b. Architect will return annotated file when review is complete.
 - c. Annotate and retain one copy of file as an electronic Project record document file.
 - 2. 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.
 - 3. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
 - a. 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.
 - b. Mark each copy of each submittal to show which products and options are applicable.
 - c. Include manufacturer's catalog cuts, manufacturer's product specifications, standard color charts, statement of compliance with specified referenced standards, testing by recognized testing agency, application of testing agency labels and seals, and notation of coordination requirements as applicable:
 - d. For equipment, include wiring diagrams showing factory-installed wiring, printed performance curves, operational range diagrams, and clearances required to other construction (if not indicated on accompanying Shop Drawings) in addition to the above, as applicable.
 - e. Submit Product Data before or concurrent with Samples.
- B. 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.
 - 1. Preparation: Fully illustrate requirements in the Contract Documents. Include identification of products, schedules, compliance with specified standards, notation of coordination requirements, notation of dimensions established by field measurement, relationship and attachment to adjoining construction clearly indicated, and seal and signature of professional engineer if specified as applicable.
 - 2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8½ by 11 inches, but no larger than 30 by 42 inches.
- C. 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 generic description of Sample, product name and name of manufacturer, sample source, number and title of applicable Specification Section, and Specification paragraph number and generic name of each item.
3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
4. 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 that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in undamaged condition at time of use.
 - b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
5. 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 three full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line.
6. 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. Samples include, but are not limited to partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
 - a. Number of Samples: Submit three sets of Samples. Architect will retain two 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.
- D. Coordination Drawing Submittals: Comply with requirements specified in Section 01 31 00, Project Management and Coordination.
- E. Contractor's Construction Schedule: Comply with requirements specified in Section 01 32 00, Construction Progress Documentation.
- F. Application for Payment and Schedule of Values: Comply with requirements specified in Section 01 29 00, Payment Procedures.
- G. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 01 77 00, Closeout Procedures.
- H. Maintenance Data: Comply with requirements specified in Section 01 78 23, Operation and Maintenance Data.

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.

- B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit PDF electronic file 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.

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. Project Closeout and Maintenance Material Submittals: See requirements in Section 01 77 00, Closeout Procedures.
- C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include 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'S ACTION

- A. Action Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.
- B. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.
- C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.
- D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- E. Submittals not required by the Contract Documents may be returned by the Architect without action.

3.3 CLAIM NOTIFICATION

- A. If the submitter or contractor issues submittals for which an additional cost is anticipated, the submittal must clearly indicate such cost including all supporting information.
 - 1. Lack of accompanying cost information known at the time of the original submittals shall be grounds for disallowance of such cost.
- B. Upon return of submittal(s) to the originator of the submittal(s), the submitter shall thoroughly review all mark-ups and / or comments prior to proceeding with the work.
- C. Based on the mark-ups and / or comments returned, the submitter shall have fifteen (15) calendar days to submit a claim notification for additional costs the submitter may feel is warranted by the mark-ups / and or comments of the Architect or Consultant.
 - 1. The fifteen (15) calendar day period shall commence upon Contractor's receipt of the submittal from the Architect.
- D. In the absence of any claim notification within the specified time period, it shall be agreed the submitter shall provide the work in accordance with the Contract Documents and the reviewed submittal at no additional cost.
- E. In the event a claim notification is submitted to the general contractor / construction manager, submittal the submittal process shall not be complete until all such claim notifications have been fully resolved.

END OF SECTION 01 33 00

SECTION 01 35 23

CONTRACTOR SITE RULES

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, 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 CONTRACTOR SITE RULES

- A. Streets are to be kept clean at all times.
- B. No foul language or spitting on floor.
- C. No tobacco products on school property.
- D. The possession or use of alcohol or illegal drugs is strictly prohibited.
- E. No shorts or tank tops – workers must be fully clothed.
- F. No workers with a history of felony convictions or warrants.
- G. No parking on grass, under shade trees, sidewalks or non-vehicular paved areas.
- H. Contractor's employees, Subcontractors and their agents and employees working on any District facility must wear picture identification with the company name. Any exceptions must be approved in advance with the designated District representative.
- I. Keep the premises free from accumulation of waste, materials or rubbish caused by the work under this contract at each site. Boxes must be broken down prior to removal from the building. Upon completion of the work, and prior to the final inspection, have the premises in a neat and clean condition at all times. Clean Project facility and exterior of debris on a daily basis.
- J. Take all precautions necessary for the safety of, and provide protection to prevent damage, injury or loss to:
 - 1. All employees on the project and all other persons who may be affected thereby.
 - 2. All the work and all materials to be incorporated therein, whether in storage on or off the site.
 - 3. All property at the site and adjacent thereto including trees, shrubs, lawns, walks, pavements, roadways, structures, utilities and any other school property.
- K. Any work that may interfere with school activities must be authorized in advance through District representative. A management plan will be devised to minimize the effect of the interference.
- L. Doors must not be propped open when working after-hours.
- M. Do not talk with any school personnel or students. Talk only with personnel directly associated with the project.

END OF SECTION 01 35 23

SECTION 01 35 26

TRENCH SAFETY SYSTEMS

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, 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 SUMMARY

- A. Section includes all material, equipment and labor to ensure the safety and health of workers in any trench or excavation on this project.
- B. Related Requirements
 - 1. Section 03 30 00, Cast-in-Place Concrete
 - 2. Section 31 20 00, Earth Moving

1.3 REFERENCES

- A. The standards and drawings included herein have been promulgated by the U.S. Department of Labor Occupational Safety and Health Administration (OSHA) and are minimum standards for the contractor's reference and information.
- B. Recognizing that the contractor shall be solely responsible for and have control over construction means, methods, techniques and sequences and procedures at the site, the contractor shall adhere to these minimum standards and any revision or additional requirement which may be published by OSHA or the local political subdivision of the state of Texas during the period of construction.
- C. Refer to construction industry standards OSHA 220-revised February, 1983. Part 1926-Occupational Safety and Health Standards, subpart P - Excavating, Trenching and Shoring are reprinted herein for reference. Refer to Excavating and Trenching operations OSHA 2226 dated July 1975.
- D. According to the OSHA construction safety and health standards "a trench is referred to as a narrow excavation in which the depth is greater than the width, although the width is not greater than 15 feet. An excavation is any man made cavity or depression in the earth's surface. This can include excavation for anything from cellars to highways."
- E. For additional definitions, refer to paragraph 1926.653 of the above referenced OSHA Standards.
- F. Texas Health and Safety Code, Chapter 161, Subchapter Q, Installation of Asbestos
- G. Texas Occupations Code, Chapter 1954, Asbestos Health Protection

1.4 INFORMATIONAL SUBMITTALS

- A. When a trench safety system other than that indicated is used, the Contractor shall provide a certificate signed and sealed by a Registered Professional Engineer, licensed in the State of Texas. The certificate shall state that the system is designed in conformance with the appropriate OSHA standards and the applicable specifications required by this item. If the Contractor elects to provide a trench safety system different than that indicated, he shall provide drawings demonstrating the system as well as the location where the system will be installed. These drawings shall be provided prior to commencing work.
- B. State law requires that a pay item be established for trench safety systems. The Contractor shall show a separate pay item for trench safety systems on the Bid Form, the Schedule of Values and Application for Payment.
- C. Submit Material Safety and Data Sheet (MSDS) for all materials, products, and parts.

1.5 QUALITY INSURANCE

- A. General Protection requirements, as a minimum, shall conform to paragraph 1926.650 of the above referenced OSHA Standards.
- B. Specific excavation requirements apply to all excavations and, as a minimum, shall conform to paragraph 1926.651 of the above referenced OSHA Standards. Specific trenching requirements apply to all trenching and as a minimum shall conform to paragraph 1926.652 of the above referenced OSHA Standards.
- C. The Contractor shall designate a competent employee who shall be responsible for inspecting all trenching and excavations after every rainstorm or other hazard increasing occurrence and the protection against slides and cave-ins shall be increased if necessary.

1.6 INDEMINIFICATION

- A. The Contractor shall indemnify and hold harmless the Owner, its Consultants, employees and agents, from any and all damages, costs (including, without limitation, legal fees, court costs, and the cost of investigation), judgements or claims by anyone for injury or death of persons resulting from the collapse or failure of trenches constructed under this Contract.
- B. The Contractor acknowledges and agrees that this indemnity provision provides indemnity for the Owner in case the Owner is negligent either by act of omission in providing for trench safety, including, but not limited to inspections, failure to issue stop work orders, and the hiring of the Contractor.

2 PRODUCTS

- 2.1 Materials used for sheeting, sheet piling, cribbing, bracing, shoring, underpinning, and other structural retaining systems shall be in good serviceable condition, of good quality, of a suitable condition and grade to perform the intended use. Wood shall be sound, free from large or loose knots, and of the proper dimensions. The Contractor shall be responsible for maintaining the systems in a manner consistent with the intended design and in a manner that will prevent exposure of works to hazards.

3 EXECUTION**3.1 GENERAL SAFETY REQUIREMENTS**

- A. The work area shall be kept free of hazards to the employees. All surface encumbrances, which may create a hazard, shall be removed, supported or otherwise isolated as necessary to safeguard employees.
- B. The Contractor shall take special precautions to locate existing utilities and to protect those systems as required. The Contractor shall call the Utility Coordinating Committee as required 24 hours prior to excavating around existing utilities.
- C. The Contractor shall provide safe access and egress to excavations. Ramps or stairways shall be structurally sound and capable of providing a safe means of escape from the excavation. Trenches in excess of four feet in depth shall have a safe means of egress from the trench spaced such that no more than 25 feet of lateral travel would be required to reach the egress system.
- D. The employees shall be protected from work place hazards such as vehicular traffic, falling loads, and hazardous atmosphere. Excavations shall be marked so that employees and equipment are clearly warned of the location of the excavations. Trenches shall be kept free of water accumulation such that it would present a hazard to employees. Adjacent structures shall be stabilized as necessary so as not to present a possible hazard to the employees. Equipment shall be kept sufficiently clear of excavations so as not to create a potential overburden stress to trench walls causing cave-ins. Safe access shall be provided with handrails where access over trenches is required.
- E. Emergency rescue equipment as required by OSHA shall be readily available at the site and shall be maintained to good working condition.

- F. Daily inspections of excavations, the adjacent areas, and the protective systems shall be made by a person or persons competent to make such inspections to keep the Contractor notified of unsafe conditions so that necessary precautionary action can be taken.

3.2 TRENCH WALL LAYBACK

A. General

1. In areas where no pavement or other structural elements are to be constructed, the sides of the trenches over five (5) feet deep may be sloped to provide protection from cave ins. If written approval is given by the Owner, trenches beneath pavement or other structures may also be laid back. Backfill for laid back trenches shall be as provided for a vertical wall trench for the full width of the excavation.

B. Layback Slope Requirements

1. The Contractor shall be responsible for providing the proper lay back slopes for all soil conditions encountered. Where soils data is provided for the Contractor's use, that information is intended as a sampling of the types of soil materials that may be encountered. However, the Contractor shall be diligent in observing the actual soil conditions as his work proceeds and shall be responsible for providing a safety system adequate to meet the minimum standards for the actual types of soils encountered. Special precautions shall be taken to monitor conditions when working in fill areas, areas subject to surcharge and areas exposed to vibrations from nearby equipment and machinery.
2. At the Contractors option where a layback trench system is approved for use, the Contractor may layback the sides of the trench at a slope of one and one-half (1½) feet horizontal to one (1) foot vertical without testing for the soil stability. When this method is used, it does not preclude the removal of unsuitable materials encountered and replacement with suitable materials. This method shall not be used in unsuitable soils such as wet sands, silts, and peat or in other areas which require special procedures, equipment and materials.
3. The Contractor may engage a competent person in the means of soil classification to determine the soil classification as a means of reducing the trench wall slopes. Layback slopes may be sloped up to the maximum allowable slopes as follows for the given types of soil.

MAXIMUM ALLOWABLE SLOPES

Soil Materials

For Excavations Less than 20 Feet Deep [3] Slope H:V

Stable Rock	Vertical (90°)
Type A-[2]	¾:1 (53°)
Type B	1:1 (45°)
Type C	1½:1 (34°)

Notes:

- a. Numbers shown in parentheses next to maximum allowable slopes are angles expressed in degrees from the horizontal. Angles have been rounded off.
 - b. A short-term maximum allowable slope of 1/2H:1V (63°) is allowed in excavations in Type A soil that are 12 feet (3.67 m) or less in depth. Short-term maximum allowable slopes for excavations greater than 12 feet (3.67 m) in depth shall be 3/4H:1V (53°).
 - c. A registered professional engineer shall design sloping or benching for excavations greater than 20 feet deep.
4. The types of soil given in paragraph 3.02 A3. are defined as follows:
- a. Stable Rock - Natural solid mineral matter that can be excavated with vertical sides and remain in tract while exposed.
 - b. Type A - Cohesive soils with an unconfined compressive strength of 1.5 tons per square foot or greater. Examples of cohesive soils are: clay, silty clay, sandy clay, clay loam and in some cases, silty clay loam and sandy clay loam cemented soils such a caliche and hard pan are also considered Type A. However, no soil is Type A if:
 - 1) The soil is fissured.
 - 2) The soil is subject to vibration from heavy traffic, piling driving, or similar effects.

- 3) The soil has been previously disturbed.
- 4) The soil is part of a sloped, layered system where the layers dip into the excavation on a slope of four horizontals to one vertical or greater.
- 5) The soil is subject to other factors that would require it to be classified as a less stable material.
- c. Type B - Soil that meets one of the following:
 - 1) Cohesive soil with an unconfined compressive strength greater than 0.5 tons per square foot, but less than 1.5 tons per square foot.
 - 2) Granular cohesionless soils including: angular gravel, silt, silt loam, sandy loam and in some cases, silty clay loam and sandy clay loam.
 - 3) Previously disturbed soils except those which would otherwise be classified as Type C soil.
 - 4) Soil that meets the unconfined compressive strength or cementation requirements for Type A, but is fissured or subject to vibration.
 - 5) Dry rock that is not stable.
 - 6) Material that is part of a sloped, layered system where the layers dip into the excavation on a slope less steep than four horizontal to one vertical, but only if the soil would otherwise be classified as Type B.
- d. Type C - Soil that meets one of the following:
 - 1) Cohesive soil with an unconfined compressive strength of 0.5 tons per square foot or less.
 - 2) Granular soils including: gravel, sand and loamy sand.
 - 3) Saturated or submerged soil.
 - 4) Submerged rock that is not stable.
 - 5) Soil in a sloped, layered system where the layers dip into the excavation on a slope of four horizontal to one vertical or greater.
5. Unconfined compressible strength shall mean the load per unit area at which a soil will fail in compression. It can be determined by laboratory testing, estimated in the field using a pocket penetrometer, or other previously approved method.
6. Wet soil shall mean soil that contains significantly more moisture than moist soil, but in such a range of values that cohesive material will slump or begin to flow when vibrated. Granular material that would exhibit cohesive properties when moist will lose those cohesive properties when wet.
7. Layered systems shall be classified in accordance with its weakest layer; however, each layer may be classified individually where a more stable layer lies under a less stable layer.
8. Previously classified material whose properties, factors, or conditions affecting its classification change in any way shall be reclassified as necessary as changes to the trench shall be accomplished before continuing any work in or near the trench where there may be potential danger to workers due to trench failure.
9. The slope of a laid back trench wall shall be less steep than the maximum allowable slope when there are signs of distress. The maximum allowable slope for a material in distress shall be 1/2 horizontal to one vertical less steep than the maximum allowable slope for the material in a non-distressed condition. Distress shall mean a condition in which a cave-in is imminent or likely to occur.
10. When surcharge loads from adjacent structures, stored material or equipment, operating equipment, or traffic are present, a competent person shall determine the degree to which the actual slope must be reduced below the maximum allowable slope, and shall assure that such a reduction is achieved.
11. An adequate means of exit such as a ladder or steps shall be provided and located so as to require no more than 25 feet of lateral travel.

3.3 TIMBER SHORING**A. General**

1. Timber shoring may be used as a means of trench protection from cave-ins in trenches that do not exceed 20 feet in depth. The timber shoring system may be used in lieu of sloping and benching systems, or in conjunction with those systems. Good judgment shall be used by the Contractor in selecting the proper system when alternative designs are given.

B. Soil Classification

1. The timber shoring systems designs are subject to soil classifications outlined in 3.02-B of this section. Classification shall be conducted by a competent person using the proper means and methods of classification described in this section.

C. Basis And Limitations**1. Dimension of Timber Members**

- a. The sizes of the timber members shown in the details are taken from the National Bureau of Standards (NBS) report, "Recommended Technical Provisions for Construction Practice in Shoring and Sloping of Trenches and Excavations." In addition where NBS did not recommend specific sizes for members, member sizes are based upon an analysis of the sizes required for use by existing codes and an empirical practice.
- b. The required dimensions of the members listed in the tables refer to actual dimensions and not nominal dimensions of the timber.

2. Limitation of Application

- a. It is not intended that the timber shoring specification apply to every situation that may be experienced in the field. These data were developed to apply to situations that are anticipated to be present at the site. Where the system provided does not meet the requirement of the actual conditions in the field, the Contractor shall either notify the Owner of the situation and present an engineered solution designed and sealed by the Registered Professional Engineer, or shall notify the Owner of the unanticipated conditions and await instructions.
- b. When any of the following conditions are present, the members specified and shown in the details are not considered adequate.
 - 1) When loads imposed by structures or by stored material adjacent to the trench weigh in excess of the load imposed by a two foot soil surcharge. Adjacent shall mean the area within a horizontal distance from the edge of the trench equal to the depth of the trench.
 - 2) When vertical loads imposed on crossbraces exceed a 240 pound gravity load distributed on a one foot section of the center of the crossbrace.
 - 3) When surcharge loads are present from equipment weighing in excess of 20,000 pounds.
 - 4) When only the lower portion of a trench is shored and the remaining portion of the trench is sloped or benched unless:
 - a) The sloped portion is sloped at an angle less steep than 3H:1V;
 - b) The members are selected from the tables based upon the total trench depth from the top of the overall trench and not the toe of the slope.
3. Cross braces or trench jacks shall be placed in true horizontal position, be spaced vertically, and be secured to prevent sliding, falling or kickouts.
4. Backfilling and removal of trench supports shall progress together from the bottom of the trench. Jacks or braces shall be released slowly and, in unstable soil, ropes shall be used to pull out the jacks or braces from above after employees have cleared the trench.
5. An adequate means of exit shall be provided such as a ladder or steps and shall be located so as to require no more than 25 feet of lateral travel.
6. Where necessary due to wet soils or other similar conditions, the shoring system shall use tight sheeting such that material is contained behind the sheeting.

3.4 ALTERNATIVE SHORING SYSTEMS

- A. Alternative shoring systems may be used when approved by the Owner. Steel, aluminum or other approved materials may be used in lieu of wood for shoring where the system is designed, constructed and maintained in a manner that will give equal to or greater protection than the wood system.
- B. Sheet Piling
 - 1. Sheet piling may be used when approved by the Owner to shore the sides of the trench. Sheet piles shall be removed at the completion of the work unless otherwise directed by the Owner. When piling is to remain, the piling shall be cut off at least three feet from the top of the excavation. The sheet piling system shall be designed by a Registered Professional Engineer and shall provide equal or greater protection than the specified wood shoring system. The Owner shall approve materials for the piling.
- C. Trench Boxes
 - 1. Trench boxes that provide equal or greater protection as the specified wood shoring system may be used. The Contractor shall be responsible for insuring the adequacy, maintenance, and design of the trench box used. The Contractor shall also be responsible for the proper use and operation of the trench box.
- D. Shield Systems
 - 1. General
 - a. Shield systems shall not be subjected to loads exceeding those which the system was designed to withstand.
 - b. Shields shall be installed in a manner to restrict lateral or other hazardous movement of the shield in the event of the application of sudden lateral loads.
 - c. Workers shall be protected from the hazard of cave-ins when entering or exiting the areas protected by shields.
 - d. Workers shall not be allowed in shields when shields are being installed, removed, or relocated.
 - 2. Excavations of earth material to a level not greater than two feet below the bottom of a shield shall be permitted, but only if the shield is designed to resist the forces calculated for the full depth of the trench and there are no indications while the trench is open of a possible cave-in below the bottom of the shield.
 - 3. Use of shields shall be subject to approval by the Owner.

END OF SECTION 01 35 26

SECTION 01 42 13

ABBREVIATIONS AND ACRONYMS

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, 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 TYPICAL TRADE ORGANIZATION AND INDUSTRY ABBREVIATIONS

Acoustical Society of America.....	ASA
Adhesive & Sealant Council, Inc.	ASC
Air Conditioning & Refrigeration Institute	ARI
Aluminum Association	AA
American Association of State Highway Officials	AASHTO
American Concrete Institute	ACI
American Council of Independent Laboratories	ACIL
American Hardboard Association	AHA
American Hotdip Galvanizers Association.....	AHGA
American Institute of Architects	AIA
American Institute of Steel Constructors	AISC
American Institute of Timber Construction	AITC
American Iron & Steel Institute	AISI
American National Standards Institute, Inc.	ANSI
American Plywood Association	APA
American Society for Testing & Material	ASTM
American Society of Civil Engineers	ASCE
American Society of Heating, Refrigeration and Air Conditioning Engineers	ASHRAE
American Society of Mechanical Engineers	ASME
American Subcontractors Association.....	ASA
American Woodworking Institute	AWI
American Welding Society	AWS
American Wood Preserver's Institute	ASPI
Architectural Aluminum Manufacturers Association.....	AAMA
Architectural Woodwork Institute	AWI
Asphalt Institute	AI
Associated General Contractors of America	AGC
Brick Institute of America	BIA
Building Research Institute	BRI
California Redwood Association	CRA
Chain Link Fence Manufacturers Institute.....	CLFM
Concrete Reinforcing Steel Institute	CRSI
Construction Specification Institute	CSI
Door and Hardware Institute	DHI
Facing Tile Institute	FTI
Federal Specifications	FS
Flat Glass Marketing Association	FGMA
Gypsum Association	GA

Hardwood Plywood Manufacturers Association	HPMA
International Conference of Building Officials	ICBO
Joint Sealer Manufacturers Association	JSMA
Maple Flooring Manufacturers Association	MFMA
Metal Lath Association	MLA
National Association of Architectural Metal Manufacturers.....	NAAMM
National Association of Mirror Manufacturers	NAMM
National Bureau of Lathing & Plastering	NBLP
National Clay Pipe Institute	NCPI
National Concrete Masonry Association	NCMA
National Electrical Manufacturers Association	NEMA
National Environmental Systems Contractors	NESC
National Fire Protection Association	NFPA
National Forest Products Association	NFPA
National Hardware Lumber Association	NHLA
National Ornamental Metal Manufacturers Association	NOMMA
National Paint, Varnish and Lacquer Association	NPVLA
National Ready Mixed Concrete Association	NRMCA
National Roofing Contractors Association	NRCA
National Society of Professional Engineers	NSPE
National Woodwork Manufacturers Association, Inc.	NWMA
Painting and Decorating Contractors of America	PDCA
Perlite Institute, Inc.	PI
Portland Cement Association.....	PCA
Resilient Floor Covering Institute	RFCI
Rubber and Vinyl Floor Council	RVFC
Southern Building Code Congress	SBC
Southern Forest Products Association	SFPA
Southern Hardwood Lumber Manufacturing Association	SHLMA
Steel Deck Institute	SDI
Steel Door Institute	SDI
Steel Joist Institute	SJI
Steel Structures Painting Council	SSPC
Texas Accessibility Standards.....	TAS
Tile Council of America, Inc.	TCA
Underwriter's Laboratories, Inc.	UL
Venetian Blind Institute	VBI
Vinyl Fabrics Institute	VFI
West Coast Lumber Inspection Bureau	WCLIB
Western Red Cedar Lumber Association	WRCLA
Western Wood Products Association.....	WWPA

1.3 TYPICAL CONTRACT DOCUMENT ABBREVIATIONS

Acoustical	ACOUST
Air Handling Unit	AHU
Alternate.....	ALT
Aluminum A	LUM
Bottom	BOT
Building	BLDG
Carpet	CPT
Cast-In-Place	CIP

Centerline	CL
Ceramic Tile	CT or CER TILE
Classroom	CR
Concrete	CONC
Concrete Masonry Unit	CMU
Continuous	CONT
Corridor	CORR
Diameter	DIA
Dimension(s)	DIM or DIMS
Door	DR
Each	EA
Electrical	ELECT
Elevation	ELEV
Equal	EQ
Existing	EX or EXIST
Expansion Joint	EJ or EXP JT
Exterior	EXT
Floor	FL
Floor Drain	FD
Finish or Finished	FIN
Finish Floor	FF or FIN FL
Fixture	FIXT
Floor	FL
Flowline	FL
Frame	FR
Galvanized	GALV
Gauge	GA
General Contractor	GC
Grade	GR
Gypsum Board	GYP BD
Handicap	HC
Hardware	HW
Height	HT
Hollow Metal	HM
Hot Dipped Galvanized	HD GALV
Inside Diameter	ID
Insulation	INSUL
Interior	INT
Lavatory	LAV
Light	LT
Manhole	MH
Manufacturer	MFGR or MFR
Marmoleum Composition Tile	MCT
Markerboard	MB
Masonry	MAS
Material	MATL
Match Existing	ME
Maximum	MAX
Metal	MTL
Minimum	MIN
Not in Contract / Work by Others	NIC
Office	OFF

On Center	OC
Outside Diameter	OD
Overflow Drain	OD
Paint	PT, PB-X, or PA-X
Plastic Laminate	PLAM, PL, or PLAST LAM
Radius	RAD
Reflected Ceiling Plan	RCP
Reinforcing	REINF
Reinforced Concrete Pipe	RCP
Required	REQ
Refer	RE
Resilient Tile	RT
Restroom	RR
Roof Drain	RD
Room	RM
Rough Opening	RO
Sanitary Sewer	SAN SWR
Schedule.....	SCHED
Sidewalk	SW
Similar	SIM
Solid Core Plastic Laminate	SCPL
Space	SP
Stainless Steel	SS
Storage	STOR
Storm Sewer	STM SWR
Suspended Acoustical Ceiling	SAC
Tack Board	TB
Temporary Bench Mark	TBM
Thick	THK
Top of Curb	TC or TOC
Top of Grate	TG or TOG
Top of Steel	TS or TOS
Treated	TRTD
Typical	TYP
Urinal	URIN
Vinyl Enhanced Tile	VET
Vinyl Wall Covering	VWC
Water Closet	WC
Wood	WD

END OF SECTION 01 42 13

SECTION 01 45 23

TESTING AND INSPECTING SERVICES

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, 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 DESCRIPTION

- A. Refer to Section AB for substitutions.
- B. Materials Testing Laboratory:
 - 1. A testing lab to perform all material testing during the construction phase shall be selected by the Owner, and the Contractor shall be notified as soon as possible.
 - 2. All testing laboratory services shall be provided and paid for by the Owner outside of this Contract or by allowance amount inside this Contract.
 - 3. The Contractor shall allow in his proposal the coordination and supervision of tests to be performed by an independent laboratory selected by the Owner.
 - 4. The Contractor shall cooperate with the testing laboratory in all matters pertaining to the work. The Owner retains the option to add to or delete any or all testing specified herein.
- C. Contractor Inspections:
 - 1. Contractor shall be responsible for coordination, scheduling and cost of all governmental inspections required to obtain approval and issuance of the Certificate of Occupancy / Certificate of Compliance / or similar documentation allowing the Owner to fully occupy and use the building for its intended purpose.
 - 2. Provide other tests outside of government purview as specified.
 - 3. Coordinate with governmental agencies having jurisdiction as required to obtain all necessary inspection and approvals.
- D. Owner Inspections:
 - 1. The Owner shall provide required consultants to perform other testing and inspections as described.
 - 2. All such testing and inspections shall be paid for by the Owner.
 - 3. Testing and inspections include, but may not be limited to TDLR / TAS / ADA approvals, IECC compliance, and windstorm certification.
 - 4. Contractor shall coordinate and cooperate with Owner in regard to all Owner furnished testing and inspections.

1.3 RELATED REQUIREMENTS

- A. Conditions of the Contract: Inspections and testing required by laws, ordinances, rules, regulations, orders or approvals, or public authorities.
- B. Respective Sections of Specifications: Certification of products.
- C. Each Specification Section Listed: Laboratory test required and standards for testing.
- D. Testing laboratory inspection, sampling and testing is required for:
 - 1. Section 31 20 00 – Earth Moving
 - 2. Section 31 23 33 - Trenching and Backfilling
 - 3. Section 31 32 13.19 - Soil Stabilization
 - 4. Division 3 - Concrete
 - 5. Section 03 52 16 – Light Weight Insulating Concrete
 - 6. Section 04 20 00 - Unit Masonry
 - 7. Section 05 12 00 - Structural Steel Framing

8. Section 07 81 16 - Cementitious Fireproofing
9. Electrical, plumbing and mechanical tests required in relative sections.
10. As requested by the Owner or Architect

1.4 AUTHORITIES AND DUTIES OF THE TESTING LABORATORY

- A. The testing laboratory shall provide testing services under a separate agreement with the Owner or Architect, who shall be responsible for the costs of initial testing – pass or fail.
 1. The Contractor shall be responsible for costs of all re-tests required to achieve passing results.
 2. The Contractor shall be responsible for charges of the testing lab for expenses incurred for cancelled and / or mis-scheduled testing requests.
 3. The testing lab shall invoice Contractor direct for all re-tests of failed initial tests; and send copies of the invoices to the Architect and Owner for record.
 4. The testing lab and Contractor shall be responsible to negotiate and execute a separate agreement if required by the testing lab for charges described above.
- B. The laboratory is not authorized to revoke, alter, relax, enlarge, or release any requirement of the Specifications, or to approve or accept any portion of the work.
 1. When it appears that the material furnished or work performed by the Contractor fails to fulfill specification requirements, the testing laboratory shall promptly notify the Contractor, Architect and Owner of work being tested of such deficiencies.
- C. The laboratory shall promptly distribute copies of the laboratory test and inspection reports. Standard distribution shall include copies of all reports to the Owner, Architect, and Contractor.
 1. The structural engineer, civil engineer, MEP engineer, concrete supplier, and any outside consultants shall receive copies of the testing results regarding their particular phase of the project.
 2. Electronic distribution of test reports / results is mandatory.
- D. The testing lab is required to furnish a report of the status of testing performed as it relates to anticipated expenses described in the Agreement with the testing lab. Reports shall be furnished at most bi-monthly to the Owner and Architect.
 1. Report information shall include verification that Owner paid testing progress corresponds with anticipated expenses.
 2. The testing lab shall be required to notify the Architect and Owner immediately if / when the testing lab anticipates exceeding the lump sum fee agreed to by the Owner.
 3. Such notification must occur prior to expensing 75% of the testing lab fee.

1.5 TESTING LABORATORY CONTRACTUAL RELATIONSHIPS

- A. The Owner shall contract with the Testing Laboratory outside the Owner-Contractor Agreement.
- B. The Owner shall pay for the initial laboratory services / tests – pass or fail.
- C. In the case of a failed test that does not meet the specified requirements, the Contractor shall be responsible for payment directly to the Testing Laboratory for all services / re-testing required to achieve a passing result.
 1. The Owner shall not be invoiced for services or re-testing associated with failed initial tests.
- D. The Testing Laboratory is responsible for making separate arrangements with the Contractor for reimbursement of services or re-testing associated with failed initial tests.

1.6 TESTING LABORATORY GUIDELINES AND PROCEDURES

- A. Technicians scheduled to perform specific testing services must be qualified to review and perform other services that overlap (i.e., earthwork, foundation inspections, rebar inspection, and concrete), when scheduled concurrently at the project site.
- B. Technician time for services performed will be reimbursed at a regular time rate. Compensation at the overtime rate will be considered for any hours over eight hours spent at the job site on a single day, field testing services performed on a Saturday or Sunday, and any field services performed on a recognized holiday.
- C. In order to accurately document time on site, technicians are required to sign in and sign out on a testing log maintained by the Contractor.

- D. Concrete design mixes will receive a cursory review with any discrepancies reported to the Architect.
- E. Nuclear density testing will be based on a daily rental rate for the actual testing equipment; compensation on a per test basis will not be considered.
- F. Report distribution shall include the Owner, Architect, Contractor, Civil Engineer, Structural Engineer, and others requesting or requiring review of the specific testing results.
- G. Job site trips solely for cylinder pick-up shall be minimized. Whenever possible, cylinder / specimen pick-up shall be conducted when a technician is scheduled to be on-site for other testing work.
- H. Structural steel inspections shall include a plant visit reviewing shop fabrication, welding and an overall review of the shop fabrication quality control standards. Structural steel field inspection shall include a 100% visual review of all field fillet welds and initial frequency of 25% ultrasonic testing of full field penetration welds. There shall be 100% visual review of all bolted connections, and a minimum of two (2) bolts tested at every bolted connection.
- I. The Contractor shall bear the responsibility of scheduling all testing services. The Contractor and the testing laboratory shall assume full responsibility to coordinate the testing services. Cancellations and/or failed tests will be reimbursable to the Owner by the responsible party for the cancellation or failure of a test or service.

1.7 REFERENCE

- A. Earthwork
 - 1. ASTM D4318-10 – Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils
 - 2. ASTM D698 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort.
 - 3. ASTM D6938-10 – Standard Test Method for In-Place Density and Water Content of Soil-Aggregate by Nuclear Method (shallow Depth)
 - 4. AASHTO T89 - Determining the Liquid Limit of Soils
 - 5. AASHTO T90 - Determining the Plastic Limit and Plasticity Index of Soils
 - 6. AASHTO T99 - Moisture-Density Relations of Soils
- B. Concrete
 - 1. ASTM C 31/C 31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
 - 2. ASTM C 138, Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete.
 - 3. ASTM C 143 - Standard Test method for Slump of Hydraulic Cement Concrete.
 - 4. ASTM C 173 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
 - 5. ASTM C 231 - Standard Test method for Air Content of Freshly Mixed Concrete by the Pressure Method.
 - 6. ASTM C 1064 - Standard Test Method for Temperature of Freshly Mixed Hydraulic-Mixed Cement Concrete.
 - 7. ACI 301 – Specifications for Structural Concrete for Buildings.
- C. Masonry
 - 1. ASTM C780-12 – Standard Test Method for Preconstruction and Construction Evaluation for Plain and Reinforced Unit Masonry
 - 2. ASTM C109 / C109-11b - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (using 2 inch cube specimens).
 - 3. ASTM C1019 – Standard Test Method for Sampling and Testing Grout.
 - 4. ASTM C1314 – Standard Test Method for Compressive Strength of Masonry Prisms.
- D. Lightweight Insulating Concrete
 - 1. ASTM C495 – Standard Test Method for Compressive Strength of Lightweight Insulating Concrete.

1.8 TESTS CONDUCTED

- A. Earthwork:
 - 1. Existing subgrade under building slabs and paving: In-place density tests for each 2,500SF, or fraction thereof.
 - 2. Select earth fill at building pad: In-place density tests for each 2,500 SF, or fraction thereof, of each compacted lift.
 - a. Proctor curve for one type of fill material. If the original choice of material does not meet the specifications, the Contractor shall pay for additional testing.
 - b. Liquid limit of fill material.
 - c. Plastic limit and plasticity index of fill material.
 - 3. Perform moisture content tests for each 5,000 SF of building pad immediately prior to placement of under-slab vapor membrane.
 - 4. Earth fill at new paving: In-place density tests for each 4,000 SF, or fraction thereof, of each compacted lift.
 - a. Proctor curve for one type of fill material. If the original choice of material does not meet the specifications, the Contractor shall pay for additional testing.
 - b. Liquid limit of fill material.
 - c. Plastic limit and plasticity index of fill material.
 - 5. Trenching and Backfilling: In-place density tests for each 100 LF, or fraction thereof, of each compacted lift.
 - 6. Soil Stabilization: Various tests relative to the requirements of Texas Highway Department standard Specification for Construction of Highways, Streets and Bridges.
- B. Cast-In-Place Concrete:
 - 1. Review proposed concrete design mixes.
 - 2. Provide full time services for the review of all drilled pier excavation and placement of concrete.
 - a. Include a daily report noting grid lines and locations of each pier drilled.
 - b. After the drilled pier shaft has been drilled, the lab shall test an undisturbed sample and verify that it meets or exceeds the design specification.
 - 3. Provide on-site services for each concrete pour at all structural concrete at the building (footings, grade beams, slab on grade, columns, tilt-wall panels, and other miscellaneous structural concrete).
 - a. Included within this scope of work is the review of all the rebar placement, size, spacing of stirrups, and miscellaneous placement requirements.
 - 4. Cast four (4) concrete test cylinders for every 50 cubic yards or fraction thereof, placed on any day for structural concrete.
 - 5. Provide on-site services for each concrete pour at all concrete paving.
 - 6. Cast four (4) concrete test cylinders for each 100 cubic yards, or fraction thereof, placed on any day for all other types of concrete.
 - 7. Strength level of an individual class of concrete shall be considered satisfactory when both of the following criteria are met:
 - a. The arithmetic average of any three consecutive strength tests equal or exceed f'_c .
 - b. No individual strength test (average of two cylinders) falls below f'_c by more than 500 psi.
 - 8. Conduct slump testing of concrete at intervals equal to test cylinders are made. Make additional slump tests whenever consistency of concrete appears to vary. Slump tests corresponding to samples from which strength tests are made shall be reported with strength test results. Other slump tests need not be reported.
 - 9. Test Footings (Shafts) (Piers) (Caissons): Same diameter and type specified for footings, placed in same manner. Accepted test footings may be used in the Work.
 - 10. Noncompliant Test Reports: Fax test reports indicating noncompliance immediately to each party on the test report distribution list. Copies shall be on different colored paper.
 - 11. Inspect application of curing compound and monitor curing conditions to assure compliance with specification requirements. Report curing deficiencies to the Contractor immediately and submit a written report to the Architect.

- C. Lightweight Insulating Concrete:
 - 1. Types of Tests:
 - a. Field: Wet density
 - b. Lab: Dry density and 28-day compressive strength
 - 2. Number of Test Sets: Not less than one for each day's work
- D. Masonry:
 - 1. Provide pre-construction and construction evaluation of proposed mortars and grout(s).
 - 2. Mortar Cubes: Cast four (4) mortar test specimens at random intervals during masonry work; one set specimen per 2,000 SF of surface area of masonry wall or veneer.
 - 3. Masonry Grout: Cast four (4) grout test specimens at random intervals during masonry work; one set specimen per 2,000 SF of surface area of CMU wall, or fraction thereof.
 - 4. Masonry Prisms: Tests shall be conducted for each 2,000 SF of surface area, or fraction thereof, on all CMU exterior (back-up) walls, and interior CMU walls 16' or taller.
- E. Structural Steel:
 - 1. Radiographic inspection shall be provided for all welds called for on the drawings as full penetration butt welds. If welds are inaccessible to radiograph, welds shall have ultrasonic inspection.
 - 2. The testing of welded connections indicated on the drawings shall be paid for from the testing laboratory allowance; however, in the event the fabricator obtains approval from the structural engineers for additional welds not shown on the drawings, the cost of testing those additional welds shall be paid for by the Contractor.
 - a. Inspection of field welding shall include:
 - 1) Visually inspect fillet welds for size, soundness, and proper return around ends. Inspect seams, folds, and delamination.
 - 2) Visually inspect welds for proper repair of painting.
 - 3) Ultrasonically test penetration welds in accordance with ASTM E164.
 - 4) Inspect surfaces to be welded. Note surface preparations, fit up, and cleanliness of surface. Verify electrodes for size, type, and condition.
 - 5) Welding inspector shall be present during alignment and fit up of members being welded and shall verify for correct surface preparation of root openings, sound weld metal, and proper penetration in the root pass. Where weld has not penetrated completely, inspector shall order the joint to be chipped down to sound metal, or gouged out, and rewelded. Thoroughly inspect root passes for cracks. Gouge out cracks and rewelded to 2 inches beyond each end of crack.
 - 6) Inspector shall verify that welds have been marked with welder's symbol and shall mark welds requiring repairs and reinspection. Inspector shall maintain a written record of welds. Work completed and inspected shall receive an identification mark by the inspector. Identify unacceptable material and Work identified by word reject or repair marked directly on the material.
 - 7) Testing agency shall advise the Owner and Architect of any shop and/or field conditions which may require further tests and examination by means other than those specified. Additional tests and examinations shall be performed as authorized by the Owner and Architect.
 - 8) Owner reserves the right to use ultrasonic or radiographic inspection to verify adequacy of welds. Testing procedures and acceptance criteria shall be as specified in AWS D1.1.
 - 9) Weld quality to comply with the American Institute of Steel Construction (AISC) Manual of Steel Construction.
 - 10) Determine percentage of weld tested by the number of welds that fail the initial testing.
 - 11) Reweld and retest welds that fail until the welds pass. Test two additional welds for every weld failure.
- F. Reinforcing Steel Mechanical Splices:
 - 1. Inspection and Observation Services:

- a. Visually inspect and report on completed condition of each mechanical splice of reinforcing steel.
 - b. Visually inspect each mechanical splice to ensure compliance with the ICC-ES Reports and the manufacturer's published criteria for acceptable completed splices.
 - c. Place special emphasis on the inspection of the end preparation of each bar to be spliced required by the ICC-ES Report.
2. Reports: Submit reports to Architect:
 - a. Submit copies of manufacturer's published criteria for acceptable completed splices prior to observing mechanical splices.
 - b. Reports on each mechanical splice shall indicate location of the splice, size of bars spliced, and acceptability or rejection of splice. Indicate reasons for rejection on each report.
- G. Open web Joists and Joist Girders:
 1. Inspect joists at jobsite for compliance with specified fabrication requirements. Verify welded connections between web and chord, splices, and straightness of members.
 2. Inspect installation of joists at jobsite. Check connections to supporting members, chord extensions, number of rows of bridging, and bridging connections for compliance with Contract Documents and referenced standards.
 3. Verify welder qualification certificates for both shop and field welding operators.
- H. Metal Floor Deck:
 1. Field inspection shall consist of:
 - a. Verifying types, gauges and finishes for compliance with Contract Documents and shop drawings.
 - b. Examine composite floor deck exposed to crawl space for damage to galvanizing due to welding or construction activities. Repair galvanized composite floor deck in accordance with the specifications.
 - c. Examine the erection of metal deck, fastenings, reinforcing of holes, deck reinforcing, miscellaneous deck supports, hanger tabs, shear studs, deck closures, painting or other coating.
 - d. Certification of welders.
 - e. Inspect and test field welded shear studs used to fasten metal floor decking to supporting steel as specified for structural steel.
- I. Metal Roof Deck:
 1. Field inspection shall consist of:
 - a. Verify types, gauges and finishes for compliance with Contract Documents and shop drawings.
 - b. Examine the erection of the metal deck, including fastenings at supports and side laps, reinforcing of holes, and miscellaneous deck supports.
 - c. Certification of welders.
 - d. Visual inspection of at least 25 percent of welds.
- J. Spray Applied Fire Resistive Material:
 1. Verify all fireproofing has been installed to the depth(s) required to achieve the specified fire-resistance ratings.
- K. Expansion Bolt Installation:
 1. Inspect drilling of each hole and installation of each expansion bolt for compliance with Contract Documents and shop drawings.
 2. Verify installation torque for each expansion bolt for compliance with manufacturer's installation instructions.
- L. Lightweight Insulating Concrete Fill:
 1. Inspection and Observation Services (As required):
 - a. Inspection of roof deck prior to start of Work.
 - b. Inspection during installation of insulation and lightweight insulating concrete fill Work to ascertain compliance with Contract Documents.
 - c. Observation of base ply fastener pull tests performed by Contractor to ascertain minimum withdrawal resistance of 40 pounds per fastener.

2. Testing Services (As required):
 - a. References (As applicable for tests required):
 - 1) American Society for Testing and Materials (ASTM)
 - a) C177, Standard Test Method for Steady State Heat Flux Measurements and Thermal Transmission Properties By Means of the Guarded Hot Plate Apparatus
 - b) C495, Test Method for Compressive Strength of Lightweight Insulating Concrete
 - c) C578, Specification for Rigid, Cellular Polystyrene Thermal Insulation.
 - b. Test EPS insulation board for thermal insulation value in accordance with ASTM C177.
 - c. Test lightweight insulating concrete fill in accordance with ASTM C495 for:
 - 1) a. Mix design compressive strength.
 - 2) b. Mix design wet and dry density range.
 - 3) c. Number of Tests:
 - a) 1) One per 5,000 square feet.
 - b) 2) Not less than one for each day's Work.
 - d. Test EPS insulation board for density in accordance with ASTM C578.
- M. Roofing:
 1. Inspection and Observation Services (As required):
 - a. Inspection of roof deck prior to start of Work.
 - b. Inspect on site condition of stored roofing materials.
 - c. Inspection during roofing, roof insulation, and sheet metal Work to ascertain compliance with Contract Documents.
 - d. Observation of roof test cuts performed by Contractor to ascertain that they are properly made.
 - e. Observation of patching of roof test cuts to ascertain that they are properly made.
 2. Testing Services (As required):
 - a. Perform dissection and analysis on cuts provided by Contractor to confirm number of plies, bonding of plies, weight of bitumen and softening temperature to ascertain compliance with specifications.
- N. Test Specimens:
 1. Concrete Cylinder Specimens: Break one (1) at 7 days and two (2) at 28 days. If the 28 day break average exceeds minimum specified requirements, discard the fourth cylinder. If the 28 day break average is below specified minimum, hold and break the fourth cylinder at 56 days; or process as directed by the structural Engineer.
 2. Grout Specimens: Break one (1) at 7 days and two (2) at 28 days. If the 28 day break average exceeds minimum specified requirements, discard the fourth cylinder. If the 28 day break average is below specified minimum, hold and break the fourth cylinder at 56 days; or process as directed by the structural Engineer.
 3. Mortar Specimens: Break one (1) at 7 days and two (2) at 28 days. If the 28 day break average exceeds minimum specified requirements, discard the fourth cylinder. If the 28 day break average is below specified minimum, hold and break the fourth cylinder at 56 days; or process as directed by the structural Engineer.

2 GOVERNMENTAL INSPECTIONS AND CONTRACTOR TESTING

2.1 GOVERNMENTAL INSPECTIONS

- A. The Contractor shall allow in his Proposal the application, coordination, scheduling and cost of all on-site inspections to be performed by governmental authorities having jurisdiction which are required for approval of the Work and occupancy of the building; including, but limited to:
 1. City departments
 2. County departments
 3. Flood Control Districts
 4. Municipal Utility Districts
 5. Health Departments

6. Fire Marshall Offices.
- B. The Contractor shall make all corrective measures in accordance with instructions received from the governing authority inspector having jurisdiction, as required to receive 100% approval for the work being inspected.
- C. The Contractor shall record and keep record of all governmental agency tests and inspections; including deficiencies noted by the agency, and corrective action(s) taken to receive final approval of the agency.
- D. The Contractor shall bear all costs for initial inspections, re-inspections and any other expenses related to on-site inspections made by governing authorities.
- E. No allowance shall be made for additional Contract Time, nor an increase in the Contract Sum for any unanticipated expenses or delays resulting from failed governmental inspection or resulting re-inspections required to obtain agency approval(s).

2.2 BELOW SLAB PLUMBING TESTING

- A. In addition to normal industry / governmental testing required for the plumbing system(s), Contractor shall allow in his Proposal the application, coordination, scheduling and cost to provide a static water test(s) on plumbing piping as described below.
- B. The contractor shall perform a static pressure test on all plumbing piping systems below the building slab.
- C. The test(s) shall be maintained continuously from the time the pipe installation is initially tested prior to final cover-up, and continue throughout all foundation preparation and placement; and terminating a minimum of seven (7) days after the placement of concrete slabs.
- D. Maintain sealed caps on all stub-ups to prevent dissipation of water within the piping system. Provide one (1) sealed removable cap at each system to verify test results.
- E. Any failure of the static testing indicating leakage during the above period shall be immediately reported to the Architect, MEP Engineer and Owner.
- F. The Contractor shall be responsible for all corrective measures necessary to repair and / or replace defecting piping as directed by the Architect.
- G. Refer to Division 22 – Plumbing for additional information and requirements.

3 OWNER CONSULTANT OBSERVATIONS AND INSPECTIONS

3.1 GENERAL

- A. Throughout the progress of the Work, the Owner's A/E consultants may be required to coordinate outside parties to perform government required testing, reviews and / or observations of the project at specific stages of the Work.
- B. Such activities include, but are not limited to the following:
 1. Texas Department of Licensing and Regulation (TDLR): Review of construction documents and inspection of the Work upon completion, as a whole, to verify compliance with Texas Accessibility Standards (TAS) and ADA.
 2. International Energy Code Compliance (IECC): Review of construction documents and inspection of the Work upon completion, as a whole, to verify compliance with energy codes standards and efficiencies.
 3. Texas Department of Insurance (TDI): Review of submittals and on-site observations at specific stages of progress of the work, including completion, as required for issuance of compliance documentation for TWIA wind storm insurance eligibility.
- C. Such activities are outside the scope of Work included in the Contract, but may be required to receive final approval of the project by all governing authorities.
- D. The Contractor shall cooperate with the Architect to facilitate the required activities. Architect shall provide sufficient notification of activities

3.2 TEXAS DEPARTMENT OF LICENSING AND REGISTRATION (TDLR)

- A. The Owner /Architect shall be responsible for interfacing with Texas Department of Licensing and Registration (TDLR) regarding state approval for compliance with Texas Accessibility Standards.
- B. The Owner /Architect shall make the initial submission of the Contract Documents for review.
- C. TAS review comments affecting the Work shall be incorporated into the Work as directed by the Architect either by Addendum, Change Proposal Request, Minor Change or Clarification.
- D. During the progress of the Work, the Contractor shall bring to the Architect's attention any portion of the Work that may be questionably compliant with TDLR / TAS.
- E. The Architect shall coordinate and manage the TAS inspection of the completed project.
 - 1. TAS required corrective issues due to Contractor error (materials, installation, etc.) shall be paid for by the Contractor.
- F. All corrective work shall be completed within thirty (30) days after notification unless otherwise agreed upon by the Owner.

3.3 INTERNATIONAL ENERGY CODE (IECC) COMPLIANCE

- A. The Owner /Architect shall be responsible for interfacing with the governing authority regarding compliance with the IECC.
- B. The Owner /Architect shall make the initial submission of the Contract Documents for review.
- C. IECC review comments affecting the Work shall be incorporated into the Work as directed by the Architect either by Addendum, Change Proposal Request, Minor Change or Clarification.
- D. During the progress of the Work, the Contractor shall bring to the Architect's attention any portion of the Work that may be questionably compliant with IECC.
- E. The Architect shall coordinate and manage IECC interim and final inspections as required for compliance
 - 1. IECC inspection is required prior to interior cover of exterior walls. The Contractor shall be responsible to coordinate with the Architect to schedule such inspection(s) at the appropriate time(s).
 - 2. IECC required corrective measures due to design issues shall be paid for by the Owner.
 - 3. IECC required corrective issues due to Contractor issues (materials, installation, etc.) shall be paid for by the Contractor.
- F. All corrective work shall be completed within thirty (30) days after notification unless otherwise agreed upon by the Owner.

3.4 WINDSTORM CERTIFICATION

- A. For projects subject to the requirements of Texas Department of Insurance (TDI) and Texas Windstorm Insurance Association (TWIA) in order to qualify for Owner to obtain windstorm insurance, the Contractor shall coordinate all trades as required to assure TDI / TWIA requirements are being met in the production, fabrication and / or installation of Work falling under TDI / TWIA jurisdiction.
- B. The Owner's separate consultant shall provide all inspections at appropriate times which are required to obtain Texas Department of Insurance (TDI) and Texas Windstorm Insurance Association (TWIA) approval. Inspections include, but are not limited to:
 - 1. Slab preparation
 - 2. Structural steel framing
 - 3. Building envelope
 - 4. Completed project.
- C. Contractor shall perform all corrective work required to receive approval from Owner's Consultant

END OF SECTION 01 45 23

SECTION 01 50 00

TEMPORARY FACILITIES AND CONTROLS

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, 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 SUMMARY

- A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.
- B. Related Requirements
 - 1. Section 01 11 00, Summary of Work
 - 2. Section 01 57 13, Temporary Erosion and Sediment Control
 - 3. Section 01 57 23, Temporary Storm Water Pollution Control

1.3 REFERENCES

- A. Use current editions unless noted otherwise.
- B. ASTM International (ASTM)
 - 1. ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials
 - 2. ASTM E136, Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C
- C. National Fire Protection Association (NFPA)
 - 1. NFPA 70, National Electric Code
 - 2. NFPA 241, Standard for Safeguarding Construction, Alteration, and Demolition Operations
 - 3. NFPA 701, Standard Methods of Fire Tests for Flame Propagation of Textiles and Films

1.4 USE CHARGES

- A. 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's construction forces Architect, testing agencies, and authorities having jurisdiction.
- B. Sewer Service: Pay sewer-service use charges for sewer usage by all entities for construction operations.
- C. Water Service: Pay water-service use charges for water used by all entities for construction operations.
- D. Electric Power Service: Pay electric-power-service use charges for electricity used by all entities for construction operations.

1.5 INFORMATIONAL SUBMITTALS

- A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.
- B. Erosion- and Sedimentation-Control Plan: Show compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

1.6 QUALITY ASSURANCE

- A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

2 PRODUCTS

2.1 MATERIALS

- A. 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 $\frac{3}{8}$ inch OD line posts and 2 $\frac{7}{8}$ inch OD corner and pull posts, with 1 $\frac{5}{8}$ inch OD top rails
- 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 $\frac{3}{8}$ inch OD line posts and 2 $\frac{7}{8}$ inch OD corner and pull posts, with 1 $\frac{5}{8}$ inch OD top and bottom rails. Provide concrete or galvanized-steel bases for supporting posts.

2.2 TEMPORARY FACILITIES

- A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.
- B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, 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. Provide conference room of sufficient size to accommodate meetings of 12 individuals. Provide electrical power service and 120-V ac duplex receptacles, with no fewer than one receptacle on each wall. Furnish room with conference table, chairs, and 4 foot square tack and marker boards.
 - 3. Provide a separate office equipped with desk, chair, layout table, telephone, four drawer file cabinet, and lockable door.
 - 4. Drinking water and private toilet
 - 5. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68° F to 72° F
 - 6. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height
- C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.
 - 1. Store combustible materials apart from building.

2.3 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
- B. HVAC Equipment: Provide Filter at each return air grille in system and remove at end of construction.

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.
- 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. 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: Install water service and distribution piping in sizes and pressures adequate for construction.
- 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. 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.
- G. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
- H. 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.
- I. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install one telephone line(s) for each field office.
 - 1. Provide additional telephone lines for the following:
 - a. Provide a dedicated telephone line for each facsimile machine in each field office.
 - 2. At each telephone, post a list of important telephone numbers.
 - a. Police and fire departments
 - b. Ambulance service
 - c. Contractor's home office
 - d. Contractor's emergency after-hours telephone number
 - e. Architect's office
 - f. Engineers' offices
 - g. Owner's office
 - h. Principal subcontractors' field and home offices
 - 3. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.
- J. Electronic Communication Service: Provide printer(s) and computer(s) in the primary field office equipped with the software and connectivity capabilities necessary to access Project electronic documents, maintain electronic communications, and perform other necessary functions.

3.3 SUPPORT FACILITIES INSTALLATION

- A. General: Comply with the following:
 - 1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E136. 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. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas within construction limits indicated on Drawings.
 - 1. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.
- C. Traffic Controls: Comply with requirements of authorities having jurisdiction.
 - 1. Protect existing site improvements to remain including curbs, pavement, and utilities.
 - 2. Maintain access for fire-fighting equipment and access to fire hydrants.
- D. Parking: Provide temporary parking areas for construction personnel.
- E. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
 - 1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
 - 2. Remove snow and ice as required to minimize accumulations.
- F. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.
 - 1. Identification Signs: Provide Project identification signs as indicated on Drawings.
 - 2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
 - a. Provide temporary, directional signs for construction personnel and visitors.
 - 3. Maintain and touchup signs so they are legible at all times.
- G. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 01 73 00, Execution.
- H. Temporary Elevator Use: Use of elevators is not permitted
- I. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.
- J. 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.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.
- B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
 - 1. Comply with work restrictions specified in Section 01 10 00, Summary.
- C. Temporary Erosion and Sedimentation Control: Comply with requirements of 2003 EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent and requirements specified in Section 31 10 00, Site Clearing.
- D. Tree and Plant Protection: Comply with requirements specified in Section 01 56 39, Temporary Tree and Plant Protection.
- E. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.
- F. 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.
- G. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- H. 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 weathertight enclosure for building exterior.

1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.
- I. 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; manage fire-prevention program.
 1. Prohibit smoking in construction areas.
 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.

3.5 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. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:
 1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
 2. Keep interior spaces reasonably clean and protected from water damage.
 3. Periodically collect and remove waste containing cellulose or other organic matter.
 4. Discard or replace water-damaged material.
 5. Do not install material that is wet.
 6. Discard, replace, or clean stored or installed material that begins to grow mold.
 7. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.
- D. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
 1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
 2. Use permanent HVAC system to control humidity.
 3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.
 - a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective.
 - b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
 - c. Remove materials that can not be completely restored to their manufactured moisture level within 48 hours.

3.6 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.

1. 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.
- C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- D. 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.
 2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
 3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 01 77 00, Closeout Procedures.

END OF SECTION 01 50 00

SECTION 01 56 39
TEMPORARY TREE PROTECTION & CARE

PART 1 GENERAL

1.01 RELATED DOCUMENTS

Drawings and General Provisions of the contract, including General and Supplementary Conditions and all applicable specification sections apply to this section.

1.02 SCOPE

This section includes protection, tree removal, tree crown pruning, root pruning, temporary root protection matting, pest management, fertilization and watering of existing trees. This includes individual trees and groupings that are indicated to remain. Trees which are to remain and must be protected are indicated on the Drawings.

1.03 RELATED WORK IN OTHER SECTIONS

The following items of associated work are included in other sections of these specifications:

1. Site Clearing
2. Landscape planting

1.04 SUBMITTALS

- A. Submit degreed Forester or arborist name for Owner approval and written documentation that this certified professional has been retained and will be performing and supervising the work.
- B. If needed, submit shop drawings/cut sheets and material samples for the specified Temporary Root Protection Matting.

1.05 GENERAL PROVISIONS

- A. Arborist Qualifications: Engage a qualified ISA certified arborist or degreed Foresters who has successfully completed tree protection, trimming and root pruning work. Membership in professional organization such as the International Society of Arboriculture (ISA), the Tree Care Industry Association (TCIA), the American Society of Consulting Arborists (ASCA) are required, as well as proof of insurance and compliance with applicable OSHA regulations and industry standards.
- B. Temporary Tree Protection: Provide temporary fencing outside drip line/c (outer perimeter of branches) to protect the critical root zone against damage for the trees that are to remain.
- C. Protect Root Systems: Do not store construction materials, debris, or excavated materials within drip line. Restrict foot traffic and equipment to prevent excessive compaction of soil over root zone. This zone shall also be protected against erosion, siltation and leaching of lime and other detrimental materials into the protected areas.

1.06 QUALITY ASSURANCE

Contractor to participate in a pre-installation meeting with Owners Representative prior to the start of work. Contractor to identify all existing trees to be removed and to remain for Owner approval prior to tree removal. Any conflicts between Tree Protection and Clearing and Grubbing or Demolition should be brought to the attention of the Project Manager prior to tree removal.

PART 2-MATERIALS

2.01 MATERIALS

- A. New topsoil: fertile, friable, surface soil containing natural loam. Obtain from local sources from areas having similar characteristics to indigenous topsoil. Provide topsoil that is free of subsoil and clay lumps, and free of brush, weeds, roots, stones larger than 2 inches in any dimension and free of other extraneous or toxic matter harmful to plant growth.

- B. Tree Protection Fencing: 6' ht. temporary above grade chain link panels.
- C. Temporary Root Protection Matting: geocomposite material comprised of a tri-planar geonet structure with thermally bonded nonwoven geotextiles on both sides. Material shall be Tenax PoaDrain or Tenax Tendrain II 770-2.
- D. Coarse shredded wood mulch.
- E. Tree Protection Signs: affixed to all tree protection fencing or separate stakes but shall not be affixed directly to trees. Signs to be bilingual in English and Spanish.

PART 3 - EXECUTION

3.01 GENERAL

- A. Protect tree root systems from damage due to noxious materials caused by run off or spillage during mixing, placement and/or storage of construction materials. Protect root systems from flooding, eroding or excessive wetting.
- B. Remove branches, if required to clear new construction and for overhead clearance for equipment access. Cut branches and roots, if required, with sharp, clean pruning instruments; do not break or chop.

3.02 TREE PROTECTION

- A. Tree protection fencing shall be 6' ht chain link fencing constructed at or beyond the tree drip line of the existing trees to remain. **See plan for each area.**
- B. The fencing shall remain in place throughout all of the project construction.

3.03 TREE REMOVAL

- A. Within the tree protection area, vines and underbrush shall be removed.
- B. Grind stumps to 6" below grade
- C. Dead trees within the tree protection area, shall be removed. This includes dead trees at the beginning, at the end of the construction period and up to 6 months after Substantial Completion.

3.04 CONSTRUCTION CLEARANCE PRUNING

- A. Pruning for specific clearance (construction access or proposed improvements) shall be reviewed and approved by the Landscape Architect.
- B. Existing tree canopies in conflict with construction shall be professionally pruned to remove the limbs in question, but shall not under any circumstances be broken off with construction equipment.

3.05 TREE CANOPY PRUNING

- A. Trees that are protected with fencing shall be canopy pruned in accordance with ANSI A-300 Pruning Standards and ISA Best management Practices. At a minimum, pruning shall consist of the removal of dead, dying, diseased, interfering, objectionable and weak branches on the main trunks as well as those within the leaf area.
- B. All tree branches shall be removed from the ground to 6' height clearance.
- C. Work accomplished under the direction of an experienced ISA certified arborist or degreed forester only.

3.06 ROOT PRUNING

- A. Root prune only if required for new construction conflict. Work to be confirmed by Arborist subcontractor.
- B. Roots can be pruned using a small trencher to cut a narrow trench to a depth of two feet. The trench should be backfilled immediately and watered to remove air pockets from the soil and to moisten the roots.

- C. Work accomplished under the direction of an experienced ISA certified arborist or degreed forester only.

3.07 DEEP ROOT FEEDING AND INSECT CONTROL

- A. Deep root feed existing trees to remain a minimum of two feedings.
- B. Treat or pre-treat for any insect infestation and monitor throughout the construction process.

3.08 SUPPLEMENTAL WATERING

- A. Supplemental watering may be required within the tree protection zone throughout construction. As directed and advised by the arborist/forester, the contractor will supply water to the trees.

3.09 EXCAVATION AROUND TREES

- A. Use alternate route around trees when possible. If not possible, excavate within proximity of trees only where indicated. Do not machine excavate within drip line.
- B. Where excavating for new construction is required within drip line of trees, hand excavate to minimize damage to root system. Use narrow-tine spading forks and comb soil to expose roots. Tunnel under or around roots by hand digging.
- C. Do not allow exposed roots to dry out before permanent backfill is placed; provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in moist condition and temporarily support and protect from damage until permanently relocated and covered with earth.

3.10 GRADING AND FILLING AROUND TREES

- A. Maintain existing grade within the drip line of trees.
- B. Minor fills: Use topsoil fill material as specified to fill a maximum of 2 inches over roots a year. Place in single layer and do not compact; hand grade to required finished elevations.

3.11 CLEAN UP

- A. All temporary matting and fencing shall be removed at the completion of the project.

3.12 REPAIR AND REPLACEMENT OF TREES

- A. Repair trees damaged by construction operations. Make repairs promptly after damage occurs to prevent progressive deterioration.
- B. When trees other than those designated for removal are destroyed, or badly damaged as a result of construction operations, remove and replace with same size, species and variety up to and including 12" caliper. Contractor shall plant, maintain and warranty all new trees as per Landscape Section.

3.13 DISPOSAL

- A. Burning on Owner's property of removed trees and branches is not permitted on site.
- B. Removal from Owner's property: Remove excess excavation, displaced trees, and trimmings and dispose of off Owner's property in accordance with local ordinances.

END OF SECTION

SECTION 01 73 00

EXECUTION

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, 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 SUMMARY

- A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, construction layout, field engineering and surveying, installation of the Work, cutting and patching, coordination of Owner-installed products, progress cleaning, starting and adjusting, protection of installed construction, and correction of the Work.
- B. Related Requirements:
 - 1. Section 01 10 00, Summary of Work
 - 2. Section 01 33 00, Submittal Procedures
 - 3. Section 01 77 00, Closeout Procedures
 - 4. Section 02 41 13.10, Removing Existing Pavements, Utilities, and Structures

1.3 REFERENCES

- A. Use current editions unless noted otherwise.
- B. National Fire Protection Association (NFPA)
 - 1. NFPA 241, Standard for Safeguarding Construction, Alteration, and Demolition Operations

1.4 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.

1.5 INFORMATIONAL SUBMITTALS

- A. Certificates: Submit certificate signed by land surveyor or professional engineer certifying that location and elevation of improvements comply with requirements.
- B. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.
- C. Certified Surveys: Submit two copies signed by land surveyor.

1.6 QUALITY ASSURANCE

- A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.
- B. 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 of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements 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 results in increased maintenance or decreased operational life or safety.
 3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.
 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.
- C. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

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 Architect for the visual and functional performance of in-place materials.

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. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
 2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
 3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
1. Description of the Work
 2. List of detrimental conditions, including substrates
 3. List of unacceptable installation tolerances

4. Recommended corrections
- D. 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 and Owner 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. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. 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 Contractor, submit a request for information to Architect according to requirements in Section 01 31 00, Project Management and Coordination.

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 promptly.
- B. General: Engage a land surveyor or 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 limits on use of Project site.
 3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
 4. Inform installers of lines and levels to which they must comply.
 5. Check the location, level and plumb, of every major element as the Work progresses.
 6. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
 7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.
- C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill 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.

3.4 FIELD ENGINEERING

- A. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.

1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.
- B. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
 1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
 2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
 3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

3.5 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. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.
- F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- G. 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.
- H. 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.
- I. 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.
- J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 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.
- B. 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.
- C. Temporary Support: Provide temporary support of work to be cut.
- D. 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.
- E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Section 01 11 00, Summary of Work.
- F. 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.
- G. 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 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.
- H. 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 rehang 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 weathertight condition and ensures thermal and moisture integrity of building enclosure.
- I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.7 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 if changes to schedule are required due to differences in actual construction progress.
 2. Preinstallation Conferences: Include Owner's construction personnel at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.8 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
 1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
 2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80° F.
 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
 - a. Use containers intended for holding waste materials of type to be stored.
 4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.
- 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. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 01 50 00, Temporary Facilities and Controls.
- H. 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.
- I. 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.

- J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.9 STARTING AND ADJUSTING

- A. Coordinate startup and adjusting of equipment and operating components with requirements in other sections and Section 01 91 13, General Commissioning Requirements.
- B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
- D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.10 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.

END OF SECTION 01 73 00

SECTION 01 77 00 CLOSEOUT PROCEDURES

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, 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 SUMMARY

- A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, Substantial Completion procedures, Final Completion procedures, final cleaning, and repair of the Work.
- B. Related Requirements
 - 1. Section 01 29 00, Payment Procedures
 - 2. Section 01 78 23, Operation and Maintenance Data
 - 3. Section 01 78 39, Project Record Documents
 - 4. Section 01 79 00, Demonstration and Training

1.3 ACTION SUBMITTALS

- A. Product Data: For cleaning agents
- B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion
- C. Certified List of Incomplete Items: Final submittal at Final Completion

1.4 CLOSEOUT SUBMITTALS

- A. Certificates of Release: From authorities having jurisdiction
- B. Certificate of Insurance: For continuing coverage

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.6 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list),
- B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - 1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - 2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, and similar final record information.
 - 3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 - 4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number where applicable.

- a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Architect's signature for receipt of submittals.
5. Submit test/adjust/balance records.
6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
- C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 1. Advise Owner of pending insurance changeover requirements.
 2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
 3. Complete startup and testing of systems and equipment.
 4. Perform preventive maintenance on equipment used prior to Substantial Completion.
 5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 01 79 00, Demonstration and Training.
 6. Advise Owner of changeover in heat and other utilities.
 7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
 8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
 9. Complete final cleaning requirements, including touchup painting.
 10. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
 1. Re-inspection: Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.
 2. Results of completed inspection will form the basis of requirements for final completion.

1.7 FINAL COMPLETION PROCEDURES

- A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:
 1. Submit a final Application for Payment according to Section 01 29 00, Payment Procedures. Architect will process final Certificate for Payment upon completion of all final completion procedures.
 2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
 4. Closeout Forms
 - a. Submit two copies each of the forms included herein and listed below, bound in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8½ inch by 11 inch paper. **Use only the enclosed forms. Forms retyped or altered in any way will not be accepted.** Additional copies of the forms are available from the Architect.
 - 1) Contractor's Affidavit of Payment of Debts and Claims—AIA G706A-1994

- 2) Contractor's Affidavit of Payment of Release of Liens –AIA G706A-1994
 - 3) Consent of Surety to Final Payment –AIA G707-1994
 - 4) General Contractor Conditional Waiver and Release on Final Payment
 - 5) Subcontractor / Supplier Conditional Waiver and Release on Final Payment
 - 6) General Contractor Warranty
 - 7) Subcontractor Warranty
 - 8) General Contractor Hazardous Material Certificate
 - 9) Subcontractor/Supplier Asbestos Certificate
 - 10) Plumbing Subcontractor/Supplier Lead Certificate
 - 11) Mechanical Subcontractor/Supplier Refrigerants Certificate
 - 12) Electrical Subcontractor/Supplier PCB Certificate
 - 13) Certificate of TEA Compliance
 - b. Insert additional forms required in other Sections.
 - c. Provide heavy paper dividers with plastic-covered tabs for each type of form. Mark tab to identify the form.
 - d. First sheet shall identify the Project, Owner, Architect, Architect's Consultants, and Contractor. Provide company name, address, telephone number and contact representative for each. Subsequent pages shall include the Table of Contents.
 - e. Identify each binder on the front and spine with the typed or printed title "CLOSEOUT FORMS," Project name, and name of Contractor.
 - f. Closeout Forms Electronic File: Scan Closeout Forms and assemble complete package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
- B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements.
1. Re-inspection: Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.
 2. Re-inspection Fees: Should re-inspection(s) in addition to the initial re-inspection be necessary due to Contractor's failure to have completed all Work as claimed, Owner will execute a change order reducing the Contract Sum by an amount equal to the cost of the extra services of the Architect and the Architect's consultants incurred as a result of the additional re-inspection(s).

1.8 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, starting with exterior areas first and proceeding from lowest floor to highest floor.
 2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
 3. Submit list of incomplete items in the following format:
 - a. MS Excel electronic file.
 - b. PDF electronic file.
 - c. Three paper copies.

1.9 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.
- B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

- C. Organize warranty documents into an orderly sequence based on the table of contents of 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 8½ inch 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. Warranty Electronic File: 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 bookmarked table of contents at beginning of document.
- D. Provide additional copies of each warranty to include in operation and maintenance manuals.

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.

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.
 - 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. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
 - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - e. 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.
 - f. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 - g. Sweep concrete floors broom clean in unoccupied spaces.
 - h. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
 - i. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
 - j. Remove labels that are not permanent.

- 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 on inspection.
 - o. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
 - p. Complete cleaning procedures and requirements required in other Sections.
 - q. Leave Project clean and ready for occupancy.
- C. Construction Waste Disposal: Comply with waste disposal requirements in Section 01 50 00, Temporary Facilities and Controls.

3.2 REPAIR OF THE WORK

- A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.
- B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
 - 1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
 - 2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that already show evidence of repair or restoration.
 - a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
 - 3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
 - 4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.


AIA® Document G706®A – 1994
Contractor's Affidavit of Release of Liens

PROJECT: <i>(Name and address)</i>	ARCHITECT'S PROJECT NUMBER :	OWNER: []
New Caney ISD New Administration Building	2023159.00	ARCHITECT: []
21330 Valley Ranch Pkwy. New Caney, TX. 77357	CONTRACT FOR:	CONTRACTOR: []
TO OWNER: <i>(Name and address)</i>	General Construction	SURETY: []
	CONTRACT DATED:	OTHER: []
New Caney Independent School District		
22784 Hwy 59 S. Porter, TX. 77365		

STATE OF:
COUNTY OF:

The undersigned hereby certifies that to the best of the undersigned's knowledge, information and belief, except as listed below, the Releases or Waivers of Lien attached hereto include the Contractor, all Subcontractors, all suppliers of materials and equipment, and all performers of Work, labor or services who have or may have liens or encumbrances or the right to assert liens or encumbrances against any property of the Owner arising in any manner out of the performance of the Contract referenced above.

EXCEPTIONS:

SUPPORTING DOCUMENTS ATTACHED HERETO:

1. Contractor's Release or Waiver of Liens, conditional upon receipt of final payment.
2. Separate Releases or Waivers of Liens from Subcontractors and material and equipment suppliers, to the extent required by the Owner, accompanied by a list thereof.

CONTRACTOR: *(Name and address)*

CONTRACTOR'S Authorized Representative (Signature)

BY: .

(Printed name and title)

Date

Subscribed and sworn to before me on this date:

Notary Public:
 My Commission Expires:


AIA® Document G706® – 1994
Contractor's Affidavit of Payment of Debts and Claims

PROJECT: <i>(Name and address)</i>	ARCHITECT'S PROJECT NUMBER:	OWNER: []
New Caney ISD New Administration Building	2023159.00	ARCHITECT: []
21330 Valley Ranch Pkwy. New Caney, TX.	CONTRACT FOR:	CONTRACTOR: []
77357	General Construction	SURETY: []
TO OWNER: <i>(Name and address)</i>	CONTRACT DATED:	OTHER: []
New Caney Independent School District		
22784 Hwy 59 S. Porter, TX. 77365		

STATE OF:
COUNTY OF:

The undersigned hereby certifies that, except as listed below, payment has been made in full and all obligations have otherwise been satisfied for all materials and equipment furnished, for all work, labor, and services performed, and for all known indebtedness and claims against the Contractor for damages arising in any manner in connection with the performance of the Contract referenced above for which the Owner or Owner's property might in any way be held responsible or encumbered.

EXCEPTIONS:

**SUPPORTING DOCUMENTS ATTACHED
HERE TO:**

- Consent of Surety to Final Payment.
Whenever Surety is involved, Consent of Surety is required. AIA Document G707, Consent of Surety, may be used for this purpose
Indicate Attachment [] Yes [] No

The following supporting documents should be attached hereto if required by the Owner:

- Contractor's Release or Waiver of Liens, conditional upon receipt of final payment.
- Separate Releases or Waivers of Liens from Subcontractors and material and equipment suppliers, to the extent required by the Owner, accompanied by a list thereof.
- Contractor's Affidavit of Release of Liens (AIA Document G706A).

CONTRACTOR:*(Name and address)*

CONTRACTOR'S Authorized Representative *(Signature)*

BY: .

(Printed name and title)

Date

Subscribed and sworn to before me on this date:

Notary Public:
My Commission Expires:

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User Notes: (6732521b3a52c84e6afa684e)

 **AIA® Document G707™ – 1994**

Consent of Surety to Final Payment

PROJECT: <i>(Name and address)</i>	ARCHITECT'S PROJECT NUMBER:	OWNER: []
New Caney ISD New Administration Building	2023159.00	ARCHITECT: []
21330 Valley Ranch Pkwy. New Caney, TX. 77357	CONTRACT FOR:	CONTRACTOR: []
	General Construction	SURETY: []
	CONTRACT DATED:	OTHER: []
TO OWNER: <i>(Name and address)</i>		
New Caney Independent School District		
22784 Hwy 59 S. Porter, TX. 77365		

In accordance with the provisions of the Contract between the Owner and the Contractor as indicated above, the
(Insert name and address of Surety)

on bond of
(Insert name and address of Contractor)

, SURETY,

hereby approves of the final payment to the Contractor, and agrees that final payment to the Contractor shall
not relieve the Surety of any of its obligations to
(Insert name and address of Owner)

, CONTRACTOR,

New Caney Independent School District
22784 Hwy 59 S. Porter, TX. 77365

, OWNER,

as set forth in said Surety's bond.

IN WITNESS WHEREOF, the Surety has hereunto set its hand on this date:
(Insert in writing the month followed by the numeric date and year.)

Attest:
(Seal):

SURETY *(Signature)*

BY: _____
(Printed name and title)

GENERAL CONTRACTOR CONDITIONAL WAIVER AND RELEASE ON FINAL PAYMENT

PROJECT: New Caney ISD New Administration Building OWNER: New Caney Independent School District
ARCHITECT: GPD Group

On receipt by the signer of this document of a check from New Caney Independent School District in
the sum of \$ _____, payable to _____,
General Contractor

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 New Caney Independent School District located at _____

to the following extent: All work related to construction of New Caney ISD New Administration Building.

This release covers the final payment to the signer for all labor, services, equipment, or materials furnished to the property or to New Caney Independent School District.

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 _____

By (signature) _____

Company Name

Title _____

[illegible]

This instrument was acknowledged before me on this _____ day of _____, 20____, by

_____, _____ of _____
Name Job Title

Company Name _____

Notary Public: _____

My Commission Expires: _____

SUBCONTRACTOR / SUPPLIER
CONDITIONAL WAIVER AND RELEASE ON FINAL PAYMENT

PROJECT: New Caney ISD New Administration Building OWNER: New Caney Independent School District
ARCHITECT: GPD Group

On receipt by the signer of this document of a check from _____
General Contractor

in the sum of \$_____, payable to _____
Subcontractor / Supplier

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 New Caney Independent School District located at _____

to the following extent: All work related to construction of New Caney ISD New Administration Building

This release covers the final payment to the signer for all labor, services, equipment, or materials furnished to the property or to New Caney Independent School District (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 *By (signature)*

Company Name *Title*

STATE OF TEXAS §
 §
COUNTY OF HARRIS §

This instrument was acknowledged before me on this _____ day of _____, 20____, by

_____, _____ of
Name *Job Title*

Company Name

Notary Public: _____

My Commission Expires: _____

GENERAL CONTRACTOR WARRANTY

STATE OF TEXAS

PROJECT: New Caney ISD New Administration Building

COUNTY OF _____

OWNER: New Caney Independent School District

ARCHITECT: GPD Group.

KNOW ALL MEN BY THESE PRESENTS:

_____, being first duly sworn, disposes and says:

1. That he is the _____ of _____, the contractor who constructed the project referenced above, and that, he is duly authorized to make this General Contractor Warranty.
2. The undersigned Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract are of good quality and new except where otherwise required or permitted by the Contract Documents, that the Work is free from defects not inherent in the quality required or permitted, and that the Work conforms with the requirements of the Contract Documents. Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective. The Contractor's warranty excludes remedy from damage or defect caused by abuse, modifications not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear under normal usage.
3. In the event of failure of materials, products, or workmanship, during the specified warranty periods, the Contractor shall take appropriate measures to assure correction or replacement of the defective items, whether notified by the Owner or Architect.
4. The Contractor warrants the entire project for a period of **12** months from the Date of Substantial Completion and specific sections of work for such additional periods as enumerated in the Contract Documents, except as follows:

ATTEST (If Corporation)

Name of Contractor_____
Secretary_____
By_____
Date

Subscribed and sworn to before me on this _____ day of _____, 20____

Notary Public: _____

My Commission Expires: _____

SUBCONTRACTOR WARRANTY

STATE OF TEXAS

PROJECT: New Caney ISD New Administration Building

COUNTY OF _____

OWNER: New Caney Independent School District

ARCHITECT: GPD Group

KNOW ALL MEN BY THESE PRESENTS:

_____, being first duly sworn, disposes and says:

1. That he is the _____ of _____, the subcontractor who supplied, installed, and/or erected the work described below, and that, he is duly authorized to make this Subcontractor Warranty:

Work Performed: _____

Specification Section(s): _____

2. The undersigned Subcontractor warrants to the Owner and Architect that materials and equipment furnished under the Contract are of good quality and new except where otherwise required or permitted by the Contract Documents, that the Work is free from defects not inherent in the quality required or permitted, and that the Work conforms with the requirements of the Contract Documents. Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective. The Subcontractor's warranty excludes remedy from damage or defect caused by abuse, modifications not executed by the Subcontractor, improper or insufficient maintenance, improper operation, or normal wear and tear under normal usage.
3. In the event of failure of materials, products, or workmanship, during the specified warranty periods, the Contractor shall take appropriate measures to assure correction or replacement of the defective items, whether notified by the Contractor, Owner or Architect.
4. The Subcontractor warrants the work performed for a period of _____ months from the Date of Substantial Completion, except as follows:

ATTEST (If Corporation)

Name of Subcontractor / Supplier_____
Secretary_____
By_____
Date

Subscribed and sworn to before me on this _____ day of _____, 20____

Notary Public: _____

My Commission Expires: _____

GENERAL CONTRACTOR HAZARDOUS MATERIAL CERTIFICATE

STATE OF TEXAS

PROJECT: New Caney ISD New Administration Building

COUNTY OF _____

OWNER: New Caney Independent School District

ARCHITECT: GPD Group

KNOW ALL MEN BY THESE PRESENTS:

_____, being first duly sworn, disposes and says:

1. That he is the _____ of _____, the contractor who constructed the project referenced above, and that, he is duly authorized to make this Certification.
2. That to the best of his information, knowledge, and belief none of the below listed hazardous materials have been incorporated into the project:
 - Asbestos or asbestos containing materials
 - Lead in any portion of drinking water system (conformance with the Safe Drinking Water Acts Amendment of 1986 is required)
 - Refrigerant R-11 (Trichlorofluoromethane)
 - Refrigerant R-12 (Dichlorodifluoromethane)
 - Refrigerant R-113 (Trichlorotrifluoromethane)
 - Refrigerant R-114 (Dichlorotetrafluoromethane)
 - Refrigerant R-500 (combination of R-12 and R-152a)
 - Refrigerant R-502 (combination of R-22 and R-115)
 - Transformer Cooling Agent P.C.B. (Polychloride Biphenyls)

ATTEST (If Corporation)

Name of Contractor_____
Secretary_____
By_____
Date

Subscribed and sworn to before me on this _____ day of _____, 20____

Notary Public: _____

My Commission Expires: _____

SUBCONTRACTOR / SUPPLIER ASBESTOS CERTIFICATE

STATE OF TEXAS

PROJECT: New Caney ISD New Administration Building

COUNTY OF _____

OWNER: New Caney Independent School District

ARCHITECT: GPD Group

KNOW ALL MEN BY THESE PRESENTS:

_____, being first duly sworn, disposes and says:

1. That he is the _____ of _____, the subcontractor/supplier who constructed or provided the sections of work described below, and that, he is duly authorized to make this Certification.

Work Performed: _____

Specification Section(s): _____

2. That to the best of his information, knowledge, and belief **no asbestos or asbestos containing materials** have been incorporated into the project.

ATTEST (If Corporation)

Name of Subcontractor / Supplier_____
Secretary_____
By_____
Date

Subscribed and sworn to before me on this _____ day of _____, 20____

Notary Public: _____

My Commission Expires: _____

PLUMBING SUBCONTRACTOR / SUPPLIER LEAD CERTIFICATE

STATE OF TEXAS

PROJECT: New Caney ISD New Administration Building

COUNTY OF _____

OWNER: New Caney Independent School District

ARCHITECT: GPD Group

KNOW ALL MEN BY THESE PRESENTS:

_____, being first duly sworn, disposes and says:

1. That he is the _____ of _____, the subcontractor/supplier who constructed or provided the sections of work described below, and that, he is duly authorized to make this Certification.

Work Performed: _____

Specification Section(s): _____

2. That to the best of his information, knowledge, and belief **no lead** has been incorporated in any portion of the drinking water system and the system is in conformance with the Safe Drinking Water Acts Amendment of 1986.

ATTEST (If Corporation)

Name of Subcontractor / Supplier_____
Secretary_____
By_____
Date

Subscribed and sworn to before me on this _____ day of _____, 20____

Notary Public: _____

My Commission Expires: _____

MECHANICAL SUBCONTRACTOR / SUPPLIER REFRIGERANT CERTIFICATE

STATE OF TEXAS

PROJECT: New Caney ISD New Administration Building

COUNTY OF _____

OWNER: New Caney Independent School District

ARCHITECT: GPD Group

KNOW ALL MEN BY THESE PRESENTS:

_____, being first duly sworn, disposes and says:

1. That he is the _____ of _____, the subcontractor/supplier who constructed or provided the sections of work described below, and that, he is duly authorized to make this Certification.

Work Performed: _____

Specification Section(s): _____

2. That to the best of his information, knowledge, and belief none of the refrigerants listed below have been incorporated into the project:

- Refrigerant R-11 (Trichlorofluoromethane)
- Refrigerant R-12 (Dichlorodifluoromethane)
- Refrigerant R-113 (Trichlorotrifluoromethane)
- Refrigerant R-114 (Dichlorotetrafluoromethane)
- Refrigerant R-500 (combination of R-12 and R-152a)
- Refrigerant R-502 (combination of R-22 and R-115)

ATTEST (If Corporation)

Name of Subcontractor / Supplier_____
Secretary_____
By_____
Date

Subscribed and sworn to before me on this _____ day of _____, 20____

Notary Public: _____

My Commission Expires: _____

ELECTRICAL SUBCONTRACTOR / SUPPLIER PCB CERTIFICATE

STATE OF TEXAS

PROJECT: New Caney ISD New Administration Building

COUNTY OF _____

OWNER: New Caney Independent School District

ARCHITECT: GPD Group

KNOW ALL MEN BY THESE PRESENTS:

_____, being first duly sworn, disposes and says:

1. That he is the _____ of _____, the subcontractor/supplier who constructed or provided the sections of work described below, and that, he is duly authorized to make this Certification.

Work Performed: _____

Specification Section(s): _____

2. That to the best of his information, knowledge, and belief **no Transformer Cooling Agent P.C.B.s (Polychloride Biphenyls)** have been incorporated into the project:

ATTEST (If Corporation)

Name of Subcontractor / Supplier_____
Secretary_____
By_____
Date

Subscribed and sworn to before me on this _____ day of _____, 20____

Notary Public: _____

My Commission Expires: _____

**CERTIFICATION
OF PROJECT
COMPLIANCE**

Completion of this form is required under the provisions of §61.1036(c)(3)(F) TAC for all public school district construction projects. Instructions for completion of this form can be found on page 2.

1. PROJECT INFORMATION**DISTRICT:****Facility:****ARCHITECT/ENGINEER:****Address:****CONTRACTOR/CM:****City:****CONTRACT DATE:****DATE DISTRICT AUTHORIZED PROJECT:****BRIEF DESCRIPTION OF PROJECT:****2. CERTIFICATION OF DESIGN AND CONSTRUCTION**

The intent of this document is to assure that the school district has provided to the architect/engineer the required information and the architect/engineer has reviewed the School Facilities Standards as required by the State of Texas, and used his/her reasonable professional judgment and care in the architectural/engineering design and that the contractor has constructed the project in a quality manner in general conformance with the design requirements and that the school district certifies to project completion.

3. The District certifies that the educational program and the educational specifications of this facility along with the identified building code to be used have been provided to the architect/engineer.

DISTRICT:**BY:****DATE:**

4. The Architect/Engineer certifies the above information was received from the school district, and that the building(s) were designed in accordance with the applicable building codes. Further, the facility has been designed to meet or exceed the design criteria relating to space (minimum square footage), educational adequacy, and construction quality as contained in the School Facilities Standards as adopted by the Commissioner of Education, June 9, 2003, and as provided by the district.

ARCHITECT/ENGINEER:**BY:****DATE:**

5. The Contractor/CM certifies that this project has been constructed in general conformance with the construction documents as prepared by the architect/engineer listed above.

CONTRACTOR/CM:**BY:****DATE:**

6. The District certifies completion of the project (as defined by the architect/engineer and contractor).

DISTRICT:**BY:****DATE:****END OF SECTION 01 77 00**

SECTION 01 78 23

OPERATION AND MAINTENANCE DATA

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, 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 SUMMARY

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
 - 1. Operation and maintenance documentation directory
 - 2. Emergency manuals
 - 3. Operation manuals for systems, subsystems, and equipment
 - 4. Product maintenance manuals
 - 5. Systems and equipment maintenance manuals
- B. Related Requirements
 - 1. Section 01 33 00, Submittal Procedures
 - 2. Section 01 77 00, Closeout Procedures
 - 3. Section 01 78 39, Project Record Documents
 - 4. Section 01 79 00, Demonstration and Training

1.3 DEFINITIONS

- A. System: An organized collection of parts, equipment, or subsystems 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. Architect and Commissioning Authority will comment on whether content of operations and maintenance submittals are acceptable.
 - 2. Where applicable, clarify and update reviewed manual content to correspond to revisions 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.
 - 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. Three paper copies. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves.
- C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect and Commissioning Authority 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 and at least 15 days before commencing demonstration and training. Architect and Commissioning Authority will return copy with comments.

1. Correct or revise each manual to comply with Architect's and Commissioning Authority's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's and Commissioning Authority's comments and prior to commencing demonstration and training.

2 PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

- A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information. 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 Construction Manager
 7. Name and contact information for Architect
 8. Name and contact information for Commissioning Authority
 9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals
 10. Cross-reference to related systems in other operation and maintenance 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 on 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 on 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 8½ inch 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, subject matter of contents, and indicate Specification Section number on bottom of spine. Indicate volume number for 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 8½ inch by 11 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 has 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 manual, identified by product name and arranged 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 manual, identified by product name and arranged 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. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- H. 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.

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 Section 01 78 39, Project Record Documents.
- E. Comply with Section 01 77 00, Closeout Procedures, for schedule for submitting operation and maintenance documentation.

END OF SECTION 01 78 23

SECTION 01 78 39

PROJECT RECORD DOCUMENTS

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, 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 SUMMARY

- A. Section includes administrative and procedural requirements for project record documents, including Record Drawings and Miscellaneous record submittals.
- B. Related Requirements:
 - 1. Section 01 77 00, Closeout Procedures
 - 2. Section 01 78 23, Operation and Maintenance Data

1.3 CLOSEOUT SUBMITTALS

- A. Record Drawings: Comply with the following:
 - 1. Number of Copies: Submit copies of record Drawings as follows:
 - a. Initial Submittal:
 - 1) Submit one paper-copy set of marked-up record prints.
 - 2) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
 - b. Final Submittal:
 - 1) Submit PDF electronic files of scanned record prints and one set of prints.
 - 2) Print each drawing, whether or not changes and additional information were recorded.
- B. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit annotated PDF electronic files and directories of each submittal.

2 PRODUCTS

2.1 RECORD DRAWINGS

- A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
 - 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. Use 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. 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 with comment function enabled.
 - 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 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.
- B. Format: Submit miscellaneous record submittals as scanned PDF electronic files of marked-up miscellaneous record submittals.
 - 1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

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 revisions to project record documents as they occur; do not wait until 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

SECTION 01 79 00

DEMONSTRATION AND TRAINING

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, 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 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
- B. Related Requirements
 - 1. Section 01 33 00, Submittal Procedures
 - 2. Section 01 77 00, Closeout Procedures
 - 3. Section 01 78 23, Operation and Maintenance Data
 - 4. Section 01 78 39, Project Record Documents

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 using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.
- B. 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 within seven days of end of each training module.
 - 1. Identification: On each copy, provide an applied label with the following information:
 - a. Name of Project
 - b. Name of Architect
 - c. Name of Contractor
 - d. Date of video recording
 - 2. Transcript: Prepared in PDF electronic format. Include a cover sheet with same label information as the corresponding video recording and a table of contents with links to corresponding training components. Include name of Project and date of video recording on each page.
 - 3. At completion of training, submit complete training manual(s) for Owner's use in PDF electronic file format on compact disc or flash drive.

1.5 QUALITY ASSURANCE

- A. Instructor Qualifications: A factory-authorized service representative experienced in operation and maintenance procedures and training.

- B. Videographer Qualifications: A professional videographer who is experienced photographing demonstration and training events similar to those required.

1.6 COORDINATION

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.
- B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and 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.

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 teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. 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:
 - 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

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 requirements in Section 01 78 23, Operation and Maintenance Data.
- B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

- A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.
- B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
- C. 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, through Architect, with at least seven days' advance notice.
- D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.
- E. Cleanup: Collect used and leftover educational materials and remove from Project site. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

3.3 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

- A. General: Engage a qualified commercial videographer to record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.
 - 1. At beginning of each training module, record each chart containing learning objective and lesson outline.
- B. Video: Provide minimum 1080p video resolution converted to format file type acceptable to Owner, on electronic media.
 - 1. Electronic Media: Read-only format compact disc acceptable to Owner, with commercial-grade graphic label.
 - 2. File Hierarchy: Organize folder structure and file locations according to project manual table of contents. Provide complete screen-based menu.
 - 3. File Names: Utilize file names based upon name of equipment generally described in video segment, as identified in Project specifications.
 - 4. Contractor and Installer Contact File: Using appropriate software, create a file for inclusion on the Equipment Demonstration and Training DVD that describes the following for each Contractor involved on the Project, arranged according to Project table of contents:
 - a. Name of Contractor/Installer
 - b. Business address
 - c. Business phone number
 - d. Point of contact
 - e. E-mail address
- C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to adequately cover area of demonstration and training. Display continuous running time.
 - 1. Film training session(s) in segments not to exceed 15 minutes.
 - a. Produce segments to present a single significant piece of equipment per segment.
 - b. Organize segments with multiple pieces of equipment to follow order of Project Manual table of contents.
 - c. Where a training session on a particular piece of equipment exceeds 15 minutes, stop filming and pause training session. Begin training session again upon commencement of new filming segment.
- D. Light Levels: Verify light levels are adequate to properly light equipment. Verify equipment markings are clearly visible prior to recording.
 - 1. Furnish additional portable lighting as required.
- E. Narration: Describe scenes on video recording by audio narration by microphone while video recording is recorded or dubbing audio narration off-site after video recording is recorded. Include description of items being viewed.
- F. Transcript: Provide a transcript of the narration. Display images and running time captured from videotape opposite the corresponding narration segment.
- G. Preproduced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

END OF SECTION 01 79 00

**SECTION 02 41 17
DEMOLITION****PART 1 – GENERAL****1.01 DESCRIPTION**

- A. This Section specifies the requirements for 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. Building structures, as indicated on Drawings, except items to be removed by WISD prior to start of work.
 - 2. Entrances, drives, parking lots and structures, and adjacent landscape work to limits indicated on Drawings.
 - 3. Building foundations and supporting walls to a uniform depth of 12 inches below lowest foundation elevation.
 - 4. Paving, curbs, gutters, walkways, and related concrete and asphalt.

1.02 SUBMITTALS

- A. In accordance with Section 01340 - Shop Drawings, Product Data, Samples, and Record Documents of these Specifications, the following shall be submitted:
 - 1. Proposed methods and operations of building demo to WISD 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 WISD operations.

1.03 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. Occupancy

Structures to be demolished will be discontinued in use prior to start of Work.

D. Condition of Structures and Work Site

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

E. 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.

F. Explosives

Use of explosives will not be permitted.

G. Traffic

Contractor shall comply with Section 01570 - Traffic Regulation of these Specifications. Conduct demolition operations and removal of debris to ensure minimum interference with WISD 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.

H. Protection

Contractor shall comply with Section 01510 - Temporary Facilities of these Specifications. 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.

I. Damages

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

J. Utility Services

Contractor shall comply with Section 01541 - Maintenance and Protection of Utilities of these Specifications. 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 WISD and utility owner.

PART 2 - PRODUCTS (Not used)

PART 3 - EXECUTION**3.01 DEMOLITION****A. General**

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

B. Pollution Control

Contractor shall comply with Section 01560 - Environmental Impact Controls of these Specifications. 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. Building Demolition

Demolish building and structures completely and remove from Work Site. Use such methods as required to complete Work within limitations of governing regulations.

1. Proceed with demolition in systematic manner, from top of structure to ground.
2. Demolish concrete and masonry in small sections.
3. Break up and remove concrete and asphalt slabs-on-grade, unless otherwise shown to remain.

D. 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.

E. Filling Voids

1. Completely fill below-grade areas and voids resulting from demolition. Coordinate with work of Sections 311100 – Clearing and Grubbing, and 310000 – 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 310000 - 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.

3.02 DISPOSAL OF DEMOLISHED MATERIALS

DEMOLITION**SECTION 02 41 17****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 10

CONCRETE EPOXY BONDING AGENT

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, 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 SUMMARY

- A. Section includes all concrete bonding agent work for bonding fresh concrete to hardened concrete.
- B. Related Sections
 - 1. Section 03 05 20, Reinforcing Epoxy Bonding Agent
 - 2. Section 03 30 00, Cast-In-Place Concrete
 - 3. Section 03 63 00, Epoxy Grouting

1.3 REFERENCES

- A. Use current editions unless noted otherwise.
- B. Texas Health and Safety Code, Chapter 161, Subchapter Q, Installation of Asbestos
- C. Texas Occupations Code, Chapter 1954, Asbestos Health Protection

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00, Project Management and Coordination.

1.5 ACTION SUBMITTALS

- A. Submit product data for each type of product indicated.

1.6 INFORMATIONAL SUBMITTALS

- A. Submit Material Safety and Data Sheet (MSDS) for all materials, products, and parts.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver material to the site in manufacturer's original unopened containers.

1.8 WARRANTY

- A. Provide written warranty against defects in material and workmanship for the work of this Section for a period of **two** years from the Date of Substantial Completion. Warranty shall include, but not necessarily be limited to, loss of adhesion, cracking or spalling of bonded concrete.
- B. Refer to Section 01 77 00, Closeout Procedures, for Warranty form.

2 PRODUCTS

2.1 MANUFACTURERS

- A. Degussa Building Systems (MBT): Concreive Liquid (LPL)
- B. E-Poxy Industries: Eva-Pox Fresh Concrete Bonder No. 2
- C. Rescon Technology Corp.: Product R649, Fresh Concrete Bonder
- D. Sika Chemical Corporation: Sikadur 32 Hi-Mod
- E. Thermal-Chem, Inc.: Thermal-Chem Wet Concrete Bonder, Product No. 5 or 501

2.2 MATERIALS

- A. All epoxy material shall be new and manufactured within the shelf life limitations set forth by the manufacturer.
- B. Epoxy shall be two-part epoxy adhesive material, and shall be of epichlorohydrin/amine type. Polysulphide epoxies are not acceptable.
- C. Epoxy used shall be insensitive to the presence of water and moisture, and shall be capable of application and of strength development even when applied to damp surfaces having a temperature of 40° F or above.
- D. Epoxy shall develop a minimum strength of 2000 psi in tension and 4000 psi in compression at the end of seven days.
- E. Epoxies used shall not deteriorate under approximately 200 freeze/thaw cycles.
- F. Epoxies used shall be 100% solids without solvents.

3 EXECUTION**3.1 INSPECTION**

- A. Inspect surfaces to ensure that surfaces are clean, dry and free from all foreign matter such as dirt, oil, grease, water, frost, curing compound, protective coatings, asphalt and all other foreign matter.

3.2 PREPARATION

- A. Clean and prime surfaces in accordance with manufacturer's recommendations prior to application of concrete bonding agent.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's printed instructions.

END OF SECTION 03 05 10

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 15 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
- B. Vapor barrier products:
 - 1. Basis of Design: Stego Wrap Vapor Barrier (15-mil) by Stego Industries LLC., (877) 464-7834 www.stegoindustries.com
 - 2. Approved Alternate: Vaporguard by Reef Industries, 713-507-4250. www.reefindustries.com.
 - 3. Approved Alternate: PMPC by WR Meadows, 800-342-5976. <http://www.wrmeadows.com/pmpc/>
 - 4. Approved Alternate: Moistop Ultra by Fortifiber, 1-800-773-4777. www.fortifiber.com

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. 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.

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. 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.
- C. 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.
- D. 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, restraighening, 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 restraighening until surface is left with a uniform, smooth, granular texture. Interior slabs shall be brought to a "matte" sheen; do not over trowel.
 - 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.
 - 2. Moisture mitigation required due to over trowelling concrete slabs to the point that moisture is trapped within the concrete slab shall be at the Contractors sole risk and responsibility; and shall not be at any additional cost to the Owner

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 03 15 13

WATERSTOPS

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, 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 SUMMARY

- A. Section includes non-swelling waterstops.
- B. Related Requirements
 - 1. Section 03 00 00, Concrete
 - 2. Section 03 10 00, Concrete Forming and Accessories
 - 3. Section 03 30 00, Cast-In-Place Concrete
 - 4. Section 07 10 00, Damp[roofing and Waterproofing

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00, Project Management and Coordination.
- B. Review conditions, installation procedures, schedules, and coordination with other Work.
- C. Pre-installation meeting attendees include the General Contractor, Installing Contractor, Waterstop Manufacturer Representative, Concrete Contractor, Design Representative, Owner's Representative, and trades with associated scopes of work that directly affect the waterstop application, protection, and long-term ability to maintain a watertight assembly.

1.4 ACTION SUBMITTALS

- A. Provide submittals in accordance with Section 01 33 00 Submittal Procedures.

1.5 INFORMATIONAL SUBMITTALS

- A. Submit the following product data and certificates.
- B. Product data
 - 1. Guide specification
 - 2. Safety data sheets
 - 3. Standard details
 - 4. Technical data sheets
- C. Certificates
 - 1. Product certification stating assembly components are supplied and warranted by a single source Manufacturer.
 - 2. Statement confirming Installer is approved by Waterproofing Manufacturer to complete Work as specified.

1.6 QUALITY ASSURANCE

- A. Qualifications
 - 1. Manufacturer qualifications
 - a. Minimum of 20 years of experience in the production and sales of waterstops.
 - 2. Installer qualifications
 - a. Approved by Waterproofing Manufacturer to complete Work as specified.
 - b. Minimum 2 years of experience in installing waterstops.

- B. Mock-ups
 - 1. Construct mockups at a size and location as directed by the Architect to verify project specific applications and set quality standards for materials and execution in accordance with manufacturer's recommendations.
 - a. Include waterstop as part of the mockup.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Delivery and Acceptance Requirements.
 - 1. Deliver materials in original, factory-sealed, unopened containers with intact and legible product label and manufacturer name.
- B. Storage and Handling.
 - 1. Store materials as recommended by the Manufacturer in a protected area and out of direct sunlight. Protect materials from rain and physical damage.

1.8 SITE CONDITIONS

- A. Ambient Conditions
 - 1. Do not perform Work during inclement weather.
 - 2. Do not perform Work on surfaces covered in standing water.

1.9 WARRANTY

- A. Provide written warranty against defects in material and workmanship for the work of this Section for a period of **one (1)** year from the Date of Substantial Completion.
- B. Warrants product against product defect; provides material only for a period of **ten (10)** years from date of purchase.
- C. Refer to Section 01 77 00, Closeout Procedures, for Warranty form.

2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable manufacturers
 - a. Henry® a Carlisle Company
- B. Performance Criteria
 - 1. Does not swell when in contact with water
 - 2. Certified NSF/ANSI Standard 61 for use in potable water systems
 - 3. Flow Resistance: Meets Federal Specification SSS-210
 - 4. Resistance to hydrostatic head: 68 feet of water (on non-moving joints)

2.2 MATERIALS

- A. Non-swelling preformed joint sealant with a single component, self-sealing adhesive compound providing a lasting, watertight bond to fresh and cured concrete surfaces, having the following typical properties:
 - 1) Basis of design: Henry Synko-Flex® Waterstop
- B. Primer
 - 1. Solvent based primer:
 - 1) Basis of design: Synko-Flex Solvent Based Primer
 - 2. Emulsion based primer:
 - 1) Basis of design: Synko-Flex Emulsion Primer
 - 3. Waterstop adhesive
 - a. Moisture cure, medium modulus polymer modified sealing compound:
 - 1) Basis of design: Henry 925 BES Sealant execution

2.3 ACCESSORIES

- A. Mechanical fasteners
 - 1. Mechanical fasteners used to secure waterstop to concrete substrate
- B. Tie wire
 - 1. Rebar tie wire to secure waterstop into place around pipe penetrations

3 EXECUTION**3.1 INSPECTION**

- A. Verification of Conditions
 - 1. Verify substrates are in accordance with Waterstop Manufacturer requirements and as specified in this Section prior to waterstop installation. Commencement of the Work indicates installer acceptance of the substrate.
 - a. Verify surfaces are sound, clean, dry, and free of oil, grease, dust, dirt, loose particles, excess mortar, frost, laitance, loose and flaking particles, or other contaminants.
 - b. Verify substrates are continuous and secure, smooth and without large voids, spalled areas, or sharp protrusions.
 - c. Verify pipe penetrations are dry prior to waterstop installation.
 - d. Verify areas of anticipated waterstop has a minimum of 2 inches (50 millimeters) of concrete cover.

3.2 PREPARATION

- A. Protection of In-Place Conditions
 - 1. Protect areas and surfaces not included in scope of Work against damage or soiling.
- B. Clean cured concrete vertical substrates with a wire or stiff bristle brush prior to priming.

3.3 INSTALLATION

- A. Waterstop
 - 1. Warm waterstop during cold weather for optimal flexibility prior to application.
 - 2. Splice waterstop strips together with a 1 inch (25 millimeter) overlap or side lap to create a continuous waterstop, ensuring no separation or air pockets.
 - 3. All non-rigid waterstops shall be installed in a continuous keyway cast into the receiving concrete. Keyways shall be formed with two x four's formwork.
 - 4. Secure waterstop into place.
 - a. Horizontal applications as shown in the drawings and under curbs in mechanical rooms and gang restrooms.
 - 1) Fresh (uncured) concrete:
 - a) Peel protective release paper from one side of waterstop.
 - b) Carefully press exposed side of waterstop into fresh concrete while concrete is still wet.
 - (1) Verify waterstop is visible above wet concrete surface approximately 1/2-inch (10 millimeters).
 - c) Do not remove exposed protective release paper on waterstop until area is ready for subsequent concrete pour.
 - 2) Concrete joints:
 - a) Apply a 2 inch (50 millimeter) wide strip of primer at area of anticipated waterstop installation.
 - b) Refer to product specific technical data sheet for primer installation instructions and application rates.
 - c) Allow primer to dry to touch prior to waterstop installation, typically 2-3 hours.
 - d) Remove one side of waterstop release paper and firmly press exposed side of waterstop onto primed substrate until waterstop is depressed approximately 5/8-inch (15 millimeters) thick and 1-1/2 inches (40 millimeters) wide.

- e) Remove remaining release paper and mechanically fasten waterstop a maximum of 10 inches (250 millimeters) on center and 1 inch (25 millimeters) from ends and splices.
- b. Vertical applications:
 - 1) Peel protective release paper from one side of waterstop.
 - 2) Install waterstop with protective release paper side facing formwork, and mechanically fasten waterstop a maximum of 10 inches (250 millimeters) on center and 1 inch (25 millimeters) from ends and splices.
 - a) Finishing nails will pull through waterstop when formwork is removed.
 - 3) Install 1/2-inch (10 millimeter) chamfer strips on each side of waterstop.
- c. Pipe penetrations:
 - 1) Cut waterstop to pipe diameter.
 - 2) Remove one side of waterstop release paper and adhere exposed side of waterstop to pipe penetration by embedding waterstop into a minimum 3/8-inch (10 millimeter) bead of waterstop adhesive.
 - 3) Hold waterstop in place with tie wire.

3.4 SITE QUALITY CONTROL**A. Site Tests and Inspections**

- 1. Verify waterstop is in-place and intact prior to concrete placement. Repair damaged waterstop per Waterstop Manufacturer published literature.

3.5 CLEANING**A. Waste Management**

- 1. As the Work proceeds, and upon completion, promptly clean up and remove from the premises all rubbish and surplus materials resulting from the foregoing Work.
- 2. Clean soiled surfaces, spatters, and damage caused by Work of this Section.
- 3. Dispose of chemical grout per local code ordinances.

3.6 PROTECTION

- A. Protect waterstop from damage by other trades and concrete consolidation equipment prior to and during concrete placement.

END OF SECTION 03 15 13

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. 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.
- C. 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 $\frac{1}{4}$ inch.
 - 2. Minimum spacing between bars: Minus $\frac{1}{4}$ inch.
 - 3. Top bars in slabs and beams:
 - a. Members 8 inches deep or less: Plus or minus $\frac{1}{4}$ inch.
 - b. Members between 8 and 24 inches deep: Plus or minus $\frac{1}{2}$ 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 03 21 00
SITE CONCRETE REINFORCEMENT

PART 1 – GENERAL**1.1 SECTION INCLUDES**

- A. This WORK shall consist of furnishing and placing reinforcing steel in accordance with these SPECIFICATIONS and in conformity with the DRAWINGS.

1.2 RELATED SECTIONS

- A. The following is a list of SPECIFICATIONS which may be related to this section:

1. Section 32 13 73.19 Cast in Place Concrete

1.3 REFERENCES

- A. The following is a list of standards which may be referenced in this section:

1. American Association of State and Highway Transportation Officials (AASHTO):
 - a. M31M/M31, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
 - b. AASHTO Standard Specifications for Welding of Structural Steel Highway Bridges.
2. American Concrete Institute (ACI):
 - a. ACI Detailing Manual.
 - b. 117, Specifications for Tolerance for Concrete Construction and Materials.
 - c. 318, Building Code Requirements for Structural Concrete.
3. American Welding Society (AWS):
 - a. D1.1/D1.1M, Structural Welding Code - Steel.
 - b. D1.4/D1.4M, Structural Welding Code - Reinforcing Steel.
 - c. D2.0, Welded Highway and Railway Bridges.
4. ASTM International (ASTM):
 - a. A82/A82M, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
 - b. A497/A497M, Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete.

- c. A615, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
 - d. A996/A996M, Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement.
 - e. A706/A706M, Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
 - f. A767/A767M, Standard Specification for Zinc-coated (Galvanized) Steel Bars for Concrete Reinforcement.
 - g. A775/A775M, Standard Specification for Epoxy-coated Steel Reinforcing.
5. Concrete Reinforcing Steel Institute (CRSI):
- a. Manual of Standard Practice.
 - b. Placing Reinforcing Bars.

1.4 SUBMITTALS

- A. Two copies of a list of all reinforcing steel and bending diagrams shall be furnished to the ENGINEER at the site of the work at least one week before the placing of reinforcing steel is begun. Such lists will not be reviewed for accuracy. The CONTRACTOR shall be responsible for the accuracy of the lists and for furnishing and placing all reinforcing steel in accordance with the details shown on the plans.

1.5 DELIVERY, STORAGE, AND PROTECTION

- A. Reinforcing steel shall be stored off the ground and protected from oil or other materials detrimental to the steel or bonding capability of the reinforcing bar. Epoxy coated reinforcing bars shall be stored on protective cribbing.

PART 2 - PRODUCTS

2.1 REINFORCING STEEL

- A. Deformed Bars: All bar steel reinforcement shall be of the deformed type, ASTM A615, AASHTO M31M/M31, and Grade (40 or 60) as specified on the DRAWINGS.
- B. Spirals:
- 1. Spirals, hot-rolled plain or deformed bars per ASTM A615, Grade 60 or cold drawn wire per ASTM A82/A82M as specified on the DRAWINGS.
 - 2. Spirals for columns shall have two (2) "spacers" with a section modulus $>0.030\text{in}^3$ in order to maintain the proper pitch and spacing.
- B. Epoxy-Coated Reinforcing Bars: Epoxy-coated reinforcing bars shall conform to ASTM A775/A775M. When required, damaged epoxy coating shall be repaired with patching material conforming to ASTM A775/A775M in accordance with the material manufacturer's recommendations.

- C. Zinc-coated (Galvanized Reinforcing Bars): Zinc-coated reinforcing bars shall conform to ASTM A767/A767M. When required, damaged zinc coating shall be repaired with a zinc-rich formulation conforming to ASTM A767/A767M.
- D. Welded Wire Fabric: N/A

2.2 TIE WIRE

- A. 16 gauge wire ties, manufactured by American Wire Tie, Inc., or equal. When epoxy coated reinforcing steel is shown on the DRAWINGS, PVC coated wire ties shall be used. The minimum PVC coating shall be 0.7 mils.

2.3 BAR SUPPORTS

- A. General: Bar supports and spacing shall be in accordance with the CRSI Manual of Standard Practice, Chapter 3, a maximum of four (4) feet, or as required by the DRAWINGS.
- B. Floor Slabs: Provide either of the following support chairs (No substitutions):
 - 1) Aztec "Castle Chairs"
 - 2) OCM Inc. "Cradle Chairs"
- C. Columns: Plastic "space wheels" manufactured by Aztec (Model DO 12/40), or equal, are required.
- D. Epoxy-Coated and Zinc-Coated Bar Supports: Epoxy-coated reinforcing bars supported from formwork shall rest on coated wire bar supports made of dielectric or other acceptable materials. Wire supports shall be fully coated with dielectric material, compatible with concrete. Reinforcing bars used as support bars shall be epoxy-coated. In walls reinforced with epoxy-coated bars, spreader bars shall be epoxy-coated. Proprietary combination bar clips and spreaders used in walls with epoxy-coated reinforcing shall be made of corrosion-resistant material or coated with dielectric material.

2.4 FABRICATION

- A. Fabrication tolerances for straight and bent bars shall be in accordance with the requirements of Subsection 4.3, Tolerance, of ACI 315 and the CRSI Manual of Standard Practice.

PART 3 – EXECUTION

3.1 GENERAL

- A. Rust, seams, surface irregularities, or mill scale shall not be cause for rejection provided that the weight and height of deformations of a hand-wire-brushed test specimen are not less than the applicable ASTM Specification.

3.2 BAR LIST

- A. CONTRACTOR shall be responsible for the accuracy of the lists and for furnishing and placing all reinforcing steel in accordance with the details shown on the DRAWINGS.
- B. Bar lists and bending diagrams for structures, which are included on the DRAWINGS, do not have to be furnished by CONTRACTOR. When bar lists and bending diagrams are included on the DRAWINGS, they are intended for estimating approximate quantities. CONTRACTOR shall verify the quantity, size, and shape of the bar reinforcement against those shown on the DRAWINGS and make any necessary corrections before ordering.

3.3 BENDING

- A. All reinforcing bars shall be bent cold. Bars partially embedded in concrete shall not be field bent, except as shown on the DRAWINGS or permitted. Bars shall not be bent or straightened in a manner that may injure the material.

3.4 SPIRALS

- A. One and one-half (1-1/2) finishing bends are required at the top and bottom of the spiral. Spacers shall be provided in accordance with Chapter 5, Section 9 of the CRSI Manual of Standard Practice. Welding as an aid to fabrication and/or installation is not permitted.

3.5 PLACING AND FASTENING

- A. When placed in the WORK, the reinforcing bars shall be free from dirt, loose mill scale, paint, oil, loose rust, or other foreign substance.
- B. The placing, fastening, splicing, and supporting of reinforcing steel and wire mesh or bar mat reinforcement shall be in accordance with the DRAWINGS and the latest edition of "CRSI Placing Reinforcing Bars." In case of discrepancy between the DRAWINGS and the CRSI publication stated above, the DRAWINGS shall govern. Reinforcement shall be placed within the tolerances provided in ACI 117.
- C. Steel reinforcement shall be accurately placed in the positions shown on the DRAWINGS and firmly held during the placing and setting of concrete by means of spacer strips, stays, metal chairs or other approved devices or supports. Precast concrete bricks or other types of bricks are not permitted for support of reinforcement in footings, slabs, or any other part of the work. Chair and bolster supports for slabs and walls shall be spaced at a maximum of four- (4-) foot centers unless otherwise shown on the DRAWINGS. Staples used to attach bar supports to wall and roof forms shall have the staple "tails" clipped after form removal. For columns, three (3) wheels, spaced one hundred twenty degrees (120°) apart, shall be placed every four (4) feet of column height. CONTRACTOR may increase the column spiral pitch if a conflict occurs with the wheel. Pre-tied column reinforcing steel lowered into column forms shall be lowered vertically to prevent damage to the space wheels.
- D. Bars shall be securely tied at fifty percent (50%) of all intersections except where spacing is less than one (1) foot in each direction, when alternate intersections shall be tied unless otherwise called out on the DRAWINGS or in applicable SPECIFICATIONS. Tying of steel by spot welding shall not be permitted unless specifically authorized by ENGINEER. The placing and securing of the reinforcement in any unit or section shall be accepted by ENGINEER before any concrete is placed in any such unit or section.

- E. Bundle bars shall be tied together at not more than six- (6-) foot centers.

3.6 SPLICING

- A. Bar steel reinforcement shall be furnished in the full lengths indicated on the DRAWINGS. Splicing of bars, except where shown on the DRAWINGS, shall not be permitted without the written acceptance of ENGINEER. Splices shall be staggered. In cases where permission is granted to splice bars, other than those shown on the DRAWINGS, the additional material required for the lap shall be furnished by CONTRACTOR at CONTRACTOR's own expense. The minimum distance between staggered splices for reinforcing bars shall be the length required for a lapped splice in the bar. All splices shall be full contact splices.
- B. Splices shall not be permitted at points where the section is not sufficient to provide a minimum distance of two (2) inches between the splice and the nearest adjacent bar or the surface of the concrete.
- C. Welding of reinforcement shall be done only if detailed on the DRAWINGS or if authorized by ENGINEER in writing. Welding shall be done by a certified welder. The welding shall conform to AWS D1.4/D1.4M with the modifications and additions specified hereinafter. Where AWS D2.0 Specifications for Welded Highway and Railway Bridges is referenced, the reference shall be construed to be for AWS D1.1. Where the term AWS D1.1/D1.1M is used it shall mean the American Welding Society Structural Welding Code, D1.5/D1.5M as modified and amended by the AASHTO Standard Specifications for Welding of Structural Steel Highway Bridges. After completion of welding, coating damage to coated reinforcing steel bars shall be repaired.
- D. When required or permitted, a mechanical connection may be used to splice reinforcing steel bars or as substitution for dowel bars. The mechanical connection shall be capable of developing a minimum of one hundred twenty five percent (125%) of the yield strength of the reinforcing bar in both tension and compression. All parts of mechanical connections used on coated bars, including steel splice sleeves, bolts, and nuts shall be coated with the same material used for repair of coating damage.

3.7 CUTTING

- A. When coated reinforcing bars are cut in the field, the ends of the bars shall be coated with the same material used for repair of coating damage.

END OF SECTION 03 21 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.
1. Product Data for Credit IEQ 4.3: For liquid floor treatments and curing and sealing compounds, documentation including printed statement of VOC content.
 2. 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.
- B. 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.
- C. Steel Reinforcement Shop Drawings: Refer Section 03 20 00.
- D. Formwork Shop Drawings: Refer Section 03 10 00.
- 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 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.
 - 2. Retain class of aggregate from options in first paragraph below or revise to suit Project. ASTM C 33 limits deleterious substances in coarse aggregate depending on climate severity and in-service location of concrete. Classes in first set of options are ASTM C 33 default classes for concrete exposed to weather for Severe, Moderate, and Negligible weathering regions, respectively. Revise first two options to Class 4S or 4M if concrete will be exposed to frequent wetting. Retain last option if damage caused by concrete expansion from alkali silica or alkali carbonate reactions is anticipated.
- 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 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.

2.7 VAPOR RETARDERS

- A. See Section 03 05 80.

2.8 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 silicate 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 silicate 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.

2.9 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).

2.10 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.

2.11 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.

2.12 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.

2.13 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.

2.14 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Proportion normal-weight concrete mixture as indicated in Structural General Notes:

2.15 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.16 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.
- 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, restraighening, 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 restraighening 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.
 - 3. Moisture mitigation required due to over trowelling concrete slabs to the point that moisture is trapped within the concrete slab shall be at the Contractors sole risk and responsibility; and shall not be at any additional cost to the Owner
 - 4. Interior slabs shall be brought to a "matte" sheen; do not over trowel.
- 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-resistive granules 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 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.

3.12 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.

3.13 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.

3.14 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.

3.15 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.

3.16 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.

3.17 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 52 16

LIGHTWEIGHT INSULATING CONCRETE

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, 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 SUMMARY

- A. Section includes cast-in-place cellular lightweight insulating concrete.
- B. Related Requirements
 - 1. Section 03 30 00, Cast-in-Place Concrete
 - 2. Section 03 51 13, Cementitious Wood Fiber Decks
 - 3. Section 05 31 00, Steel Decking
 - 4. Section 06 10 53, Miscellaneous Rough Carpentry
 - 5. Section 07 52 16, SBS Modified Bituminous Membrane Roofing
 - 6. Section 07 62 00, Sheet Metal Flashing and Trim
 - 7. Section 07 92 00, Joint Sealants

1.3 REFERENCES

- A. Use current editions unless indicated otherwise.
- B. American Concrete Institute (ACI)
 - 1. ACI 301, Specifications for Structural Concrete
- C. ASTM International (ASTM)
 - 1. ASTM A185 / A185M, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete
 - 2. ASTM C150 / C150M, Standard Specification for Portland Cement
 - 3. ASTM C172 / C172M, Standard Practice for Sampling Freshly Mixed Concrete
 - 4. ASTM C260 / C260M, Standard Specification for Air-Entraining Admixtures for Concrete
 - 5. ASTM C578, Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation
 - 6. ASTM C612, Standard Specification for Mineral Fiber Block and Board Thermal Insulation
 - 7. ASTM C869 / C869M - 11 Standard Specification for Foaming Agents Used in Making Preformed Foam for Cellular Concrete
 - 8. ASTM E119, Standard Test Methods for Fire Tests of Building Construction and Materials
- D. Underwriters Laboratories Inc. (UL)
 - 1. Fire Resistance Directory
- E. Texas Health and Safety Code, Chapter 161, Subchapter Q, Installation of Asbestos
- F. Texas Occupations Code, Chapter 1954, Asbestos Health Protection

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00, Project Management and Coordination.

1.5 ACTION SUBMITTALS

- A. Submit product data for each type of product indicated. Include mixing and application instructions for each type of lightweight insulating concrete.
- B. Shop Drawings: Include plans, sections, and details showing roof slopes, lightweight insulating concrete thicknesses, embedded insulation board, roof penetrations, roof perimeter terminations and curbs, control and expansion joints, and roof drains.

- C. Submit design mixtures for each lightweight insulating concrete mix.

1.6 INFORMATIONAL SUBMITTALS

- A. Submit Material Safety and Data Sheet (MSDS) for all materials, products, and parts.
- B. Submit qualification data for installer.
- C. Submit product certificates from manufacturer for cementitious materials, foaming agents, admixtures, and molded-polystyrene insulation board.
- D. Submit material test reports for lightweight aggregates from a qualified testing agency indicating compliance with requirements.

1.7 QUALITY ASSURANCE

- A. **General Contractor, lightweight insulating concrete subcontractor, and roofing subcontractor shall ensure during the bidding period that the lightweight insulating concrete being provided is compatible with the roof membrane and that the proposal includes all costs necessary to provide a complete working system.**
- B. Installer Qualifications: An Installer who employs and retains, throughout the project, supervisors who are trained and approved by manufacturer.
- C. Fire-Resistance Ratings: Where indicated, provide lightweight insulating concrete identical to those of assemblies tested for fire resistance per ASTM E119 by a qualified testing agency.
 - 1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

1.8 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.

1.9 FIELD CONDITIONS

- A. Do not place lightweight insulating concrete unless ambient temperature is at least 40° F and rising.
- B. Do not place lightweight insulating concrete during rain or snow or on surfaces covered with standing water, snow, or ice.

1.10 WARRANTY

- A. Provide written warranty against defects in material and workmanship for the work of this Section for a period of one year from the Date of Substantial Completion.
- B. Refer to Section 01 77 00, Closeout Procedures, for Warranty form.

2 PRODUCTS

2.1 MANUFACTURERS

- A. Cellular Lightweight Insulating Concrete
 - 1. Celcore Incorporated
 - 2. Cellular Concrete LLC, Mearlcrete Division
 - 3. Elastizell Corporation of America
 - 4. Siplast

2.2 MATERIALS

- A. Cementitious Material: Portland cement, ASTM C150, Type I
- B. Foaming Agent: ASTM C869
- C. Water: Clean, potable
- D. Air-Entraining Admixture: ASTM C260
- E. Joint Filler: ASTM C612, Class 2, glass-fiber type; compressing to one-half thickness under a load of 25 psi

- F. Molded-Polystyrene Insulation Board: ASTM C578, Type I, 0.90-lb/cu. ft. minimum density.
 - 1. Provide units with manufacturer's standard keying slots of approximately 3 percent of board's gross surface area.
 - a. Alleguard Holey Board
- G. Reinforcing Fibers: Monofilament fibers manufactured from 100% homopolymer, polypropylene resin, containing no reprocessed olefin materials and in compliance with ASTM C-1116 "Standard Specification for Fiber-Reinforced Concrete and Shotcrete". Provide in 3/4" fiber cut length at a ratio of 1.5 pounds per yard of concrete.

2.3 DESIGN MIXTURES

- A. Prepare design mixtures for each type and strength of lightweight insulating concrete by laboratory trial batch method or by field-test data method. For trial batch method, use a qualified independent testing agency for preparing and reporting proposed mixture designs.
- B. Limit water-soluble chloride ions to the maximum percentage by weight of cement or cementitious material permitted by ACI 301.

2.4 CELLULAR LIGHTWEIGHT INSULATING CONCRETE

- A. Produce cellular lightweight insulating concrete with the following minimum physical properties using cementitious materials, air-producing liquid-foaming agents, and the minimum amount of water necessary to produce a workable mix.
 - 1. As-Cast Unit Weight: 36 to 44 lb/cu. ft. at point of placement, when tested according to ASTM C138/C138M
 - 2. Oven-Dry Unit Weight: 26 to 32 lb/cu. ft., when tested according to ASTM C495
 - 3. Compressive Strength: Minimum 300 psi, when tested according to ASTM C495

3 EXECUTION

3.1 PREPARATION

- A. 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 insulating concrete. Fill control joints with joint filler.
 - 1. Provide 1 inch wide control joints for roof dimensions up to 100 feet in length; 1½ inch wide control joints for roof dimensions exceeding 100 feet.

3.2 MIXING AND PLACING

- A. Mix and place lightweight insulating concrete according to manufacturer's written instructions, using equipment and procedures to avoid segregation of mixture and loss of air content.
- B. Install insulation board according to lightweight insulating concrete manufacturer's written instructions. Place insulation board in wet, lightweight insulating concrete slurry poured a minimum of 1/8 inch over the structural substrate. Ensure full contact of insulation board with slurry. Stagger joints and tightly butt insulation boards.
 - 1. Install insulation board in a stair-step configuration with a maximum step-down of 1 inch.
 - 2. Minimum Thickness: 6 inches
- C. Deposit and screed lightweight insulating concrete 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.
- D. Finish top surface smooth, free of ridges and depressions, and maintain surface in condition to receive subsequent roofing system.
- E. Begin curing operations immediately after placement, and air cure for not less than three days, according to manufacturer's written instructions.
- F. If ambient temperature falls below 32° F, protect lightweight insulating concrete from freezing and maintain temperature recommended by manufacturer for 72 hours after placement.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to sample materials, perform field tests and inspections, and prepare test reports.
- B. Testing of samples of lightweight insulating concrete obtained according to ASTM C172, except as modified by ASTM C495, shall be performed according to the following requirements:
 - 1. Determine as-cast unit weight during each hour of placement, according to ASTM C138/C138M.
 - 2. Determine oven-dry unit weight and compressive strength according to ASTM C495. Make a set of at least six molds for each day's placement, but not less than one set of molds for each 5000 sq. ft. of roof area.
 - 3. Perform additional tests when test results indicate that as-cast unit weight, oven-dry unit weight, compressive strength, or other requirements have not been met.
 - a. Retest cast-in-place lightweight insulating concrete for oven-dry unit weight and compressive strength.

3.4 DEFECTIVE WORK

- A. Refinish, or remove and replace, lightweight insulating concrete if surfaces are excessively scaled or too rough to receive roofing according to roofing membrane manufacturer's written instructions.
- B. Remove and replace lightweight insulating concrete that fails to comply with requirements.

END OF SECTION 03 52 16

SECTION 03 63 00

EPOXY GROUTING

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, 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 SUMMARY

- A. Section includes all epoxy mortar for bonding, patching and resurfacing.
- B. Related Requirements
 - 1. Section 03 05 10, Concrete Epoxy Bonding Agent
 - 2. Section 03 05 20, Reinforcing Epoxy Bonding Agent
 - 3. Section 03 30 00, Cast-In-Place Concrete

1.3 REFERENCES

- A. Texas Health and Safety Code, Chapter 161, Subchapter Q, Installation of Asbestos
- B. Texas Occupations Code, Chapter 1954, Asbestos Health Protection

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00, Project Management and Coordination.

1.5 ACTION SUBMITTALS

- A. Submit product data for each type of product indicated.

1.6 INFORMATIONAL SUBMITTALS

- A. Submit Material Safety and Data Sheet (MSDS) for all materials, products, and parts.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver material to the site in manufacturer's original unopened containers.

1.8 WARRANTY

- A. Provide written warranty against defects in material and workmanship for the work of this Section for a period of **two** years from the Date of Substantial Completion.
- B. Warranty shall include, but not necessarily be limited to, loss of adhesion, cracking or spalling of epoxy mortar.
- C. Refer to Section 01 77 00, Closeout Procedures, for Warranty form.

2 PRODUCTS

2.1 MANUFACTURERS

- A. Master Builders Technologies: Concrecive 1411 or 1482
- B. E-Poxy Industries: Eva-Pox Mortar Mix No. 3
- C. Rescon Technology Corp.: Product R616, Concrete Bonder or Product No. R404, Epoxy Mortar Resin
- D. Sika Chemical Corporation: Sikadur 31 Hi-Mod Gel or Sikadur 35 Hi-Mod LV

- E. Thermal-Chem, Inc.: Thermal-Chem Mortar Resin Product No. 3, Thermal-Chem Fibrous Mortar Resin, Product No. 306 or Thermal-Chem Mortar Resin Gel, Product No. 304

2.2 MATERIALS

- A. All epoxy material shall be new and manufactured within the shelf life limitations set forth by the manufacturer.
- B. Epoxy shall be two-part epoxy adhesive material, and shall be of epichlorohydrin/amine type. Polysulphide epoxies are not acceptable.
- C. Epoxy used shall be insensitive to the presence of water and moisture, and shall be capable of application and of strength development even when applied to damp surfaces having a temperature of 40° F or above.
- D. Epoxy shall develop a minimum strength of 2000 psi in tension and 4000 psi in compression at the end of seven days.
- E. Epoxies used shall not deteriorate under approximately 200 freeze/thaw cycles.
- F. Epoxies used shall be 100% solids without solvents.
- G. Epoxy mortar used for bonding, patching and resurfacing, shall have the following additional properties:
 - 1. Epoxy mortar shall be non-sagging.
 - 2. Sand used in preparation mortar shall be graded oven dry quartzite and furnished in bags.
 - 3. The epoxy mortar patch material shall match the existing texture and color of exposed concrete without giving a blotchy appearance. A test patch shall be applied for approval prior to final acceptance of the mortar. Size of test patch shall be approximately equal to the size of the average mortar patch to be used on the project.

3 EXECUTION**3.1 INSPECTION**

- A. Inspect surfaces to ensure that surfaces are clean, dry and free from all foreign matter such as dirt, oil, grease, water, frost, curing compound, protective coatings, asphalt and all other foreign matter.

3.2 PREPARATION

- A. Clean and prime surfaces in accordance with manufacturer's recommendations prior to application of epoxy mortar.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's printed instructions.

END OF SECTION 03 63 00

SECTION 04 20 00

UNIT MASONRY

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, 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 SUMMARY

- A. Section Includes
 - 1. Integrally colored concrete masonry units
 - 2. Face brick
 - 3. Building (common) brick
 - 4. Mortar and grout
 - 5. Steel reinforcing bars
 - 6. Masonry joint reinforcement
 - 7. Ties and anchors
 - 8. Embedded flashing
 - 9. Miscellaneous masonry accessories
 - 10. Masonry-cell insulation
 - 11. Cavity-wall insulation
- B. Related Requirements
 - 1. Section 03 30 00, Cast-in-Place Concrete
 - 2. Section 04 43 00, Stone Masonry
 - 3. Section 05 12 00, Structural Steel Framing
 - 4. Section 05 40 00, Cold-Formed Metal Framing
 - 5. Section 05 50 00, Metal Fabrications
 - 6. Section 06 16 43, Gypsum Sheathing
 - 7. Section 07 21 13, Foam Board Insulation
 - 8. Section 07 21 00, Thermal Insulation
 - 9. Section 07 62 00, Sheet Metal Flashing and Trim
 - 10. Section 07 65 26, Self-Adhering Sheet Flashing
 - 11. Section 07 92 00, Joint Sealants
 - 12. Section 08 11 13.16, Custom Hollow Metal Doors and Frames
 - 13. Section 08 41 13, Aluminum-Framed Entrances and Storefronts
 - 14. Section 09 91 00, Painting

1.3 REFERENCES

- A. Use current editions unless noted otherwise.
- B. American Concrete Institute (ACI)
 - 1. ACI 315, Details and Detailing of Concrete Reinforcement
 - 2. ACI 530, Building Code Requirements for Masonry Structures
 - 3. ACI 530.1, Specification for Masonry Structures
- C. American Society of Civil Engineers (ASCE)
 - 1. ASCE 5, Building Code Requirements for Masonry Structures
 - 2. ASCE 6, Specification for Masonry Structures
- D. ASTM International (ASTM)
 - 1. ASTM A36 / A36M, Standard Specification for Carbon Structural Steel
 - 2. ASTM A82 / A82M, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement

3. ASTM A153 / A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
4. ASTM A615 / A615M, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
5. ASTM A951 / A951M, Standard Specification for Steel Wire for Masonry Joint Reinforcement
6. ASTM A996 / A996M, Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement
7. ASTM A1008 / A1008M, Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
8. ASTM C62, Standard Specification for Building Brick (Solid Masonry Units Made From Clay or Shale)
9. ASTM C67, Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile
10. ASTM C90, Standard Specification for Loadbearing Concrete Masonry Units
11. ASTM C91, Standard Specification for Masonry Cement
12. ASTM C109 / C109M, Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens)
13. ASTM C144, Standard Specification for Aggregate for Masonry Mortar
14. ASTM C150 / C150M, Standard Specification for Portland Cement
15. ASTM C207, Standard Specification for Hydrated Lime for Masonry Purposes
16. ASTM C212, Standard Specification for Structural Clay Facing Tile
17. ASTM C216, Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale)
18. ASTM C270, Standard Specification for Mortar for Unit Masonry
19. ASTM C404, Standard Specification for Aggregates for Masonry Grout
20. ASTM C476, Standard Specification for Grout for Masonry
21. ASTM C979, Standard Specification for Pigments for Integrally Colored Concrete
22. ASTM C1019, Standard Test Method for Sampling and Testing Grout
23. ASTM C1506, Standard Test Method for Water Retention of Hydraulic Cement-Based Mortars and Plasters
24. ASTM C1623, Standard Specification for Manufactured Concrete Masonry Lintels
25. ASTM E119, Standard Test Methods for Fire Tests of Building Construction and Materials
26. ASTM E514, Standard Test Method for Water Penetration and Leakage Through Masonry
- E. The Brick Industry Association (BIA)
 1. BIA Technical Notes on Brick Construction
- F. The Masonry Society
 1. TMS 402, Building Code Requirements for Masonry Structures
 2. TMS 602, Specification for Masonry Structures
- G. The Masonry Standards Joint Committee (MSJC) Building Code Requirements and Specification for Masonry Structures – Containing Building Code Requirements for Masonry Structures (TMS 402/ACI 530/ASCE 5), Specification for Masonry Structures (TMS 602/ACI 530.1/ASCE 6), and Companion Commentaries
- H. National Concrete Masonry Association (NCMA)
 1. NCMA TEK Technical Information and Details
- I. Texas Health and Safety Code, Chapter 161, Subchapter Q, Installation of Asbestos
- J. Texas Occupations Code, Chapter 1954, Asbestos Health Protection

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00, Project Management and Coordination.

1.5 ACTION SUBMITTALS

- A. Submit product data for each type of product indicated.
- B. Submit material certificates for each type and size of the following:
 1. Masonry Units

- a. Include data on material properties and material test reports substantiating compliance with requirements.
 - b. For exposed brick, include test report for efflorescence according to ASTM C67.
- 2. Cementitious Materials: Include brand, type, and name of manufacturer.
- 3. Grout Mixes: Include description of type and proportions of ingredients.
- 4. Reinforcing bars
- 5. Joint reinforcement
- 6. Anchors, ties, and metal accessories
- C. Submit mix designs for each type of mortar and grout. Include description of type and proportions of ingredients.
 - 1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C109 / C109M for compressive strength, ASTM C1506 for water retention, and ASTM C91 for air content.
 - 2. Include test reports, according to ASTM C1019, for grout mixes required to comply with compressive strength requirement.
- D. Shop Drawings
 - 1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
 - 2. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, Details and Detailing of Concrete Reinforcement.
- E. Samples
 - 1. Integrally colored concrete masonry units (in the form of small-scale units)
 - 2. Face brick
 - 3. Weep holes/vents
 - 4. Accessories embedded in masonry.

1.6 INFORMATIONAL SUBMITTALS

- A. Submit Material Safety and Data Sheet (MSDS) for all materials, products, and parts.

1.7 QUALITY ASSURANCE

- A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.
- B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.
- C. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.
- D. Mockups: Build mockups using installers who will perform same tasks for Project for typical exterior masonry wall with steel stud backup and for typical exterior masonry wall with masonry backup in sizes adequate to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution. Mockups shall be full thickness of exterior walls, including face and backup wythes and accessories, and not less than 48 inches high and 48 inches wide.
 - 1. Include each type of masonry unit, including cast stone, to be incorporated in exterior walls.
 - 2. Include a sealant-filled joint in each mockup.
 - 3. Include window opening, frame, glazing, and all associated fasteners and flashings in each mockup.
 - 4. Include steel studs, sheathing, sheathing joint and penetration treatment, dampproofing, anchors and accessories, flashing, cavity drainage material, and weep holes in exterior masonry-veneer wall mockup.
 - 5. Clean exposed faces of mockups with masonry cleaner as indicated.
 - 6. Protect accepted mockups from the elements with weather-resistant membrane and maintain during construction in an undisturbed condition as a standard for judging the completed Work. Demolish and remove mockups when directed unless otherwise indicated.

7. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.
 - a. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.
 - b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.9 PROJECT CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.
- C. Stain Prevention: 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 spreading coverings 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.
- D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40° F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.
- E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

1.10 WARRANTY

- A. Provide written warranty against defects in material and workmanship for the work of this Section for a period of one year from the Date of Substantial Completion.
- B. Refer to Section 01 77 00, Closeout Procedures, for Warranty form.

2 PRODUCTS

2.1 MANUFACTURERS

- A. Brick
 - 1. Cloud Ceramics
 - 2. Kansas City Brick
 - 3. **Yankee Hill**
- B. Concrete Masonry Units Integral Water Repellent
 - 1. ACM Chemistries
 - 2. BASF Aktiengesellschaft
 - 3. Grace Construction Products, W. R. Grace & Co. - Conn.
- C. Integrally Colored CMU
 - 1. Best Block Construction Materials (Formerly Headwaters)
 - 2. Revels Block & Brick Co., Inc.
- D. Reinforcement
 - 1. AA Wire Products, L.L.C.
 - 2. Dur-O-Wal
 - 3. Heckmann Building Products, Inc.
 - 4. Hohmann & Barnard, Inc.
 - 5. Wire-Bond
- E. Polymer-Coated, Steel Drill Screws for Steel Studs
 - 1. ITW Buildex
 - 2. Textron Inc.
- F. Cellular Plastic Weep/Vent
 - 1. Advanced Building Products Inc.
 - 2. Blok-Lok Limited; Cell-Vent
 - 3. Dur-O-Wal
 - 4. Heckmann Building Products Inc.
 - 5. Hohmann & Barnard, Inc.
 - 6. Wire-Bond
- G. Masonry Cleaners
 - 1. Diedrich Technologies, Inc.
 - 2. EaCo Chem, Inc.
 - 3. ProSoCo, Inc.
- H. Cavity Drainage Material
 - 1. Mortar Net USA, Ltd.

2.2 MASONRY UNITS, GENERAL

- A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.
- B. Fire-Resistance Ratings: Where indicated, provide units that comply with requirements for fire-resistance ratings indicated as determined by testing according to ASTM E119, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

2.3 CONCRETE MASONRY UNITS

- A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
 - 1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
 - 2. Provide bullnose units for outside corners unless otherwise indicated.
- B. Integral Water Repellent

1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested according to ASTM E514 as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive, with test period extended to 24 hours, shall show no visible water or leaks on the back of test specimen.
2. Provide units made with ACM Chemistries RainBloc or equivalent by a listed manufacturer at all integrally colored CMU.
- C. ICCMU - Integrally Colored CMU: Comply with the requirements of ASTM C90.
 1. Comply with the requirements of ASTM C979
 2. Units shall be manufactured with integral water repellent.
 3. Density classification in first subparagraph below affects appearance and water absorption.
 4. Size (Width): Manufactured to dimensions $\frac{3}{8}$ inch less than nominal dimensions indicated on the drawings.
 5. Integrally Colored CMU – BRK- 1
 - a. Basis of Design: Best Block
 - b. Size (Actual Dimensions): $3\frac{5}{8}$ inches wide as indicated on the drawings by $7\frac{5}{8}$ inches high by $15\frac{5}{8}$ inches long
 - c. Pattern and Texture: Standard pattern, ground-face burnished finish.
 6. Integrally Colored CMU – BRK- 2
 - a. Basis of Design: Best Block
 - b. Size (Actual Dimensions): $3\frac{5}{8}$ inches wide as indicated on the drawings by $7\frac{5}{8}$ inches high by $15\frac{5}{8}$ inches long
 - c. Pattern and Texture: Standard pattern, Split-face finish.
 7. Integrally Colored CMU – (Special Shape)
 - a. Basis of Design: Best Block
 - b. Size (Actual Dimensions): $3\frac{5}{8}$ inches wide as indicated on the drawings by $7\frac{5}{8}$ inches high by $15\frac{5}{8}$ inches long "L" Corner block, 1 face and 1 end. At every corner condition and also as indicated on the drawings.
 - c. Pattern and Texture: Standard pattern, ground-face finish.
 8. Integrally Colored CMU – (Special Shape)
 - a. Basis of Design: Best Block
 - b. Size (Actual Dimensions): $3\frac{5}{8}$ inches wide as indicated on the drawings by $7\frac{5}{8}$ inches high by $15\frac{5}{8}$ inches long "L" Corner block, 1 face and 1 end. At every corner condition and also as indicated on the drawings.
 - c. Pattern and Texture: Standard pattern, Split-face finish.
 9. Integrally Colored CMU – (Special Cut)
 - a. Basis of Design: Best Block
 - b. Size (Actual Dimensions): $3\frac{5}{8}$ inches wide as indicated on the drawings by $7\frac{5}{8}$ inches high by $15\frac{5}{8}$ inches long Ground Face & Top Solid Chamfered Block. At every windowsill condition and also as indicated on the drawings.
 10. Colors: As selected by Architect from manufacturer's full range

2.4 MASONRY LINTELS

- A. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMU with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.5 BRICK

- A. General: Provide shapes indicated, with exposed surfaces matching finish and color of exposed faces of adjacent units.
 1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
 2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.

3. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.
4. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.
- B. Face Brick: Facing brick complying with ASTM C216
 1. Grade: SW
 2. Type: FBS or greater
 3. Efflorescence: Provide brick that has been tested according to ASTM C67 and is rated "not effloresced."
 4. Texture: Velour
 5. Field Brick – BRK-3
 - a. Size (Actual Dimensions): King (2¾ inches wide by 2⅝ inches high by 9⅝ inches long)
 - 1) Basis of Design: **Cloud Ceramics Dove Grey**
 - 2) Alternate Blend: **Yankee Hill Dove Grey**
 6. Accent Brick – BRK-4
 - a. Size (Actual Dimensions): King (2¾ inches wide by 2⅝ inches high by 9⅝ inches long)
 - 1) Basis of Design: **Cloud Ceramics Black Diamond**
 - 2) Alternate Blend: **Yankee Hill Charcoal**

2.6 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C150, Type I or II. Provide natural color or white cement as required to produce mortar color indicated.
- B. Hydrated Lime: ASTM C207, Type S
- C. Aggregate for Mortar: ASTM C144
 1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
 2. White-Mortar Aggregates: Natural white sand or crushed white stone.
- D. Aggregate for Grout: ASTM C404.
- E. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMU containing integral water repellent by same manufacturer.
- F. Water: Potable.

2.7 REINFORCEMENT

- A. Uncoated Steel Reinforcing Bars: ASTM A615/A615M or ASTM A996/A996M, Grade 60
- B. Masonry Joint Reinforcement, General: ASTM A951/A951M
 1. Interior Walls: Hot-dip galvanized, carbon steel
 2. Exterior Walls: Hot-dip galvanized, carbon steel
 3. Wire Size for Side Rods: 9 gauge
 4. Wire Size for Cross Rods: 9 gauge
 5. Wire Size for Veneer Ties: 9 gauge
 6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches
 7. Provide in lengths of not less than 10 feet.
- C. Masonry Joint Reinforcement for Single-Wythe Masonry: Hohmann & Barnard, Inc. #120 Truss-Mesh or equivalent by a listed manufacturer
- D. Masonry Joint Reinforcement for Multiwythe Masonry
 1. Hohmann & Barnard, Inc. #170 Lox-All Truss Adjustable Eye-Wire or equivalent by a listed manufacturer
 2. Adjustable (two-piece) type, truss design, with one side rod at each face shell of backing wythe and with separate adjustable ties with pintle-and-eye connections having a maximum adjustment of 1¼ inch. Size ties to extend at least halfway through facing wythe but with at least ⅝ inch cover on outside face.

2.8 TIES AND ANCHORS

- A. Materials: Provide ties and anchors made from materials that comply with the following unless otherwise indicated.

1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A82/A82M; with ASTM A153/A153M, Class B-2 coating
2. Steel Sheet, Galvanized after Fabrication: ASTM A1008/A1008M, Commercial Steel, with ASTM A153/A153M, Class B coating
3. Steel Plates, Shapes, and Bars: ASTM A36/A36M
- B. Corrugated Metal Ties
 1. Metal strips not less than $\frac{7}{8}$ inch wide made from 16 gauge thick, steel sheet, galvanized after fabrication
 2. Heckmann Building Products Inc. #260 Corrugated Wall Ties or equivalent by a listed manufacturer
- C. Wire Ties, General: Unless otherwise indicated, size wire ties to extend at least halfway through veneer but with at least $\frac{5}{8}$ inch cover on outside face. Outer ends of wires are bent 90 degrees and extend 2 inches parallel to face of veneer.
- D. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
 1. Anchor Section for Welding to Steel Frame
 - a. 12 gauge thick, $\frac{3}{4}$ inch wide, 9 inch long, hot-dip galvanized steel strap
 - b. Heckmann Building Products Inc. #315-B Weld-On Anchor Strap or equivalent by a listed manufacturer
 2. Tie Section
 - a. Triangular-shaped wire tie, sized to extend within 1 inch of masonry face, made from 0.187 inch diameter, hot-dip galvanized steel wire
 - b. Heckmann Building Products Inc. #316 Triangle Ties or equivalent by a listed manufacturer
- E. Adjustable Anchors for Connecting to Concrete: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
 1. Connector Section
 - a. Dovetail slots formed from 20 gauge, steel sheet, hot-dip galvanized after fabrication
 - b. Heckmann Building Products Inc. #100 Dovetail Anchor Slot or equivalent by a listed manufacturer
 2. Tie Section
 - a. Dovetail Tabs for inserting into dovetail slots in concrete and attached to tie section
 - b. Vertical Installations
 - 1) 12 gauge anchor, hot-dip galvanized after fabrication, factory assembled to triangular-shaped wire tie
 - 2) Heckmann Building Products Inc. #103 Dovetail Triangular Anchor and #316 Triangular Tie or equivalents by a listed manufacturer
 - c. Horizontal Installations
 - 1) $\frac{1}{8}$ inch thick anchor, hot-dip galvanized after fabrication, furnished loose with triangular-shaped wire tie
 - 2) Heckmann Building Products Inc. #107 Dovetail Horizontal Triangular Anchor and #316 Triangular Tie or equivalents by a listed manufacturer
- F. Partition Top Anchors
 1. 12 gauge plate with 6 inch long, $\frac{3}{8}$ inch diameter metal rod welded to plate, fabricated from steel, hot-dip galvanized after fabrication and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube
 2. Hohmann & Barnard, Inc. #420 PTA Anchor or equivalent by a listed manufacturer
- G. Rigid Anchors
 1. Fabricate from steel bars $1\frac{1}{2}$ inches wide by $\frac{1}{4}$ inch thick by 24 inches long, with ends turned up 2 inches and hot-dip galvanized after fabrication.
 2. Hohmann & Barnard, Inc. #344 Rigid Partition Anchor or equivalent by a listed manufacturer
 3. Masonry-Veneer Anchors:
 - a. Masonry Veneer

- 1) Basis-of-Design Product: Subject to compliance with requirements, provide Heckmann Building Products Inc. No. 75 Pos-I-Tie Veneer Anchoring System with Neoprene / EPDM Thermal-Grip Brick Tie Washer or comparable products by one of the listed manufacturers.
 - 2) Barrel length shall be equal to thickness of foam board insulation and sheathing so that compressive loads are transferred directly to the metal wall framing.
 - 3) Provide corrosion resistant self-drilling screw at metal stud backup and corrosion resistant concrete/CMU screw at concrete, masonry, and wood stud backup.
 - 4) Provide 3/16 inch diameter adjustable triangular brick wire ties sized to provide not less than 2 inches embedment in mortar. Tie shall be hot-dip galvanized after fabrication in accordance with ASTM A153/A153M.
4. .
- H. Refer to structural drawings for additional requirements.

2.9 EMBEDDED FLASHING MATERIALS

- A. As specified in other sections

2.10 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene, urethane, or PVC.
- B. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D226, Type I (No. 15 asphalt felt).
- C. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity
1. Strips, full-depth of cavity and 10 inches high, with dovetail shaped notches 7 inches deep that prevent clogging with mortar droppings
 2. Mortar Net USA, Ltd. Mortar Net
- D. Weep Holes/Vents
1. Plastic weep vent with insect screen and cotton wick.
 2. Size: 3/8" x 1 1/2" x 3 1/2"
 3. Basis of Design: Hohmann and Bernard 342W or equal per manufacturer listed above.

2.11 MASONRY CLEANERS

- A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

2.12 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
1. Do not use calcium chloride in mortar or grout.
 2. Use Portland cement-lime mortar unless otherwise indicated.
- B. Mortar for Unit Masonry:
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.
 3. Field mix mortar. Preblended, dry mortar mix is **not** an acceptable substitute for field mixed mortar and will **not** be approved.
- C. Grout for Unit Masonry: Comply with ASTM C476.
1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.

2. Proportion grout in accordance with ASTM C476, Table 1 or paragraph 4.2.2 for specified 28 day compressive strength indicated, but not less than 2000 psi.

3 EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
 2. Verify that foundations are within tolerances specified.
 3. Verify that reinforcing dowels are properly placed.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.
- B. Build chases and recesses to accommodate items specified in this and other Sections.
- C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.
- D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.
- F. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.
- G. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested per ASTM C67. Allow units to absorb water so they are damp but not wet at time of laying.

3.3 TOLERANCES

- A. Dimensions and Locations of Elements
 1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch or minus 1/4 inch.
 2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch.
 3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.
- B. Lines and Levels
 1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
 2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
 3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
 4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
 5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.

6. For vertical alignment of exposed head joints, do not vary from plumb by more than $\frac{1}{4}$ inch in 10 feet, or $\frac{1}{2}$ inch maximum.
 7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than $\frac{1}{16}$ inch except due to warpage of masonry units within tolerances specified for warpage of units.
- C. Joints
1. For bed joints, do not vary from thickness indicated by more than plus or minus $\frac{1}{8}$ inch, with a maximum thickness limited to $\frac{1}{2}$ inch.
 2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than $\frac{1}{8}$ inch.
 3. For head and collar joints, do not vary from thickness indicated by more than plus $\frac{3}{8}$ inch or minus $\frac{1}{4}$ inch.
 4. For exposed head joints, do not vary from thickness indicated by more than plus or minus $\frac{1}{8}$ inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than $\frac{1}{8}$ inch.
 5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than $\frac{1}{16}$ inch from one masonry unit to the next.

3.4 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in one-third running bond for brick and stacked bond for concrete masonry units or bond patterns otherwise indicated on Drawings.
- C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than the width of the unit. Bond and interlock each course of each wythe at corners.
- D. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
- E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- F. Fill space between steel frames and masonry with sealant unless otherwise indicated.
- G. Fill cores in hollow CMU with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.
- H. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.
 1. Maintain one inch space between top of all masonry and bottom of floor and roof decks and around structural framing members to accommodate deflection and other movement. Fill voids with unfaced fiberglass batt insulation. Pack insulation tight, completely filling void. At locations exposed to view, recess insulation one inch from face of masonry units and install sealant in space between masonry and floor and roof decks and around structural framing members.
 2. Fasten partition top anchors to structure above and build into top of partition. Space anchors 48 inches o.c. unless otherwise indicated.
 3. At fire-rated partitions, treat joint between top of partition and underside of structure above as required to maintain fire ratings indicated.

3.5 MORTAR BEDDING AND JOINTING

- A. Lay hollow brick and CMU as follows:
 1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints
 2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters
 3. With webs fully bedded in mortar in grouted masonry, including starting course on footings

4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted
- B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
- D. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

3.6 CAVITY WALLS

- A. Bond wythes of cavity walls together using adjustable (two-piece) type ties to allow for differential movement regardless of whether bed joints align.
- B. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.

3.7 MASONRY-CELL INSULATION

- A. Pour granular insulation into cavities to fill void spaces as indicated on the drawings. Maintain inspection ports to show presence of insulation at extremities of each pour area. Close the ports after filling has been confirmed. Limit the fall of insulation to 1 story high, but not more than 15 feet.

3.8 MASONRY JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of $\frac{5}{8}$ inch on exterior side of walls, $\frac{1}{2}$ inch elsewhere. Lap reinforcement a minimum of 6 inches.
 1. Space reinforcement not more than 16 inches o.c.
 2. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings in addition to continuous reinforcement.
- B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.
- C. Provide continuity at wall intersections by using prefabricated T-shaped units.
- D. Provide continuity at corners by using prefabricated L-shaped units.

3.9 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

- A. Anchor masonry to structural steel and concrete where masonry abuts or faces structural steel or concrete to comply with the following:
 1. Provide an open space not less than 1 inch wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
 2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
 3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.10 ANCHORING MASONRY VENEERS

- A. Anchors and ties for masonry veneers are furnished and installed under Section 07 21 13.13, Foam Board Insulation.
- B. Embed tie sections in masonry joints. Provide not less than 2 inches of air space between back of masonry veneer and face of insulation boards.

3.11 CONTROL AND EXPANSION JOINTS

- A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
- B. Form control joints in concrete masonry by installing temporary foam-plastic filler in head joints and removing filler when unit masonry is complete for application of sealant.

1. Place control joints in locations indicated on the drawings and where necessary to limit distance between control joints to 30 feet, whether indicated on the drawings or not.
2. Provide control joints directly over concrete slab control joints.
3. When possible, lay out concrete masonry so that control joints will coincide with unit module.
- C. Form expansion joints in brick by forming open joint full depth of brick wythe and $\frac{3}{8}$ inch wide for installation of sealant and backer rod specified in Section 07 92 00, Joint Sealants.
 1. Place expansion joints in locations indicated on the drawings and where necessary to limit distance between expansion joints to 25 feet, whether indicated on the drawings or not.
 2. Verify locations of joints not indicated on the drawings with Architect prior to installation.

3.12 LINTELS

- A. Install steel lintels where indicated.
- B. Provide concrete and masonry lintels where shown and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are shown without structural steel or other supporting lintels.
- C. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.13 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

- A. Prepare masonry surfaces to receive embedded flashing specified in other sections so they are smooth and free from projections that could puncture flashing. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.
- B. Install weep holes in head joints in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Provide weep holes in first course immediately above all flashing at all exterior brick walls (above finish grade of sidewalk or earth fill). Install vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.
- C. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.
- D. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:
 1. Use open head joints to form weep holes.
 2. Space weep holes not more than 30-32 inches o.c. unless otherwise indicated.
- E. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.

3.14 REINFORCED UNIT MASONRY INSTALLATION

- A. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.
- B. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
 1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
 2. Limit height of vertical grout pours to not more than 60 inches.

3.15 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

3.16 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. 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. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
 - 3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
 - 4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
 - 5. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
 - 6. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

3.17 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.
- B. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 04 20 00

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 3/4 inch 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. 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.
- F. Remove shop tags prior to ceiling installation.

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. 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. 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 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 withstand 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 or clip at each intersection.

END OF SECTION 05 40 00

SECTION 05 50 00

METAL FABRICATIONS

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, 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 SUMMARY

- A. Section includes all miscellaneous metal specified herein or indicated in the drawings unless specifically covered in other Sections of the Specifications. Principal miscellaneous metal items to be furnished are listed herein; however, this list is offered only as a guide and Contractor shall thoroughly check the drawings for other miscellaneous metals.
- B. Products furnished and installed under this Section
 - 1. Steel framing and supports for operable partitions
 - 2. Steel framing and supports for overhead coiling doors
 - 3. Steel framing and supports for mechanical and electrical equipment
 - 4. Steel framing and supports for applications where framing and supports are not specified in other Sections
 - 5. Elevator machine beams, hoist beams
 - 6. Steel shapes for supporting elevator door sills
 - 7. Metal ladders
 - 8. Metal bollards
- C. Products furnished, but not installed, under this Section
 - 1. Loose steel lintels
- D. Related Sections
 - 1. Section 03 30 00, Cast-in-Place Concrete
 - 2. Section 04 20 00, Unit Masonry
 - 3. Section 04 43 00, Anchored Stone Masonry Veneer
 - 4. Section 04 43 13.16, Adhered Stone Masonry Veneer
 - 5. Section 05 12 00, Structural Steel Framing
 - 6. Section 05 51 00, Metal Stairs
 - 7. Section 08 33 23, Overhead Coiling Doors
 - 8. Section 09 91 00, Painting
 - 9. Section 14 24 00, Hydraulic Elevators

1.3 REFERENCES

- A. Use current editions unless noted otherwise.
- B. American National Standards Institute (ANSI)
 - 1. ANSI A14.3, American National Standards for Ladders - Fixed - Safety Requirements
- C. ASTM International (ASTM)
 - 1. ASTM A36 / A36M, Standard Specification for Carbon Structural Steel
 - 2. ASTM A53 / A53M, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
 - 3. ASTM A123 / A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
 - 4. ASTM A153 / A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

5. ASTM A500 / A500M, Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
6. ASTM A780 / A780M, Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
7. ASTM B633, Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel
8. ASTM D1187, Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal
9. ASTM F1941, Standard Specification for Electrodeposited Coatings on Threaded Fasteners (Unified Inch Screw Threads (UN/UNR))
- D. ASME International (ASME)
 1. ASME A17.1, Safety Code for Elevators and Escalators
- E. National Association of Architectural Metal Manufacturers (NAAMM), Architectural Metal Products Division (AMP)
 1. NAAMM / NOMMA AMP 500, Metal Finishes Manual for Architectural and Metal Products
- F. Texas Health and Safety Code, Chapter 161, Subchapter Q, Installation of Asbestos
- G. Texas Occupations Code, Chapter 1954, Asbestos Health Protection

1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design ships ladders and ladders, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
 1. Temperature Change: 120° F, ambient; 180° F, material surfaces

1.5 ACTION SUBMITTALS

- A. Submit product data for each type of product indicated.
- B. Shop Drawings: Show fabrication and installation details for metal fabrications.
 1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
- 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.

1.6 INFORMATIONAL SUBMITTALS

- A. Submit Material Safety and Data Sheet (MSDS) for all materials, products, and parts.
- B. Welding certificates
- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats

1.7 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.8 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

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 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.

1.10 WARRANTY

- A. Provide written warranty against defects in material and workmanship for the work of this Section for a period of one year from the Date of Substantial Completion.
- B. Refer to Section 01 77 00, Closeout Procedures, for Warranty form.

2 PRODUCTS

2.1 METALS, GENERAL

- A. Metal Surfaces, General: 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.

2.2 FERROUS METALS

- A. Steel Plates, Shapes, and Bars: ASTM A36/A36M
- B. Steel Tubing: ASTM A500, cold-formed steel tubing
- C. Steel Pipe: ASTM A53/A53M, standard weight (Schedule 40) unless otherwise indicated
- D. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4
 - 1. Size of Channels: As required to support equipment.
 - 2. Material: Galvanized steel, ASTM A653/A653M, Grade 33, with G90 coating; 0.108-inch nominal thickness

2.3 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941, 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. Provide bronze fasteners for fastening bronze.

2.4 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Shop Primers: Provide primers that comply with Section 09 91 00, Painting.
- C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187
- E. Concrete: Comply with requirements in Section 03 30 00, Cast-in-Place Concrete for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3000 psi.

2.5 FABRICATION, GENERAL

- 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.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

- D. Form exposed work with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply with the following:
 - 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.
- F. 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.
- G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. 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.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. 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.
- C. Galvanize miscellaneous framing and supports where indicated.

2.7 METAL LADDERS

- A. General:
 - 1. Comply with ANSI A14.3 unless otherwise indicated.
 - 2. For elevator pit ladders, comply with ASME A17.1.
- B. Steel Ladders
 - 1. Space siderails 18 inches apart unless otherwise indicated.
 - 2. Space siderails of elevator pit ladders 12 inches apart.
 - 3. Siderails: Continuous, ½ inch by 2½ inch steel flat bars, with eased edges
 - 4. Rungs: ¾ inch diameter steel bars
 - 5. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
 - 6. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive, by using a type of manufactured rung filled with aluminum-oxide grout or by coating with abrasive material metallically bonded to rung.
 - 7. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted steel brackets.
 - 8. Galvanize exterior ladders, including brackets and fasteners.

2.8 METAL BOLLARDS

- A. Fabricate metal bollards from Schedule 40 steel pipe. Cap bollards not indicated to be filled with concrete with ¼ inch thick steel plate.
- B. Fabricate sleeves for bollard anchorage from steel pipe with ¼ inch thick steel plate welded to bottom of sleeve. Make sleeves not less than 8 inches deep and ¾ inch larger than OD of bollard.
- C. Fabricate internal sleeves for removable bollards from Schedule 40 steel pipe with an OD approximately 1/16 inch less than ID of bollards. Match drill sleeve and bollard for ¾ inch steel machine bolt.
- D. Hot-dip galvanize bollards after fabrication

2.9 LOOSE STEEL LINTELS

- A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.
- B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span but not less than 8 inches unless otherwise indicated.
- C. Galvanize loose steel lintels located in exterior walls.

2.10 FINISHES, GENERAL

- A. Comply with NAAMM / NOMMA AMP 500 for recommendations for applying and designating finishes.
- B. Finish metal fabrications after assembly.
- C. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.11 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
- B. 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.
- C. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 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. Other Items: SSPC-SP 3, "Power Tool Cleaning."
- D. 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. Stripe paint corners, crevices, bolts, welds, and sharp edges.

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.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: 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 for operable partitions securely to and rigidly brace from building structure.

3.3 INSTALLING METAL BOLLARDS

- A. Fill metal-capped bollards solidly with concrete and allow concrete to cure seven days before installing. Do not fill removable bollards with concrete.
- B. Anchor internal sleeves for removable bollards in place with concrete footings. Center and align sleeves in holes 3 inches above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace sleeves in position until concrete has cured.
- C. Place removable bollards over internal sleeves and secure with $\frac{3}{4}$ inch machine bolts and nuts. After tightening nuts, drill holes in bolts for inserting padlocks. Owner will furnish padlocks.

3.4 ADJUSTING AND CLEANING

- A. 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. Apply by brush or spray to provide a minimum 2.0 mil dry film thickness.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780.

END OF SECTION 05 50 00

SECTION 05 51 00

METAL STAIRS

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, 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 SUMMARY

- A. Section includes preassembled steel stairs with concrete-filled treads, steel tube railings attached to metal stairs, steel tube handrails attached to walls adjacent to metal stairs, and learning stair.
- B. Related Sections
 - 1. Section 03 30 00, Cast-In-Place Concrete
 - 2. Section 05 12 00, Structural Steel Framing
 - 3. Section 05 50 00, Metal Fabrications
 - 4. Section 05 52 00, Handrails and Railings
 - 5. Section 06 10 53, Miscellaneous Rough Carpentry
 - 6. Section 09 30 13, Ceramic Tiling
 - 7. Section 09 64 29, Wood Strip and Plank Flooring
 - 8. Section 09 65 13, Resilient Base and Accessories
 - 9. Section 09 65 19, Resilient Tile Flooring
 - 10. Section 09 91 00, Painting

1.3 REFERENCES

- A. Use current editions unless noted otherwise.
- B. American Society of Mechanical Engineers (ASME)
 - 1. ASME B18.2.1, Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series)
 - 2. ASME B18.6.3, Machine Screws, Tapping Screws, and Metallic Drive Screws (Inch Series)
 - 3. ASME B18.21.1, Washers: Helical Spring-Lock, Tooth Lock, and Plain Washers (Inch Series)
 - 4. ASME B18.22.1, Plain Washers
- C. ASTM International (ASTM)
 - 1. ASTM A36 / A36M, Standard Specification for Carbon Structural Steel
 - 2. ASTM A185 / A185M, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete
 - 3. ASTM A307, Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
 - 4. ASTM A500 / A500M, Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
 - 5. ASTM A513 / A513M, Standard Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing
 - 6. ASTM A563, Standard Specification for Carbons and Alloy Steel Nuts
 - 7. ASTM A1008 / A1008M, Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
 - 8. ASTM A1011 / A1011M, Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
 - 9. ASTM D1187 / D1187M, Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal

10. ASTM F568M, Standard Specification for Carbon and Alloy Steel Externally Threaded Metric Fasteners
11. ASTM F1554, Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength
- D. American Welding Society (AWS)
 1. AWS D1.1/D1.1M, Structural Welding Code – Steel
 2. AWS D1.3, Structural Welding Code – Sheet Steel
- E. National Association of Architectural Metal Manufacturers (NAAMM)
 1. NAAMM AMP 510, Metal Stairs Manual
- F. Society for Protective Coatings (SSPC)
 1. SSPC-PA 1, Shop, Field, and Maintenance Painting of Steel
 2. SSPC Paint 20, Zinc-Rich Coating (Type I – Inorganic and Type II – Organic)
 3. SSPC-SP 3, Power Tool Cleaning
- G. 2010 ADA Standards for Accessible Design (SAD)
- H. 2012 Texas Accessibility Standards (TAS)
- I. Texas Health and Safety Code, Chapter 161, Subchapter Q, Installation of Asbestos
- J. Texas Occupations Code, Chapter 1954, Asbestos Health Protection

1.4 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 anchorages for metal stairs. 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.
- C. Coordinate locations of hanger rods and struts with other work so that they will not encroach on required stair width and will be within the fire-resistance-rated stair enclosure.

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00, Project Management and Coordination.

1.6 ACTION SUBMITTALS

- A. Submit product data for each type of product indicated.
- B. Delegated-Design Submittal
 1. Submit shop drawings including plans, elevations, sections, and details. Show attachments to other work.
 2. For installed products, indicate compliance with performance requirements and design criteria. Include analysis data.
 3. Submittal shall be signed and sealed by the qualified professional engineer responsible for their preparation.

1.7 INFORMATIONAL SUBMITTALS

- A. Submit Material Safety and Data Sheet (MSDS) for all materials, products, and parts.

1.8 QUALITY ASSURANCE

- A. Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, unless more stringent requirements are indicated.
- B. Comply with the requirements of AWS D1.1/D1.1M and AWS D1.3.

1.9 WARRANTY

- A. Provide written warranty against defects in material and workmanship for the work of this Section for a period of one year from the Date of Substantial Completion.
- B. Refer to Section 01 77 00, Closeout Procedures, for Warranty form.

2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design metal stairs, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance of Stairs: Metal stairs 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.
 - 2. Concentrated Load: 300 lbf applied on an area of 4 sq. in.
 - 3. Uniform and concentrated loads need not be assumed to act concurrently.
 - 4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
 - 5. Limit deflection of treads, platforms, and framing members to L/720 or ¼ inch, whichever is less.
- C. Structural Performance of Railings: Refer to section 05 52 00 Handrails and Railings.

2.2 METALS

- A. Provide materials with smooth, flat surfaces unless otherwise indicated. For components 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 A36/A36M
- C. Steel Tubing: ASTM A500 (cold formed) or ASTM A513
- D. Uncoated, Cold-Rolled Steel Sheet: ASTM A1008/A1008M, structural steel, Grade 25, unless another grade is required by design loads; exposed
- E. Uncoated, Hot-Rolled Steel Sheet: ASTM A1011/A1011M, structural steel, Grade 30, unless another grade is required by design loads

2.3 FASTENERS

- A. Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A (ASTM F568M, Property Class 4.6); with hex nuts, ASTM A563; and, where indicated, flat washers
- B. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563; and, where indicated, flat washers
- C. Machine Screws: ASME B18.6.3
- D. Lag Screws: ASME B18.2.1
- E. Plain Washers: Round, ASME B18.22.1
- F. Lock Washers: Helical, spring type, ASME B18.21.1

2.4 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 - 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187.
- E. Concrete Materials and Properties: Comply with requirements in Section 03 30 00, Cast-in-Place Concrete, for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.
- F. Welded Wire Fabric: ASTM A185/A185M, 6 by 6 inches, W1.4 by W1.4, unless otherwise indicated.

2.5 FABRICATION, GENERAL

- A. Provide complete stair assemblies, including metal framing, hangers, struts, railings, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.

1. Join components by welding unless otherwise indicated.
2. Use connections that maintain structural value of joined pieces.
- B. Preassembled Stairs: Assemble stairs in shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- E. Form exposed work with accurate angles and surfaces and straight edges.
- F. Weld connections to comply with the following:
 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. Weld exposed corners and seams continuously unless otherwise indicated.
 5. At exposed connections, finish exposed welds to comply with NOMMA "Voluntary Joint Finish Standards" for Type 1 welds: no evidence of a welded joint.
- G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated. Locate joints where least conspicuous.
- H. Fabricate joints that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

2.6 STEEL-FRAMED STAIRS

- A. Stair Framing
 1. Fabricate stringers of steel tubes.
 2. Provide closures for exposed ends of tube stringers.
 3. Construct platforms of steel tube headers and miscellaneous framing members as needed to comply with performance requirements.
 4. Weld stringers to headers; weld framing members to stringers and headers.
- B. Metal-Pan Stairs: Form risers, subreads pans, and subplatforms to configurations shown from steel sheet of thickness needed to comply with performance requirements but not less than 0.067 inch or thickness indicated on the drawings.
 1. Steel Sheet: Uncoated cold or hot-rolled steel sheet
 2. When visible, directly weld metal pans to stringers; locate welds on top of subreads where they will be concealed by concrete fill. Do not weld risers to stringers.
 3. When not visible, attach risers and subreads to stringers with brackets made of steel angles or bars. Weld brackets to stringers and attach metal pans to brackets by welding, riveting, or bolting.
 4. Shape metal pans to include nosing integral with riser.
 5. At Contractor's option, provide stair assemblies with metal-pan subreads filled with reinforced concrete during fabrication.
 6. Provide subplatforms of configuration indicated or, if not indicated, the same as subreads. Weld subplatforms to platform framing.

2.7 STAIR RAILINGS

- A. Steel Tube Railings: refer to Section 05 52 00, Handrails and Railings.

2.8 FINISHES

- A. Comply with NAAMM "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal stairs after assembly.

- C. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning"
- D. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1 for shop painting.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

3 EXECUTION

3.1 INSTALLATION, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.
- C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete unless otherwise indicated.
- D. 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.
- E. Field Welding: Comply with requirements for welding in "Fabrication, General" Article.
- F. Place and finish concrete fill for treads and platforms to comply with Section 03 30 00, Cast-in-Place Concrete.

3.2 INSTALLING METAL STAIRS WITH GROUTED BASEPLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of baseplates.
- B. Set steel stair baseplates on wedges, shims, or leveling nuts. After stairs have been positioned and aligned, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
 - 1. Use nonmetallic, nonshrink grout unless otherwise indicated.
 - 2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.3 INSTALLING RAILINGS

- 1. Refer to Section 05 52 00, Handrails and Railings.

3.4 ADJUSTING AND CLEANING

- A. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 09 91 00 Painting.

END OF SECTION 05 51 00

SECTION 05 52 00

HANDRAILS AND RAILINGS

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, 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 SUMMARY

- A. Furnish and install interior ornamental powder coated steel guard rail system with resin inlay panels inside powder coated steel frames, as shown at stair and balcony locations on the drawings and specified herein.
- B. Furnish and install interior powder coated steel AND stainless steel handrails at stairs
- C. Related Sections
 - 1. Section 03 30 00, Cast-in-Place Concrete
 - 2. Section 05 12 00, Structural Steel Framing
 - 3. Section 05 51 00, Metal Stairs
 - 4. Section 06 10 53, Rough and Finish Carpentry
 - 5. Section 09 29 00, Gypsum Board
 - 6. Section 09 91 00, Painting

1.3 REFERENCES

- A. Use current editions unless noted otherwise.
- B. 2010 ADA Standards for Accessible Design (SAD)
- C. 2012 Texas Accessibility Standards (TAS)
- D. American Architectural Manufacturers Association (AAMA)
- E. American Society for Testing and Materials (ASTM)
 - 1. E 894 Standard Test Methods for Anchorage of Permanent Metal Railing Systems and Rails for Buildings.
 - 2. E 935 Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings.
 - 3. E 985 Specification for Permanent Metal Railing Systems and Rails for Buildings.
- F. National Fire Protection Association (NFPA)
 - 1. 101 Life Safety Code
- G. National Association of Architectural Metal Manufacturers (NAAMM), Architectural Metal Products Division (AMP)
 - 1. NAAMM / NOMMA AMP 500, Metal Finishes Manual for Architectural and Metal Products
- H. Texas Health and Safety Code, Chapter 161, Subchapter Q, Installation of Asbestos
- I. Texas Occupations Code, Chapter 1954, Asbestos Health Protection

1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design handrails and railings, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1.5 ACTION SUBMITTALS

- A. Submit product data for each type of product indicated.
- B. Comply with the requirements of the General and Supplementary Conditions.
- C. Samples:
 - 1. Submit samples of specified finishes for architectural approval.
 - 2. Submit a typical four foot wide section of the specified handrail.
 - a. Construct the handrail submittal prior to beginning any other handrail/guardrail Work.
 - b. The approved sample may be permanently installed in the project.
- D. Prepare handrail and railing systems shop drawings under the supervision of a qualified professional engineer. Shop drawings shall show fabrication and installation of ornamental metalwork including plans, elevations, details of components, and attachments to other units of Work. Indicate materials and profiles of each ornamental metalwork member, fitting, joinery, finishes, fasteners, anchorages, and accessory items.
 - 1. Include setting drawings, templates, and directions for installation of anchor bolts and other anchorages to be installed as unit of Work of other sections.
 - 2. For installed products indicated to comply with certain design loadings, include structural analysis data sealed and signed by the qualified professional engineer licensed in the State of Texas.

1.6 INFORMATIONAL SUBMITTALS

- A. Submit Material Safety and Data Sheet (MSDS) for all materials, products, and parts.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Where ornamental rails are indicated to fit to other construction, check actual dimensions of other construction by accurate field measurements before fabrication; show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- B. Where field measurements cannot be made without delaying the Work, General Contractor will guarantee dimensions and Ornamental Metal Rail Fabricator will proceed with fabricating ornamental metalwork without field measurements. General Contractor will coordinate construction to ensure that actual dimensions correspond to guaranteed dimensions

1.8 QUALITY ASSURANCE

- A. Installation conference shall be scheduled in accordance with the requirements of Section 01 31 00, Project Management and Coordination.
- B. Fabricator Qualifications: Firm with five years experience in successfully producing ornamental metalwork similar to that indicated for this Project and with sufficient production capacity to produce required units without delaying the Work.
- C. Installer Qualifications: Arrange for installation by installer with five years of experience successfully installing powder coated and stainless steel railing systems and with sufficient capacity to perform project and not delay the work.
- D. Engineer Qualifications: Professional engineer legally authorized to practice in jurisdiction where Project is located and experienced in providing engineering services of the kind indicated that have resulted in the installation of assemblies similar to this Project in material, design, and extent and that have a record of successful in-service performance.

1.9 DELIVERY AND STORAGE

- A. Deliver materials to the job site in good condition and properly protected against damage to finished surfaces.
- B. Store ornamental metalwork inside a conditioned area, away from uncured concrete and masonry, and protected from weather, moisture, soiling, abrasion, extreme temperatures, and humidity.

1.10 PROJECT 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 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.

1.11 WARRANTY

- A. Provide written warranty against defects in material and workmanship for the work of this Section for a period of one year from the Date of Substantial Completion.
- B. Refer to Section 01 77 00, Closeout Procedures, for Warranty form.

2 PRODUCTS**2.1 FABRICATORS:**

- A. A-1 Preferred Handrail
- B. Big D Metalworks
- C. Gulf Coast Railings
- D. Pool Custom Ironworks, Inc.
- E. Texas Metal Tech

2.2 MATERIALS:

- A. Metals
 - 1. Metal Surfaces, General: 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.
 - 2. Steel Plates, Shapes, and Bars: ASTM A36/A36M
 - 3. Steel Tubing: ASTM A500, cold-formed steel tubing
 - 4. Steel Pipe: ASTM A53/A53M, standard weight (Schedule 40) unless otherwise indicated
 - 5. Stainless Steel: Stainless steel grade type AISI 304/304L or 316/316L; surface to be 240 grain/grit finish; tubes 1-1/2" (38mm) outside diameter by 5/64" (2 mm) wall thickness.
 - 6. Channels and other metals as indicated on the drawings.
- B. Fasteners
 - 1. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
 - 2. Provide stainless-steel fasteners for fastening aluminum.
 - 3. Provide stainless-steel fasteners for fastening stainless steel.
 - 4. Other Fasteners and set screws as indicated on the drawings.

2.3 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Shop Primers: Provide primers that comply with Section 09 91 00, Painting.

2.4 FABRICATION, GENERAL

- 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.

- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply with the following:
 - 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.
- F. 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.
- G. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- H. 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.

2.5 FINISHES, GENERAL

- A. Comply with NAAMM / NOMMA AMP 500 for recommendations for applying and designating finishes.
- B. Finish metal fabrications after assembly.
- C. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.
- D. Powder Coat exposed metal surfaces. Colors to be selected from standard RAL Colors. Prime and prepare surfaces per manufacturer's requirements. Touch up field welds as required with enamel paint type B to match powder coating. Refer to painting Specification for additional information.
- E. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 1. Other Items: SSPC-SP 3, "Power Tool Cleaning."
- F. 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. Stripe paint corners, crevices, bolts, welds, and sharp edges.

3 EXECUTION

3.1 INSTALLATION

- A. Installation
 - 1. Installation shall be by the manufacturer or a qualified, authorized representative of the manufacturer.
 - 2. Installation must be in accordance with standard or non-standard, yet applicable details (instructions) provided by the manufacturer.
 - 3. Install components plumb and in-line, accurately fitted, free from distortion or defects and securely anchored to structure.
 - 4. Provide anchors, plates, angles, etc., necessary for connecting railings to structure.
 - 5. Any and all field welding shall be by a certified welder. Welds should be ground smooth prior to final touch up painting.
 - 6. Access must be made available for anchors that require through bolting either vertically or horizontally.
 - 7. Core concrete slab as required for center rail installation.

B. Erection Tolerances

1. Maximum variation from plumb will be $\frac{1}{4}$ ".
2. Maximum offset from true alignment for every 50-foot of railing shall be $\frac{1}{4}$ ", non-cumulative.

3.2 PROTECTION AFTER INSTALLATION

- A. Provide protective covering on all hand and guardrails if construction is not yet finished in the area.

3.3 MAINTENANCE AND CLEANING

- A. Railings shall be cleaned, including infill panels, by contractor to the satisfaction of the owner.
 1. Wipe with moistened cloth only. Do not use cleaning agents with abrasive or acid/alkaline content.

3.4 CORRECTION OF DEFICIENCIES

- A. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in field to shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 05 52 00

SECTION 05 73 00

DECORATIVE GLAZED METAL RAILINGS

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, 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 SUMMARY

- A. Furnish and install interior handrails and rails as follows:
 - 1. Lobby Stairs: Stainless Steel railings with glass infill, as shown at stairs and balcony locations on the drawings and specified herein.
- B. Related Requirements
 - 1. Section 03 30 00, Cast-in-Place Concrete
 - 2. Section 05 12 00, Structural Steel Framing
 - 3. Section 05 51 00, Metal Stairs
 - 4. Section 05 52 00, Handrails and Railings
 - 5. Section 06 10 53, Rough and Finish Carpentry
 - 6. Section 09 29 00, Gypsum Board
 - 7. Section 09 91 00, Painting

1.3 REFERENCES

- A. Use current editions unless indicated otherwise.
- B. ASTM International (ASTM)
 - 1. ASTM A1008 / A1008M, Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
 - 2. ASTM C1048, Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass
 - 3. ASTM D1187 / D1187M, Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal
- C. National Association of Architectural Metal Manufacturers (NAAMM)
 - 1. Metal Finishes Manual for Architectural and Metal Products
- D. 2010 ADA Standards for Accessible Design (SAD)
- E. 2012 Texas Accessibility Standards (TAS)
- F. Texas Health and Safety Code, Chapter 161, Subchapter Q, Installation of Asbestos
- G. Texas Occupations Code, Chapter 1954, Asbestos Health Protection

1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design handrails and railings, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Railings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.
 - 1. Handrails and Top Rails of Guards:
 - a. Uniform load of 50 lbf/ ft. applied in any direction
 - b. Concentrated load of 200 lbf applied in any direction
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 - 2. Infill of Guards:
 - a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.

- b. Infill load and other loads need not be assumed to act concurrently.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects
- D. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.5 ACTION SUBMITTALS

- A. Submit product data for each type of product indicated.
- B. Comply with the requirements of the General and Supplementary Conditions.
- C. Samples:
 - 1. Submit samples of specified finishes for architectural approval.
 - 2. Submit a typical four foot wide section of the specified handrail.
 - a. Construct the handrail submittal prior to beginning any other handrail/guardrail Work.
 - b. The approved sample may be permanently installed in the project.
- D. Prepare handrail and railing systems shop drawings under the supervision of a qualified professional engineer. Shop drawings shall show fabrication and installation of ornamental metalwork including plans, elevations, details of components, and attachments to other units of Work. Indicate materials and profiles of each ornamental metalwork member, fitting, joinery, finishes, fasteners, anchorages, and accessory items.
 - 1. Include setting drawings, templates, and directions for installation of anchor bolts and other anchorages to be installed as unit of Work of other sections.
 - 2. For installed products indicated to comply with certain design loadings, include structural analysis data sealed and signed by the qualified professional engineer licensed in the State of Texas.

1.6 INFORMATIONAL SUBMITTALS

- A. Submit Material Safety and Data Sheet (MSDS) for all materials, products, and parts.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Where ornamental rails are indicated to fit to other construction, check actual dimensions of other construction by accurate field measurements before fabrication; show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- B. Where field measurements cannot be made without delaying the Work, General Contractor will guarantee dimensions and Ornamental Metal and Aluminum Rail Fabricator will proceed with fabricating ornamental metalwork without field measurements. General Contractor will coordinate construction to ensure that actual dimensions correspond to guaranteed dimensions

1.8 QUALITY ASSURANCE

- A. Installation conference shall be scheduled in accordance with the requirements of Section 01 31 00, Project Management and Coordination.
- B. Fabricator Qualifications: Firm with five years experience in successfully producing ornamental metalwork similar to that indicated for this Project and with sufficient production capacity to produce required units without delaying the Work.
- C. Installer Qualifications: Arrange for installation by installer with five years of experience successfully installing aluminum, powder coated and stainless steel railing systems and with sufficient capacity to perform project and not delay the work.
- D. Engineer Qualifications: Professional engineer legally authorized to practice in jurisdiction where Project is located and experienced in providing engineering services of the kind indicated that have resulted in the installation of assemblies similar to this Project in material, design, and extent and that have a record of successful in-service performance.

1.9 DELIVERY AND STORAGE

- A. Deliver materials to the job site in good condition and properly protected against damage to finished surfaces.
- B. Store ornamental metalwork inside a conditioned area, away from uncured concrete and masonry, and protected from weather, moisture, soiling, abrasion, extreme temperatures, and humidity. Store product in manufacturer's packing until ready for installation.

1.10 PROJECT 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. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- B. 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.

1.11 WARRANTY

- A. Provide written warranty against defects in material and workmanship for the work of this Section for a period of one year from the Date of Substantial Completion.
- B. Refer to Section 01 77 00, Closeout Procedures, for Warranty form.

2 PRODUCTS**2.1 MANUFACTURERS**

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Stainless Steel Glass railing "Sania Inline Button Retainer" as manufactured by Efficient-Tec International LLC, S3 Stainless Steel Systems or equivalent by one of the manufacturers listed below.
 - 1. Efficient-Tec International LLC, S3 Stainless Steel Systems.
 - 2. Hollaender Architectural Railing Systems.
 - 3. HDI Railing Systems.

2.2 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
- B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails, unless otherwise indicated.

2.3 STAINLESS STEEL

- A. Guardrail:
 - 1. Post: Provide 1½ in IPS, (1.90 in OD) Stainless Steel, Alloy 316, unless otherwise indicated.
 - 2. Cap: 1.67" O.D. or 1.90" O.D. Stainless Steel ornamental tubing, Alloy 316
 - 3. Post Spacing: 48" maximum.
- B. Assist Rail:
 - 1. Sude mounted 1.67" O.D. Stainless Steel Ornamental tubing, Alloy 316
 - 2. Brackets: Efficient-Tec Handrail Brackets
- C. Post Mount:
 - 1. Facia Mount, 316 Stainless Steel
 - a. Brackets: 4" x 4" square Efficient-Tec Handrail Brackets (as shown in drawings).
- D. Finish:
 - 1. Stainless Steel material - No. 6 brushed satin finish

2.4 FASTENERS

- A. General: Provide Stainless Steel rails with Stainless steel fittings alloy 316.

- B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.

2.5 FLANGES AND ANCHORS

- A. Anchors: As per the manufacturer's recommendations for the basis of design "Sania Inline Button Retainer side mounted railing system."

2.6 GLASS INFILL PANELS FOR RAILINGS

- A. Tempered Glass: ASTM C1048, Fully Tempered, Condition A, Type 1 (Frosted Glass), Quality Q3. Products shall comply with properties indicated for class, thickness, and manufacturing process that have been tested for surface and edge compression according to ASTM C1048 and for impact strength according to 16 CFR 1201 for category 2 materials.
- B. Plastic Interlayer: Minimum 0.060 inch thick.
- C. Impact Strength: Category II, tested in accordance with 16 CFR 1201
- D. Thickness: 9/16 inch
- E. Configuration: As indicated on drawings
- F. Edges: Ground Smooth and polished
- G. Color: Clear, no tint
 - 1. Provide Frosted or etched glass where shown on drawings
- H. Glass to be laminated tempered.

2.7 FABRICATION

- A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.
- B. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
- C. Form work true to line and level with accurate angles and surfaces.
- D. Form change in direction of railing:
 - 1. As detailed
 - 2. Radius bends
 - 3. Mitered joints
 - 4. Prefabricated flush radius elbows or mitered elbows as detailed
- E. Connections: Fabricate railings with nonwelded connections, unless otherwise indicated.
- F. Nonwelded Connections: Connect members with concealed mechanical fasteners, fittings and two part Delo-Duopox 1895 epoxy, unless otherwise indicated. Fabricate members and fittings to produce flush, smooth, rigid, tight hairline joints.
- G. Welded Connections: Use welding method that is appropriate for metal and finish indicated and that develops strength required to comply with structural performance criteria. Finish exposed welds and surfaces smooth, flush, and blended to match adjoining surfaces.
- H. Close exposed ends of railing members with prefabricated end fittings.
- I. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.

2.8 FINISHES, GENERAL

- A. Comply with NAAMM *Metal Finishes Manual for Architectural and Metal Products* for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

- C. 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.

3 EXECUTION

3.1 EXAMINATION

- A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements have been clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

- A. Install railing in accordance with approved shop drawings.
- B. Perform cutting, drilling, shimming and fitting required for installation.
- C. Install railing accurately in location, alignment and elevation free from distortion or defects and securely anchored to structure.
- D. Provide anchors, plates, angles, etc., necessary for connecting railings to structure.
- E. All embedded anchor plates and supporting steel shall be provided by another trade and coordinated with the railing supplier.
- F. Access must be made available by contractor, for anchors that require through bolting either vertically or horizontally.
- G. Post plumb within a tolerance of 1/8 inch in 3 feet.
- H. Maximum offset from alignment for every 20-foot of railing shall be 1/4 inch, non-cumulative.
- I. Fit exposed connections together to form tight, hairline joints.
- J. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
 - 1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.

3.3 RAILING CONNECTIONS

- A. Nonwelded Connections: Use mechanical joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings.
- B. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches beyond joint on either side, fasten internal sleeve securely to 1 side, and locate joint within 6 inches of post.

3.4 ANCHORING RAILING ENDS

- A. Anchor railing ends to concrete and masonry with round flanges connected to railing ends and anchored to wall construction with anchors and bolts.
- B. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and connected to railing ends using nonwelded connections.

3.5 ATTACHING HANDRAILS TO WALLS

- A. Attach handrails to wall with wall brackets. Provide brackets with 1-1/2 inch clearance from inside face of handrail and finished wall surface U.N.O.
- B. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
- C. Secure wall brackets to building construction as indicated, or if not indicated, as follows:
 - 1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
 - 2. For hollow masonry anchorage, use toggle bolts.

3. Provide blocking between studs in stud wall construction.

3.6 ADJUSTING AND CLEANING

- A. Railing and infill panels shall be cleaned by the contractor to the owner's satisfaction.
 1. Clean with mild soap and warm water.
 2. Do not use acid solutions, steel wool or other harsh abrasives.

3.7 PROTECTION

- A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.
- B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit or provide new units as necessary to meet Architect's requirements.

END OF SECTION 05 73 00

SECTION 06 10 53

MISCELLANEOUS ROUGH CARPENTRY

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, 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 SUMMARY

- A. Section includes rooftop equipment bases, and support curbs; wood blocking, cants, and nailers; wood furring and grounds; and plywood backing panels.
- B. Related Requirements
 - 1. Section 05 40 00, Cold-Formed Metal Framing
 - 2. Section 09 22 16, Non-Structural Metal Framing
 - 3. Section 09 91 00, Painting

1.3 DEFINITIONS

- A. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension
- B. Lumber grading agencies, and the abbreviations used to reference them, include the following:
 - 1. SPIB: The Southern Pine Inspection Bureau

1.4 REFERENCES

- A. Use current editions unless noted otherwise.
- B. American Wood-Preservers' Association (AWPA)
 - 1. AWPA U1, Use Category System: User Specification for Treated Wood
- C. ASME International (ASME)
 - 1. ASME B18.2.1, Square and Hex Bolts and Screws, Inch Series
 - 2. ASME B18.6.1, Wood Screws (Inch Series)
- D. ASTM International (ASTM)
 - 1. ASTM A153 / A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
 - 2. ASTM A307, Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
 - 3. ASTM A563, Standard Specification for Carbons and Alloy Steel Nuts
 - 4. ASTM B633, Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel
 - 5. 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
 - 6. ASTM C1002, Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs
 - 7. ASTM D2898, Standard Practice for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing
 - 8. ASTM D3201, Standard Test Method for Hygroscopic Properties of Fire-Retardant Wood and Wood-Based Products
 - 9. ASTM D3498, Standard Specification for Adhesives for Field-Gluing Plywood to Lumber Framing for Floor Systems
 - 10. ASTM D5664, Standard Test Method for Evaluating the Effects of Fire-Retardant Treatments and Elevated Temperatures on Strength Properties of Fire-Retardant Treated Lumber

11. ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials
12. ASTM E488, Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements
13. ASTM F593, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs
14. ASTM F594, Standard Specification for Stainless Steel Nuts
15. ASTM F1667, Standard Specification for Driven Fasteners: Nails, Spikes, and Staples
- E. ICC Evaluation Service, Inc.
 1. NES NER-272, Power Driven Staples and Nails for Use in All Types of Building Construction
- F. Texas Health and Safety Code, Chapter 161, Subchapter Q, Installation of Asbestos
- G. Texas Occupations Code, Chapter 1954, Asbestos Health Protection

1.5 ACTION SUBMITTALS

- A. Submit product data for each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
 2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
 3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D5664.
 4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
 5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

1.6 INFORMATIONAL SUBMITTALS

- A. Submit Material Safety and Data Sheet (MSDS) for all materials, products, and parts.

1.7 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

1.9 WARRANTY

- A. Provide written warranty against defects in material and workmanship for the work of this Section for a period of one year from the Date of Substantial Completion.
- B. Refer to Section 01 77 00, Closeout Procedures, for Warranty form.

2 PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
 - 1. Factory mark each piece of lumber with grade stamp of grading agency.
 - 2. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece if authorities having jurisdiction require quality mark on all materials. Omit marking and provide certificates of treatment compliance issued by inspection agency if authorities having jurisdiction do not require quality mark on all materials.
 - 3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
 - 4. Provide dressed lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content of Lumber: 19 percent unless otherwise indicated

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Preservative Treatment by Pressure Process: AWP A U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
 - 2. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
 - 1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece if authorities having jurisdiction require quality mark on all materials. Omit marking and provide certificates of treatment compliance issued by inspection agency if authorities having jurisdiction do not require quality mark on all materials.
- D. Application: Treat items indicated on Drawings, and the following:
 - 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing
 - 2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete

2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame spread index of ≤ 25 when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test
 - 1. Use treatment that does not promote corrosion of metal fasteners.

2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898. Use for exterior locations and where indicated.
3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D3201 at 92 percent relative humidity. Use where exterior type is not indicated.
- C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.
- D. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece if authorities having jurisdiction require quality mark on all materials. Omit marking and provide certificates of treatment compliance issued by inspection agency if authorities having jurisdiction do not require quality mark on all materials.
- E. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.
- F. Application: Treat items indicated on Drawings, and the following:
 1. Framing for raised platforms
 2. Concealed blocking
 3. Roof framing and blocking
 4. Wood cants, nailers, curbs, equipment support bases, blocking, and similar members in connection with roofing
 5. Plywood backing panels

2.4 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including blocking, nailers, rooftop equipment bases and support curbs, cants, furring, and grounds:
- B. For items of dimension lumber size, provide Construction or No. 2 grade lumber of S4S mixed southern pine (SPIB).
- C. For concealed boards, provide lumber with 19 percent maximum moisture content and of mixed southern pine (SPIB).
- D. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
- E. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

2.5 PLYWOOD BACKING PANELS

- A. Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, $\frac{3}{4}$ inch nominal thickness

2.6 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.
- B. Nails, Brads, and Staples: ASTM F1667
- C. Power-Driven Fasteners: NES NER-272
- D. Wood Screws: ASME B18.6.1
- E. Screws for Fastening to Metal Framing: ASTM C1002 and ASTM C954, length as recommended by screw manufacturer for material being fastened
- F. Lag Bolts: ASME B18.2.1

- G. Bolts: Steel bolts complying with ASTM A307, Grade A; with ASTM A563 hex nuts and, where indicated, flat washers
- H. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E488 conducted by a qualified independent testing and inspecting agency
 - 1. Material: Carbon-steel components, zinc plated to comply with ASTM B633, Class Fe/Zn 5
 - 2. Material: Stainless steel with bolts and nuts complying with ASTM F593 and ASTM F594, Alloy Group 1 or 2

2.7 MISCELLANEOUS MATERIALS

- A. Adhesives for Gluing Furring and Sleepers to Concrete or Masonry: Formulation complying with ASTM D3498 that is approved for use indicated by adhesive manufacturer.

3 EXECUTION

3.1 INSTALLATION, GENERAL

- A. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.
- B. Where wood-preserved-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- C. Plywood Backing Panels
 - 1. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels.
 - 2. Install 8 feet high panels around the full perimeter of all data rooms such that the bottom of the panels are at 12 inches above the floor. Seal top and bottom edges with continuous bead of sealant.
 - 3. Install fire-retardant treated plywood backing panels with classification marking of testing agency exposed to view.
- D. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, trim, and/or not limited to:
 - 1. All recessed or semi-recessed equipment and assemblies.
 - 2. All wall hung surface equipment and assemblies.
 - 3. All wall attached equipment and assemblies.
 - 4. Other equipment or assemblies as recommended by manufacturer for proper installation.
- E. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- F. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. NES NER-272 for power-driven fasteners
 - 2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code
- G. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.2 WOOD GROUND, SLEEPER, BLOCKING, AND NAILER INSTALLATION

- A. Install where indicated and where required for screeding or attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.
- C. Attach to steel members with bolts spaced at not less than 36 inches and within 4 inches of ends of carpentry. Stagger bolts where width of carpentry exceeds 6 inches.

END OF SECTION 06 10 53

SECTION 06 16 43

GYPSUM SHEATHING

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, 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 SUMMARY

- A. Section includes sheathing at exterior walls and sheathing joint and penetration treatment.
- B. Related Requirements
 - 1. Section 04 20 00, Unit Masonry
 - 2. Section 05 40 00, Cold-Formed Metal Framing
 - 3. Section 07 65 26, Self-Adhering Sheet Flashing

1.3 REFERENCES

- A. Use current editions unless noted otherwise.
- B. ASTM International (ASTM)
 - 1. ASTM A153 / A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
 - 2. ASTM B117, Standard Practice for Operating Salt Spray (Fog) Apparatus
 - 3. 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
 - 4. ASTM C1002, Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs
 - 5. ASTM C1177 / C1177M, Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing
 - 6. ASTM C1396 / C1396M, Standard Specification for Gypsum Board
 - 7. ASTM E119, Standard Test Methods for Fire Tests of Building Construction and Materials
- C. Gypsum Association (GA)
 - 1. GA-253, Application of Gypsum Sheathing
 - 2. GA-600, Fire Resistance Design Manual
- D. Underwriters Laboratories Inc. (UL)
 - 1. UL Fire Resistance Directory
- E. Texas Health and Safety Code, Chapter 161, Subchapter Q, Installation of Asbestos
- F. Texas Occupations Code, Chapter 1954, Asbestos Health Protection

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00, Project Management and Coordination.

1.5 ACTION SUBMITTALS

- A. Submit product data for each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1.6 INFORMATIONAL SUBMITTALS

- A. Submit Material Safety and Data Sheet (MSDS) for all materials, products, and parts.

1.7 QUALITY ASSURANCE

- A. Refer to Section 04 20 00, Unit Masonry, for requirements related to mockups.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

1.9 WARRANTY

- A. Provide written warranty against defects in material and workmanship for the work of this Section for a period of one year from the Date of Substantial Completion.
B. Refer to Section 01 77 00, Closeout Procedures, for Warranty form.

2 PRODUCTS**2.1 MANUFACTURERS**

- A. Glass-Mat Gypsum Wall Sheathing
1. CertainTeed Corporation
 2. G-P Gypsum Corporation
 3. National Gypsum Company
 4. Temple-Inland Inc.
 5. United States Gypsum Co.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory."

2.3 WALL SHEATHING

- A. Glass-Mat Gypsum Wall Sheathing: ASTM C1177 / C1177M
1. Type and Thickness: Regular, ½ inch thick
 2. Size: 48 by 96 inches, 108 inches, or 120 inches for vertical installation
 3. G-P Gypsum Corporation Dens-Glass Gold or an equivalent by a listed manufacturer

2.4 FASTENERS

- A. Provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.
B. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing 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.
1. For steel framing less than 0.0329 inch thick, use screws that comply with ASTM C1002.
 2. For steel framing from 0.033 to 0.112 inch thick, use screws that comply with ASTM C954.

3 EXECUTION**3.1 INSTALLATION, GENERAL**

- A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

- B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.
- C. Securely attach to substrate by fastening as required by local codes and authorities having jurisdiction.
- D. Coordinate sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
- E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
- F. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 GYPSUM SHEATHING INSTALLATION

- A. Comply with GA-253 and with manufacturer's written instructions.
 - 1. Fasten gypsum sheathing to cold-formed metal framing with screws.
 - 2. Install boards with a $\frac{3}{8}$ inch gap where non-load-bearing construction abuts structural elements.
 - 3. Install boards with a $\frac{1}{4}$ inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.
- B. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.
- C. Horizontal Installation: Install sheathing with V-grooved edge down and tongue edge up. Interlock tongue with groove to bring long edges in contact with edges of adjacent boards without forcing. Abut ends of boards over centers of studs, and stagger end joints of adjacent boards not less than one stud spacing. Attach boards at perimeter and within field of board to each steel stud. Space fasteners approximately 8 inches o.c. and set back a minimum of $\frac{3}{8}$ inch from edges and ends of boards.
- D. Vertical Installation: Install board vertical edges centered over studs. Abut ends and edges of each board with those of adjacent boards. Attach boards at perimeter and within field of board to each stud. Space fasteners approximately 8 inches o.c. and set back a minimum of $\frac{3}{8}$ inch from edges and ends of boards.

END OF SECTION 06 16 43

SECTION 07 11 13

BITUMINOUS DAMPPROOFING

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 72 00, General Conditions, and Document 00 73 00, Supplementary Conditions, for substitution of materials and products.
- C. Addenda issued prior to establishing the Guaranteed Maximum Price that affect this section of the specifications.

1.2 SUMMARY

- A. Section includes dampproofing on walls exposed to weather on exterior face of masonry backup for masonry veneer wall assemblies at the service yard.
- B. Related Requirements:
 - 1. Section 04 20 00, Unit Masonry

1.3 REFERENCES

- A. Use current editions unless noted otherwise.
- B. ASTM International (ASTM)
 - 1. ASTM D41, Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
 - 2. ASTM D1227, Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing
 - 3. ASTM D4479, Standard Specification for Asphalt Roof Coatings—Asbestos-Free
 - 4. ASTM D4586, Standard Specification for Asphalt Roof Cement, Asbestos-Free
- C. Texas Health and Safety Code, Chapter 161, Subchapter Q, Installation of Asbestos
- D. Texas Occupations Code, Chapter 1954, Asbestos Health Protection

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00, Project Management and Coordination.

1.5 ACTION SUBMITTALS

- A. Submit product data for each type of product.

1.6 INFORMATIONAL SUBMITTALS

- A. Submit Material Safety and Data Sheet (MSDS) for all materials, products, and parts.

1.7 QUALITY ASSURANCE

- A. Refer to Section 04 20 00, Unit Masonry, for requirements related to mockups.

1.8 FIELD CONDITIONS

- A. Weather Limitations: Proceed with application only when existing and forecasted weather conditions permit dampproofing to be performed according to manufacturers' written instructions.
- B. Ventilation: Provide adequate ventilation during application of dampproofing in enclosed spaces. Maintain ventilation until dampproofing has cured.

1.9 WARRANTY

- A. Provide written warranty against defects in material and workmanship for the work of this Section for a period of **two** years from the Date of Substantial Completion. Refer to Section 01 77 00, Closeout Procedures, for Warranty form.

2 PRODUCTS**2.1 MANUFACTURERS**

- A. Cold-Applied, Fibered Emulsified-Asphalt Dampproofing
 - 1. APOC, Inc.; a division of Gardner-Gibson
 - 2. BASF Construction Chemicals - Building Systems; Sonneborn Brand Products
 - 3. Brewer Company
 - 4. ChemMasters, Inc.
 - 5. Euclid Chemical Company (The); an RPM company
 - 6. Gardner-Gibson, Inc.
 - 7. Henry Company
 - 8. Karnak Corporation
 - 9. Koppers Inc.
 - 10. Malarkey Roofing Products
 - 11. W. R. Meadows, Inc.

2.2 MATERIALS, GENERAL

- A. Source Limitations: Obtain primary dampproofing materials and primers from single source from single manufacturer. Provide auxiliary materials recommended in writing by manufacturer of primary materials.
- B. VOC Content: Products shall comply with VOC content limits of authorities having jurisdiction unless otherwise required.

2.3 COLD-APPLIED, FIBERED EMULSIFIED-ASPHALT DAMPPROOFING

- A. Trowel Coats: ASTM D1227, Type II, Class 1
- B. Fibered Brush and Spray Coats: ASTM D1227, Type II, Class 1
- C. Brush and Spray Coats: ASTM D1227, Type III, Class 1

2.4 AUXILIARY MATERIALS

- A. General: Furnish auxiliary materials recommended in writing by dampproofing manufacturer for intended use and compatible with bituminous dampproofing.
- B. Fibered Emulsified-Asphalt Primer: ASTM D1227, Type III, Class 1, except diluted with water as recommended in writing by manufacturer
- C. Patching Compound: Asbestos-free fibered mastic of type recommended in writing by dampproofing manufacturer

3 EXECUTION**3.1 EXAMINATION**

- A. Examine substrates, areas, and conditions with Applicator present, for compliance with requirements for surface smoothness, surface moisture, and other conditions affecting performance of bituminous dampproofing work.
- B. Proceed with application only after substrate construction and penetrating work have been completed and unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Mask or otherwise protect adjoining exposed surfaces from being stained, spotted, or coated with dampproofing. Prevent dampproofing materials from entering and clogging weep holes and drains.
- B. Clean substrates of projections and substances detrimental to the dampproofing work; fill voids, seal joints, and remove bond breakers if any, as recommended in writing by prime material manufacturer.
- C. Apply patching compound to patch and fill tie holes, honeycombs, reveals, and other imperfections. Cover with asphalt-coated glass fabric where necessary.

3.3 APPLICATION

- A. Comply with manufacturer's written instructions for dampproofing application, cure time between coats, and drying time before backfilling unless more stringent requirements are indicated.
 - 1. Apply dampproofing to provide continuous plane of protection.
 - 2. Apply additional coats if recommended in writing by manufacturer or to achieve a smooth surface and uninterrupted coverage.
- B. Where dampproofing exterior face of inner wythe of exterior masonry cavity walls, lap dampproofing at least ¼ inch onto flashing, masonry reinforcement, veneer ties, and other items that penetrate inner wythe.
 - 1. Extend dampproofing over outer face of structural members and concrete slabs that interrupt inner wythe.
 - 2. Lap dampproofing at least ¼ inch onto shelf angles supporting veneer.
- C. Sheathing
 - 1. Seal around masonry anchor penetrations.
 - 2. Coordinate work to ensure that all sheathing penetrations and fastener heads for masonry anchors are covered with dampproofing.
- D. Trowel or spray apply mastic in accordance with manufacturer's printed instructions to a minimum dry thickness of 3/32 inch (approximately 1/8 inch wet thickness) with 100% coverage.
- E. Cover over all corners and reveals and work thoroughly into all joints, cracks or pockets. Make sure coating is continuous and free of breaks and pinholes.
- F. Schedule his operations to ensure that surfaces coated with emulsified coatings remain exposed and accessible for the 24 hour period after application.
- G. Keep bonding surface of masonry anchors and reinforcing clean of dampproofing mastic.

3.4 CLEANING

- A. Touch up thin areas, voids, or pinholes prior to installation of finish materials.
- B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended in writing by manufacturer of affected construction.
- C. Remove dampproofing from portions of masonry reinforcing, anchors, and accessories that will extend into the joints of the masonry veneer.

END OF SECTION 07 11 13

SECTION 07 21 13.13

FOAM BOARD INSULATION

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, 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 SUMMARY

- A. Section includes a thermal, water, and air resistance barrier system for exterior wall assemblies.
- B. Related Sections
 - 1. Section 04 20 00, Unit Masonry
 - 2. Section 04 25 16, Thin Brick Panel System
 - 3. Section 05 40 00, Cold-Formed Metal Framing
 - 4. Section 07 21 16, Blanket Insulation
 - 5. Section 07 42 13, Metal Wall Panels

1.3 REFERENCES

- A. Use current editions unless noted otherwise.
- B. ASTM International (ASTM)
 - 1. ASTM A153 / A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
 - 2. ASTM C203, Standard Test Methods for Breaking Load and Flexural Properties of Block-Type Thermal Insulation
 - 3. ASTM C209, Standard Test Methods for Cellulosic Fiber Insulating Board
 - 4. ASTM C518, Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
 - 5. ASTM C1289, Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
 - 6. ASTM D1621, Standard Test Method for Compressive Properties Of Rigid Cellular Plastics
 - 7. ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials
 - 8. ASTM E96 / E96M, Standard Test Methods for Water Vapor Transmission of Materials
- C. National Fire Protection Association (NFPA)
 - 1. NFPA 285, Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components
- D. Texas Health and Safety Code, Chapter 161, Subchapter Q, Installation of Asbestos
- E. Texas Occupations Code, Chapter 1954, Asbestos Health Protection

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00, Project Management and Coordination.

1.5 ACTION SUBMITTALS

- A. Product Data: Submit for each type of product indicated.

1.6 INFORMATIONAL SUBMITTALS

- A. Submit Material Safety and Data Sheet (MSDS) for all materials, products, and parts.

1.7 QUALITY ASSURANCE

- A. Refer to Section 04 20 00, Unit Masonry, for requirements related to mockups.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver wall system materials in Manufacturer's unopened containers or bundles, fully identified by name, brand, type and grade. Exercise care to avoid damage during unloading, storing and installation. Unload insulation be from trucks using a fork-lift or similar equipment with suitable forks to slide under bundles. Do not roll or tumble bundles from delivery trucks.
- B. Store, protect and handle wall system materials in accordance with the Manufacturer's recommendations to prevent damage, contamination and deterioration.
- C. Store insulation on pallets or other dunnage at least 4 inches above ground level.
- D. Keep materials free of dirt and other foreign matter.

1.9 WARRANTY

- A. Provide written warranty against defects in material and workmanship for the work of this Section for a period of one year from the Date of Substantial Completion. Refer to Section 01 77 00, Closeout Procedures, for Warranty form.
- B. Provide manufacturer's written six month exposure and 15 year thermal warranty.

2 PRODUCTS**2.1 MANUFACTURERS**

- A. Foil Faced Foam Board Insulation
 - 1. Dow Chemical Company
 - 2. Hunter Panels
 - 3. Rmax, Inc.
- B. Extruded-Polystyrene Board Insulation
 - 1. DiversiFoam Products
 - 2. Dow Chemical Company
 - 3. Owens Corning
 - 4. Pactiv Building Products
- C. Fasteners
 - 1. Rigid Insulation
 - a. Provide adhesive as recommended by waterproofing manufacturer.
 - 2. Masonry Veneer Anchoring System
 - a. Heckmann Building Products Inc.
 - b. Hohmann and Barnard, Inc.
 - c. Trufast Walls Inc. (Formerly Rodenhouse, Inc.)

2.2 MATERIALS

- A. Foil Faced Foam Board Insulation
 - 1. Glass-fiber-reinforced enhanced polyisocyanurate foam core sheathing faced with nominal 1.25 mil embossed acrylic-coated aluminum on one side and 0.9 mil embossed aluminum on the other side, and complying with ASTM C1289, Type I, Class 1 or 2.
 - 2. Compressive Strength (ASTM D1621): 25 psi, minimum
 - 3. Aged thermal Resistance (ASTM C518, measured at Mean Temp of 75F): 6.5 at 1 inch of thickness with 15 year thermal warranty
 - 4. Flexural Strength (ASTM C203): 55 psi, minimum
 - 5. Water Absorption (ASTM C209): 0.1% by volume, minimum
 - 6. Water Vapor Permeance (ASTM E96): <0.03 perms
 - 7. Maximum Use Temperature: 250° F
 - 8. Flame-Spread and Smoke-Developed Indexes (ASTM E84): ≤25 and <450, respectively
 - 9. Panel Size: 48 inches wide x 96 inches minimum long with square edge

10. Thickness and Stabilized R-Value: Nominal 1 inch thick, R-6.5
11. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
- B. Extruded-Polystyrene Board Insulation at masonry
 1. ASTM C578, Type IV
 2. Minimum Compressive Strength: 25psi
 3. Maximum Flame-Spread and Smoke-Developed Indexes: 75 and 450, respectively, per ASTM E84
 4. Minimum Thermal Resistance ("R" Value) at 75° F mean temperature: 5.0 per inch
 5. Thickness: 1 inch
 6. Size: 48 inches x 96 inches (minimum)
- C.
 1. Fasteners
 - a. Masonry Veneer on metal studs
 - 1) Basis-of-Design Product: Subject to compliance with requirements, provide corrosion resistant self-drilling #8 diameter Ceramic Coated Anchor with Neoprene / EPDM Thermal-Grip Brick Tie Washer or comparable products by one of the listed manufacturers.
 - 2) Barrel length shall be equal to thickness of foam board insulation so that compressive loads are transferred directly to the metal wall framing.
 - b. Metal Wall Panel Veneer: Weather resistant, ceramic coated self-drilling screws with Trufast Inc. Thermal-Grip ci Prong washers.

3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates and installation conditions for compliance with requirements for installation conditions affecting performance of the work.
- B. Verify that metal wall studs, opening framing, bridging, bracing and other framing support members and anchorage have been installed within wall system alignment tolerances and requirements.
- C. Do not install wall system components during adverse weather conditions, such as rain, sleet, snow or heavy winds or on walls when water of any type is present.
- D. Do not apply any wall system component that is damp or wet.
- E. Do not proceed with wall system installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Rigid Insulation:
 1. Install insulation in accordance with manufacturer's recommendations with the appropriate surface facing the exterior of the building.
 2. Abut insulation boards tightly together and around openings and penetrations to provide full coverage.
 3. Install insulation boards with the long dimension horizontal and level to the floor/slab. Install horizontally between masonry reinforcement. DO NOT alter brick ties to secure insulation board in place. Use maximum lengths to minimize number of joints.
 4. Secure insulation boards in place with manufacture's recommended adhesive that is compatible with waterproofing.
 5. Snugly fit the boards in an overlap at changes in wall directions (corners).
- B. Steel Stud Substrate
 1. Locate edge joints parallel to and on framing. Center end joints over supports and stagger in each course. Provide additional framing wherever insulation board joints do not bear against framing plate or sill members.
 2. Prespot washers on the surface of the installation.
 3. Drive fasteners through washers and insulation to exterior face of steel stud wall framing using specified fasteners. Add wire ties at masonry veneer walls.

- C. Masonry Substrate
 - 1. Stagger end joints 16 inches in each course.
 - 2. Prespot washers on the surface of the installation.
 - 3. Predrill hole through insulation board and washers and into substrate with 3/16 inch masonry bit.
 - 4. Drive fasteners through washers and insulation to exterior face of steel stud wall framing using specified fasteners. Add wire ties.
- D. Seal all joints between adjacent boards and repair minor damage to the foil face of insulation boards with insulation tape or liquid spray flashing.
- E. Clean all surfaces to which insulation tape or liquid spray flashing is to be applied to be free of moisture, oils, dust, dirt and other debris that could inhibit adhesion.

3.3 REPAIR

- A. Repair minor damage to foil face of insulation boards with insulation tape or liquid spray flashing.
- B. Replace damage to the foam core of insulation boards and major damage to the foil facing of insulation boards by fully cutting out the damaged area.
 - 1. At steel studs, remove a piece large enough to span entire stud spacing to ensure new joints are backed by framing.
 - 2. Cut a new piece of insulation board to fill the open area, and fasten the new piece and seal in the same manner as described above for the original installation.

3.4 PROTECTION

- A. Protect installed products until completion of project.
- B. Cover the top and edges of unfinished wall panel work to protect it from the weather and to prevent accumulation of water in the cores of the panels.
- C. Do not leave panels exposed to moisture. Wet panels shall be removed or allowed to completely dry prior to application of vapor barrier and/or cladding.
- D. Repair or replace damaged products before Substantial Completion.

END OF SECTION 07 21 13.13

SECTION 07 21 16

BLANKET INSULATION

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, 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 SUMMARY

- A. Section includes glass-fiber blankets in cavities formed by steel studs at exterior walls.
- B. Related Sections
 - 1. Section 05 40 00, Cold-Formed Metal Framing
 - 2. Section 07 21 13.13, Foam Board Insulation
 - 3. Section 09 29 00, Gypsum Board

1.3 REFERENCES

- A. Use current editions unless noted otherwise.
- B. ASTM International (ASTM)
 - 1. ASTM C665, Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
 - 2. ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials
 - 3. ASTM E136, Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C
 - 4. ASTM C665 Corrosivity to Steel
 - 5. ASTM C665 Material Specification
 - 6. ASTM C1104 Water Vapor Sorption
 - 7. ASTM C1338 Fungi Resistant,
 - 8. ASTM E84 Flame Spread
 - 9. ASTM E136 Noncombustible
 - 10. UL 723, CAN/ULC-S102-M, 0/0
 - 11. ICC (International Building Code), All Building Classification Types
- C. Texas Health and Safety Code, Chapter 161, Subchapter Q, Installation of Asbestos
- D. Texas Occupations Code, Chapter 1954, Asbestos Health Protection

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00, Project Management and Coordination.

1.5 ACTION SUBMITTALS

- A. Product Data: Submit for each type of product indicated.

1.6 INFORMATIONAL SUBMITTALS

- A. Submit Material Safety and Data Sheet (MSDS) for all materials, products, and parts.

1.7 QUALITY ASSURANCE

- A. Refer to Section 04 20 00, Unit Masonry, for requirements related to mockups.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

1.9 WARRANTY

- A. Provide written warranty against defects in material and workmanship for the work of this Section for a period of one year from the Date of Substantial Completion.
- B. Refer to Section 01 77 00, Closeout Procedures, for Warranty form.

2 PRODUCTS**2.1 MANUFACTURERS**

- A. CertainTeed Corporation
- B. Guardian Building Products, Inc.
- C. Johns Manville
- D. Knauf Insulation
- E. Owens Corning

2.2 MATERIALS

- A. Glass-Fiber Blanket
 - 1. Unfaced: ASTM C665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E84; passing ASTM E136 for combustion characteristics
 - 2. Thickness: 3½ inches (R-11) and 6 inches (R-19) as indicated on the Drawings
- B. Batt Thermal & Acoustical Mineral Wool Insulation:
 - 1. Unfaced: Tested in accordance with ASTM E84 with Flame Spread 0 and Smoke Developed 0. Standard fiber; 70% pre-consumer recycled content.
 - 2. Thickness: 3½ inches (R-13) and 6 inches (R-24) as indicated on the Drawings
- C. Insulation Anchors:
 - 1. Peel and Press Insulation Hangers: 12 gauge, 2 inch square base with low carbon steel, copper head nail and secured with a self locking washer. Lengths as necessary/required for proper application for different size wall thickness.

3 EXECUTION**3.1 INSTALLATION**

- A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.
- E. Glass-Fiber Blankets
 - 1. Cavities Formed by Steel Studs
 - a. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
 - b. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.

- c. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
- d. Where cavity heights exceed 96 inches, steel stud depth is greater than insulation thickness, or cover material is absent from one or both sides of steel studs, support unfaced blankets mechanically to flanges of metal studs.
- e. Hold insulation minimum 1 inch from slab.
- f. Where insulation is exposed at walls with gypsum board on one side, provide insulation hangers to hold insulation blanket in place at every 3 feet max o.c.

3.2 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.
- B. 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 07 21 16

SECTION 07 27 26

FLUID APPLIED AIR BARRIER SYSTEM

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 Fluid-applied air barrier membrane in exterior wall assemblies.
- B. Materials to bridge and seal the following air leakage pathways and gaps:
 - 1. Connections of the walls to the roof air barrier.
 - 2. Connections of the walls to the foundation air barrier.
 - 3. Seismic and expansion joints.
 - 4. Openings and penetrations of window frames, storefront, curtain wall and mechanical, electrical and plumbing systems.
 - 5. Barrier precast concrete and other envelope systems.
 - 6. Door frames.
 - 7. Piping, conduit, duct and similar penetrations.
 - 8. Masonry ties, screws, bolts and similar penetrations.
 - 9. All other air leakage pathways in the building envelope.
- C. Related Sections
 - 1. Section 01 45 00 – Quality Control
 - 2. Section 01 50 00 – Temporary Facilities and Controls
 - 3. Section 03 30 00 – Cast-In-Place Concrete
 - 4. Section 04 20 00 – Unit Masonry
 - 5. Section 07 52 19 – Modified Bitumen “Cool Roof” Membrane Roofing System
 - 6. Section 07 65 00 – Flexible Flashing
 - 7. Section 07 90 00 – Joint Sealants
 - 8. Section 09 21 16 – Gypsum Wallboard Systems (Exterior Sheathing)

1.3 PERFORMANCE REQUIREMENTS

- A. Material Performance: Provide air barrier materials which have an air permeance not to exceed 0.004 cubic feet per minute per square foot under a pressure differential of 1.57 pounds per square foot (0.004 cfm / ft² @ 1.57 psf), when tested in accordance with ASTM E2178 (unmodified).
- B. Provide materials with a water vapor permeance of 10.0 US perms or greater, determined in accordance with ASTM E96 Water method (Procedure B).
- C. Assembly Performance: Provide a continuous air barrier in the form of an assembly that has an air leakage not to exceed 0.04 cubic feet per minute per square foot under a pressure differential of 1.57 pounds per square foot (0.04 cfm/ft² @ 1.57 psf) when tested in accordance with ASTM E2357. The assembly shall accommodate movements of building materials by providing expansion and control joints as required. Expansion / control joints, changes in substrate and perimeter conditions shall have appropriate accessory materials at such locations.
 - 1. The air barrier assembly shall be capable of withstanding combined design wind, fan and stack pressures, both positive and negative on the envelope without damage or displacement and shall transfer the load to the structure.
 - 2. Fluid applied air barriers shall not displace adjacent materials in the air barrier assembly under full load.
 - 3. The air barrier assembly shall be joined in an airtight and flexible manner to the air barrier materials of adjacent assemblies, allowing for the relative movement of assemblies due to thermal and moisture variations, creep, and anticipated seismic movement.
- D. Connections to Adjacent Materials: Provide connections to prevent air leakage at the following locations:

1. Foundation and walls, including penetrations, ties and anchors.
2. Walls, windows, curtain walls, storefronts, louvers or doors.
3. Different wall assemblies, and fixed openings within those assemblies.
4. Wall and roof connections.
5. Floors over unconditioned space.
6. Walls, floor and roof across construction, control and expansion joints.
7. Walls, floors and roof to utility, pipe and duct penetrations.
8. Seismic and expansion joints.
9. All other potential air leakage pathways in the building envelope.

1.4 PRE-INSTALLATION CONFERENCE

- A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00, Project Management and Coordination.

1.5 ACTION SUBMITTALS

- A. Submittals: Submit in accordance with Division 1 requirements.
- B. Installer Qualifications: Submit evidence of current Contractor accreditation and Installer certification under the Air Barrier Association of America's (ABAA). Submit accreditation number of the Contractor and certification number(s) of the ABAA Certified Installer(s).
- C. Product Data: Submit material Manufacturer's Product Data, material Manufacturer's instructions for evaluating, preparing, and treating substrate, temperature and other limitations of installation conditions, Technical Data, and tested physical and performance properties.
 1. Submit letter from primary air barrier material Manufacturer indicating approval of materials that are proposed to be used that are not currently listed in the accessories section of this specification for that Manufacturer's material.
 2. Include statement from the primary air barrier material Manufacturer that the materials used in their air barrier assembly which will be used to adhere to the underlying substrate are chemically compatible to the substrate material.
- D. Samples: Submit clearly labeled samples, three (3) inch by four (4) inch minimum size of each material specified.
- E. Shop Drawings of Mock-Up: Submit Shop Drawings of proposed mock-ups showing plans, elevations, large-scale details, and air barrier transitions and terminations.
- F. Field Test Results of Mock-Up: Submit test results of air leakage test and water leakage test of mock-up in accordance with specified standards, including retesting if initial results are not satisfactory.
- G. Shop Drawings: Submit Shop Drawings showing locations and extent of air barrier assemblies and details of all typical conditions, intersections with other envelope assemblies and materials, membrane counter-flashings, and details showing how gaps in the construction will be bridged, how inside and outside corners are negotiated, how materials that cover the materials are secured with air-tight condition maintained, and how miscellaneous penetrations such as conduits, pipes, electric boxes and similar items are sealed.
 1. Include VOC content of each material, and applicable legal limit in the jurisdiction of the project.
 2. Include statement that materials are compatible with adjacent materials proposed for use.
 3. Include required values for field adhesion test on each substrate in accordance with ASTM D4541 (modified), using a type II pull tester.
- H. Compatibility: Submit letter from primary material Manufacturer stating that materials proposed for use are permanently chemically compatible and adhesively compatible with adjacent materials proposed for use.

1.6 QUALITY ASSURANCE

- A. Air Barrier Installer Qualifications: Air barrier Subcontractor(s) shall be accredited at the time of bidding and during the complete installation period by the Air Barrier Association of America (ABAA).

1. Fluid-applied membrane air barrier Installer(s) shall be certified in accordance with the requirements outlined by ABAA. Installers shall have their photo identification air barrier certification cards in their possession and available on the project site, for inspection upon request.
- B. Manufacturer: Obtain primary ABAA Evaluated Materials from a single ABAA Evaluated Manufacturer regularly engaged in manufacturing specified fluid-applied membranes. Obtain secondary materials from a source acceptable to the primary materials Manufacturer.
- C. Accredited Laboratory Testing for Materials: Laboratory accredited by International Accreditation Service Inc. (IAS), American Association for Laboratory Accreditation (A2LA), or the Standards Council of Canada (SCC).
- D. VOC Regulations: Provide products which comply with applicable regulations controlling the use of volatile organic compounds.
- E. Preconstruction Meeting: Convene a minimum of two weeks prior to commencing Work of this Section. Agenda shall include, at a minimum, construction of mock-up, sequence of construction, coordination with substrate preparation, air barrier materials approved for use, compatibility of materials, coordination with installation of adjacent and covering materials, and details of construction and chemical/fire safety plans. Attendance is required by the Fluid Applied Air Barrier System Manufacturer's field representative, representatives of related trades including covering materials, substrate materials and adjacent materials.
- F. Mock-Ups: Build mock-up representative of primary air barrier assemblies and glazing assemblies including backup wall and typical penetrations as acceptable to the Architect. Mock-up shall include the air barrier materials and air barrier accessories proposed for use in the exterior wall assembly. The mock-ups shall remain visible and intact for the duration of the fluid applied air barrier system work scopes. Mock-ups shall be suitable for field testing.
 1. Refer to Section 04 20 00, Unit Masonry, for requirements related to mockups.
- G. Mock-Up Tests for Air and Water Infiltration: The testing of the window and door opening(s) in the mock-up for air and water infiltration shall be in accordance with AAMA 501.2 (hand wand field testing), If deficiencies are found, the air barrier Contractor shall reconstruct mock-up at their cost for retesting until satisfactory results are obtained. Deficiencies include air leakage beyond values specified, uncontrolled water leakage, unsatisfactory workmanship.
- H. Air Barrier Assembly Testing: Verify air barrier assembly testing by the material Manufacturer by visiting the ABAA website to ensure an ASTM E2357 test has been completed and to obtain results. Visit the ABAA website for the reported air barrier assembly leakage rate and illustrations or CAD details which includes the methods in which the assembly test mock-ups shall be assembled.
- I. Site Visits: Manufacturer's representative shall make regular site visits to ensure proper installation is being maintained and as necessary to cover warranty items/ issues. Manufacturer's representative to generate observation reports for every site visit and distribute within 48 hours following site visit.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in original packages with seals unbroken, labeled with material Manufacturer's name, product, date of manufacture, and directions for storage.
- B. Store materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by material Manufacturer. Protect stored materials from direct sunlight and other sources of ultra-violet light.
- C. Handle materials in accordance with Manufacturer's recommendations.

1.8 PROJECT CONDITIONS

- A. Temperature: Install fluid-applied air barrier material within range of ambient and substrate temperatures recommended by material Manufacturer. Do not apply air barrier to a damp or wet substrate.

- B. Field Conditions: Do not install air barrier in snow, rain, fog, or mist. Do not install air barrier when the temperature of substrate surfaces and surrounding air temperatures are below those recommended by the Manufacturer.
- C. Sequencing: Do not install air barrier material before the roof assembly has been sufficiently installed to prevent a buildup of water in the interior of the building.
- D. Compatibility: Do not allow air barrier materials to come in contact with chemically incompatible materials.
- E. Ultra-violet exposure: Do not expose air barrier materials to sunlight longer than as recommended by the material Manufacturer.

1.9 WARRANTY

- A. Material Warranty: Provide Manufacturer's standard product warranty, for a minimum 10 years from date of Substantial Completion.
- B. Subcontractor (approved by ABAA and Manufacturer) Installation Warranty: Provide a five (5) year installation warranty from date of Substantial Completion, including all accessories and materials of the air barrier assembly, against failures including loss of air tight seal, loss of watertight seal, loss of attachment, loss of adhesion and failure to cure properly.
- C. Refer to Section 01 77 00, Closeout Procedures, for Warranty form.

2 PRODUCTS

2.1 MANUFACTURERS

- A. Fluid Applied Membrane Air Barrier: Use regular, high temperature or low-temperature formulation depending on site conditions, within temperature ranges specified by Manufacturer. Subject to compliance with requirements, provide one of the following:
 - 1. Carlisle Coatings and Waterproofing
 - 2. Grace Construction Products
 - 3. Henry Company
 - 4. STS Coatings
 - 5. TK Products
 - 6. Tremco, Inc.
 - 7. W.R. Meadows, Inc.

2.2 MATERIALS

- A. Carlisle Coatings and Waterproofing: Fire-Resist Barritech VP at 60 mils thick (wet). www.carlisle-ccw.com:
 - 1. AIR BARRIER MATERIAL PROPERTIES:
 - a. Air permeance for this material has been tested and reported as being 0.0002 cubic feet per minute per square foot under a pressure differential of 1.57 pounds per square foot (0.0002 cfm/ft² @ 1.57 psf), at 65 mils (wet), when tested in accordance with ASTM E2178 (unmodified).
 - b. Water vapor permeance for this material has been tested and reported as being 817 nanograms of water vapor passing through each square meter of area per second for each Pascal of vapor pressure differential (817 ng/(Pa·s·m²) / 14.295 US perms) at 60 mils (wet) [40 mils (dry)] when tested in accordance with ASTM E96 (water method – unmodified).
 - 2. AIR BARRIER ACCESSORY MATERIALS:
 - a. Detail Flashing: Fire-Resist 705 FR.
 - b. Counter-flashing for Metal Wall Flashings: Fire-Resist 705 FR.
 - c. Water-Based Primer for Detail Flashing: CCW-702 WB.
 - d. Solvent-Based Primer for Detail Flashing: CCW-702 or CCW-702 LV.

- e. Solvent-Based Aerosol Primer for Detail Flashing: CAV-GRIP.
 - f. Reinforcing Fabric: DCH Reinforcing Fabric.
 - g. Glass Mat: LiquiFiber-W.
 - h. Termination Mastic: SURE-SEAL Lap Sealant.
 - i. Fill Compound: CCW-201 or CCW-703 V.
- B. Grace Construction Products: Perm-A-Barrier VP, 90 mils thick (wet), 45 mils thick (dry). www.na.graceconstruction.com:
- 1. AIR BARRIER MATERIAL PROPERTIES:
 - a. Air permeance for this material has been tested and reported as being 0.0004 cubic feet per minute per square foot under a pressure differential of 1.57 pounds per square foot (0.0004 cfm/ft² @ 1.57 psf), at 69 mils (wet), when tested in accordance with ASTM E2178 (unmodified).
 - b. Water vapor permeance for this material has been tested and reported as being 741.6 nanograms of water vapor passing through each square meter of area per second for each Pascal of vapor pressure differential (741.6 ng/(Pa·s·m²) / 12.9 US perms) at 40 mils (dry) when tested in accordance with ASTM E96 (water method – unmodified).
 - 2. AIR BARRIER ACCESSORY MATERIALS:
 - a. Membrane for details and Terminations: Bituthene Liquid Membrane.
 - b. Water-Based Primer for Flashing, Transition Strip and Detail Membrane: Perm-A-Barrier WB Primer or Perm-A-Barrier Primer Plus.
 - c. Solvent-Based Primer for Flashing, Transition Strip and Detail Membrane: Bituthene Primer B-2 and Bituthene Primer B2 LVC or Bituthene Primer B2.
 - d. Through-Wall Flashings or Shelf Angle Flashings: Perm-A-Barrier Wall Flashing.
 - e. Sealants, Mastics, Adhesives and Tapes: As recommended by Grace Construction Products.
 - f. Transition Membrane: Perm-A-Barrier Detail Membrane, Perm-A-Barrier Aluminum Flashing and Perm-A-Barrier Wall Flashing.
 - g. Penetrations and Termination Sealant: Bituthene Liquid Membrane and as recommended by Grace Construction Products.
 - h. Window Flashing and Detail Membrane: Perm-A-Barrier Detail Membrane, Perm-A-Barrier Aluminum Flashing and Perm-A-Barrier Wall Flashing.
 - i. Joint Sealant: Refer to Technical Letter 1 for details on compatible waterproofing sealants.
- C. Henry Company: Air Bloc 17 MR at 70 mils (wet) & 37 mils (dry). www.henry.com:
- 1. AIR BARRIER MATERIAL PROPERTIES:
 - a. Air permeance for this material has been tested and reported as being 0.0001 cubic feet per minute per square foot under a pressure differential of 1.57 pounds per square foot (0.0001 cfm/ft² @ 1.57 psf), at 87 mils (wet) when tested in accordance with ASTM E2178 (unmodified).
 - b. Water vapor permeance for this material has been tested and reported as being 2066 nanograms of water vapor passing through each square meter of area per second for each Pascal of vapor pressure differential (2066 ng/(Pa·s·m²) / 14 US perms) at 40 mils (dry) when tested in accordance with ASTM E96 (water method – unmodified).
 - 2. AIR BARRIER ACCESSORY MATERIALS:
 - a. Transition Membrane: Blueskin SA and Blueskin SALT for low-temperature applications.
 - b. Water-Based Primer for Transition Membrane: Aquatec Primer.
 - c. Solvent-Based Primer for Transition Membrane: Blueskin Adhesive.
 - d. Solvent-Based Aerosol Primer for Transition Membrane: Blueskin Spray Prep.
 - e. Counter-flashing for Masonry Through-Wall Flashing: Blueskin TWF.

- f. Sealant: HE 925 BES Sealant.
 - g. Reinforcing Tape: HE 183 Yellow Glass Fabric.
 - h. Mastics, Adhesives and Tapes: Henry 570-05 Polybitume.
- D. STS Coatings: Wall Guardian FW-100-A (Acrylic-based component) 40 mils (wet), 20 mils (dry). www.wallguardian.com:
 - 1. AIR BARRIER MATERIAL PROPERTIES:
 - a. Air permeance for this material has been tested and reported as being 0.0001 cubic feet per minute per square foot under a pressure differential of 1.57 pounds per square foot (0.0001 cfm/ft² @ 1.57 psf), at 20 mils (dry) when tested in accordance with ASTM E2178 (unmodified).
 - b. Water vapor permeance for this material has been tested and reported as being 661 nanograms of water vapor passing through each square meter of area per second for each Pascal of vapor pressure differential (661 ng/(Pa·s·m²) / 11.5 US perms) at 22 mils (dry) when tested in accordance with ASTM E96 (water method – unmodified).
 - 2. AIR BARRIER ACCESSORY MATERIALS:
 - a. Water-Based Primer for Flashing, Transition Strip and Detail Membrane: None.
 - b. Solvent-Based Primer for Flashing, Transition Strip and Detail Membrane: BP-40 Primer for use with UT-40 Universal Tape.
 - c. Through-Wall Flashings or Shelf Angle Flashings: Gorilla Flash VF-1000.
 - d. Mastics: None.
 - e. Adhesives and Tapes: Universal Tape UT-40, a butyl based tape and Great Seal LT-100, a low voc elastomeric sealant for deflection joints and details.
 - f. Transition Strip: Universal Tape, UT-40.
 - g. Termination Mastic: Great Seal LT-100.
 - h. Window Flashing and Detail Membrane: Universal Tape UT-40.
- E. TK Products: TK-AirMax 2104 at 40+ mils (wet). www.tkproducts.com:
 - 1. AIR BARRIER MATERIAL PROPERTIES:
 - a. Air permeance for this material has been tested and reported as being 0.0008 cubic feet per minute per square foot under a pressure differential of 1.57 pounds per square foot (0.0008 cfm/ft² @ 1.57 psf), at 40+ mils (wet) when tested in accordance with ASTM E2178 (unmodified).
 - b. Water vapor permeance for this material has been tested and reported as being 1007 nanograms of water vapor passing through each square meter of area per second for each Pascal of vapor pressure differential (1007 ng/(Pa·s·m²) / 17.6 US perms) at 14 mils (dry) when tested in accordance with ASTM E96 (water method – unmodified).
 - 2. AIR BARRIER ACCESSORY MATERIALS:
 - a. Through-Wall Flashings or Shelf Angle Flashings: TK-Climate Flash, TK-Butyl Bond, TK-SS Flashing, TK-TWF-18.
 - b. Caulk: TK-Super Seal.
 - c. Adhesives and Tapes: TK-AirMax 2200 All Weather Flashing (TK Products), TK Air Max 2203 Caulk, TK-AirMax 2201 Red Sheathing Facing Tape (Venture Tape, a 3M Company), 3M All-Weather Flashing Tape 8067 (3M Company), VentureStop VB 400 (Venture Tape, a 3M Company), Venture-1585 CW-2 Red Sheathing Facing Tape (Venture Tape, a 3M Company).
 - d. Transition Membranes: TK-Climate Flash, TK-Butyl Bond, TK-SS Flashing, TK-TWF-18.
 - e. Reinforcing / Joint Tape: TK-Climate Flash, TK-Butyl Bond, TK-SS Flashing, TK-TWF-18.
 - f. Termination of Caulk: TK-AirMax Caulk 2203 (TK Products), Manus-Bond 75AM (Manus Products, Inc.)

- g. Flashing (Counter) for Masonry at Through-Wall Flashings or Transition Membranes: TK-Climate Flash, TK-Butyl Bond, TK-SS Flashing, TK-TWF-18.
- F. Tremco, Inc.: ExoAir 230 at 40 mils (wet) www.tremcosealants.com
- 1. AIR BARRIER MATERIAL PROPERTIES:
 - a. Air permeance for this material has been tested and reported as being 0.0003 cubic feet per minute per square foot under a pressure differential of 1.57 pounds per square foot (0.0003 cfm/ft² @ 1.57 psf), at 40 mils (wet) when tested in accordance with ASTM E2178 (unmodified).
 - b. Water vapor permeance for this material has been tested and reported as being 1677 nanograms of water vapor passing through each square meter of area per second for each Pascal of vapor pressure differential (1677 ng/(Pa·s·m²) at 29 mils (dry) when tested in accordance with ASTM E 96 (water method – unmodified).
 - 2. AIR BARRIER ACCESSORY MATERIALS:
 - a. Solvent Based Primer: ExoAir Primer
 - b. Termination Mastic: ExoAir Termination Mastic
 - c. Sealants: Tremflex 834, Dymonic 100, Spectrem 1
 - d. Transition Membrane for Details and Terminations: ExoAir 110, ExoAir 111, ExoAir TWF, Dymonic 100
 - e. Reinforcing / Joint Tape: Tremco 2011 mesh
 - f. Flashing at Transition Membrane: ExoAir 111, ExoAir TWF, Dymonic 100
 - g. Counterflashing for Masonry Through Wall Flashings: ExoAir TWF
 - h. Through Wall Flashings or Shelf Angle Flashings: ExoAir TWF
 - i. Solvent Based Primer for Flashing, Transition Strip and Detail Membrane: ExoAir Primer
 - j. Substrate Joint Treatment: Tremflex 834, Dymonic 100 depending on substrate.
- G. W.R. Meadows, Inc.: Air-Shield LMP, at 60 mils (wet), 30 mils (dry). www.wrmeadows.com:
- 1. AIR BARRIER MATERIAL PROPERTIES:
 - a. Air permeance for this material has been tested and reported as being 0.000096 cubic feet per minute per square foot under a pressure differential of 1.57 pounds per square foot (0.000096 cfm/ft² @ 1.57 psf), [0.00048 liters per square meter per second under a pressure differential of 75 Pa (0.00048 L/(s·m²) @ 75 Pa)] at 20 mils (dry) when tested in accordance with ASTM E2178 (unmodified).
 - b. Water vapor permeance for this material has been tested and reported as being 598 nanograms of water vapor passing through each square meter of area per second for each Pascal of vapor pressure differential (598 ng/(Pa·s·m²) [10.47 US perms] at 30 mils (dry) when tested in accordance with ASTM E 96 (water method – unmodified).
 - 2. AIR BARRIER ACCESSORY MATERIALS:
 - a. Water-Based Primer: None required for Air Shield LMP.
 - b. Solvent-Based Primer: None required for Air Shield LMP.
 - c. Solvent-Based Aerosol Primer: None required for Air Shield LMP.
 - d. Termination Mastic: Pointing Mastic or BEM.
 - e. Transition Membrane for details and terminations: Air Shield.
 - f. Reinforcing / Joint Tape: Reinforcing Fabric HCR.
 - g. Flashing at Transition Membrane: Air Shield Thru-Wall Flashing.
 - h. Counter-flashing for Masonry Through-Wall Flashings: Air Shield Thru-Wall Flashing.
 - i. Through-Wall Flashings or Shelf Angle Flashings: Air Shield Thru-Wall Flashing.
 - j. Solvent-Based Primer for Flashing, Transition Strip and Detail Membrane: Mel-Prime VOC.
 - k. Water-Based Primer for Flashing, Transition Strip and Detail Membrane: Mel-Prime WB.

- I. Substrate Joint Treatment: Air Shield Joint Filler.

2.3 AUXILIARY MATERIALS

- A. Transition Membrane Between Air and Vapor Barrier Membrane and Roofing and Other Adjacent Materials: Comply with both air barrier Manufacturer's recommendations and roofing material Manufacturer's recommendations.
- B. Provide primers, glass fabric scrim tape, mastic, and other materials not specifically described, but required for a complete and proper installation as instructed by the air barrier system Manufacturer or required to provide a continuous the air barrier assembly.
- C. Provide 16 ga. 304 stainless steel termination bars to secure all flashing with manufacturers recommended fasteners to include neoprene/EPDM washers where shown and not specifically described, but required for a complete and proper termination of flashing.

3 EXECUTION

3.1 EXAMINATION

- A. The ABAA Certified Air Barrier Contractor shall examine substrates, areas, and conditions under which the air barrier assembly will be installed, with ABAA Certified Installer present, for compliance with requirements.
 1. Confirm site access logistics and scheduling requirements, including but not limited to use of scaffolding, lifts and staging.
 2. Verify that surfaces and conditions are suitable prior to commencing work of this section. Do not proceed with installation until unsatisfactory conditions have been corrected.
 3. Ensure that the following conditions are met:
 - a. Surfaces are sound, dry, even, and excess mortar and / or other contaminants.
 - b. Inspect and confirm substrates to be smooth and without large voids or sharp protrusions. Inform General Contractor if substrates are not acceptable and need to be repaired by the substrate Subcontractor.
 - c. Inspect and confirm masonry joints to be reasonably flush and completely filled, and ensure all excess mortar accumulated on masonry ties has been removed. Inform General Contractor if masonry joints are not acceptable and need to be repaired by the masonry Subcontractor.
 - d. Masonry joints are flush and completely filled with mortar, and all excess mortar sitting on masonry ties has been removed.
 4. Verify substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263 and take suitable measures until substrate passes moisture test.
 5. Verify sealants are compatible with membrane proposed for use. Perform field peel-adhesion test on materials to which sealants are adhered.
 6. Notify Architect in writing of anticipated problems using air and vapor barrier over substrate prior to proceeding.

3.2 SURFACE PREPARATION

- A. Clean, prepare, and treat substrate according to material Manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air barrier application.
 1. Ensure that penetrating work by other trades is in place and complete.
 2. Prepare surfaces by brushing, scrubbing, scraping, grinding or compressed air to remove loose mortar, dust, oil, grease, oxidation, mill scale and other contaminants which will affect adhesion of the fluid-applied membrane.
 3. Wipe down metal surfaces to remove release agents or other non-compatible coatings using clean sponges or with a material chemically compatible with the primary air material.
- B. Prime substrate for installation of sheet membrane transition strips as recommended by material Manufacturer and as follows:

1. Prime masonry, concrete substrates with conditioning primers.
2. Prime glass-fiber surfaced gypsum sheathing an adequate number of coats to achieve required bond, with adequate drying time between coats.
3. Prime wood, metal, and painted substrates with primer.
4. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through air barrier at protrusions.
- C. Prime substrate for installation of fluid-applied air barrier if recommended by material Manufacturer based on project conditions.
- D. Protection from spray-applied materials as recommended by material Manufacturer and as follows:
 1. Mask and cover adjacent areas to protect from over-spray.
 2. Ensure any required foam stop or back up materials are in place to prevent over-spray and achieve complete seal.

3.3 INSTALLATION

- A. Fluid Applied Membrane Air Barrier: Install air barrier accessories and fluid-applied membrane air barrier material to provide continuity throughout the building envelope in a shingle fashion. Install materials in accordance with material Manufacturer's instructions and the following (unless Manufacturer recommends other procedures in writing based on project conditions or particular requirements of their recommended materials):
 1. Install veneer anchors as per air barrier Manufacturer installation sequencing.
 2. Apply treatment to exterior gypsum joints and screw heads as per air barrier material Manufacturer.
 3. Apply primer for transition material at the rate instructed by the air barrier material Manufacturer for 1 inch beyond terminating edge of transition membrane. Allow primer to set / cure completely before transition strip application.
 4. Position subsequent sheets of transition material so that membrane overlaps the membrane sheet below by a minimum of 2 inches, unless greater overlap is recommended by the material Manufacturer. Ensure transition membrane is securely sealed onto substrate with roller.
 5. Overlap horizontally adjacent pieces of transition material a minimum of 2 inches, unless greater overlap is recommended by the material Manufacturer. Roll all areas of transition strip including seams with roller.
 6. Seal around all penetrations with termination mastic / sealant, membrane counterflashing or other procedure in accordance with material Manufacturer's instructions, ensuring chemical compatibility amongst adjoining materials.
 7. Connect 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, other intersection conditions and transitions from wet cavity to dry cavity and seal penetrations using accessory materials in accordance with the material Manufacturer's instructions.
 8. Provide transition material at changes in substrate plane (with bead of sealant / mastic, membrane counter-flashing or other material recommended by material Manufacturer) under membrane to eliminate all sharp 90 degree inside corners and to make a smooth transition from one plane to another.
 - a. All corner conditions with sheathing substrates shall be treated with self-adhering flashing (recommended by material manufacturer or as specified) in addition to sealant – NO EXCEPTIONS.
 9. Provide mechanically fastened non-corrosive metal sheet or other Manufacturer approved transition material to span gaps greater than 1 inch in substrate plane and to make a smooth transition from one plane to the other. Transition membrane shall be installed continuously from air barrier material onto sheet metal maintaining 2 inch overlap on both edges.
 10. Lap transition material over top edge of through-wall flashing and head-flashing.

11. Provide backup for the membrane to accommodate anticipated movement or use other Manufacturer approved transition material at deflection and control joints.
12. Provide transition material to joint assemblies at expansion and seismic joints.
13. Provide backup for the fluid applied air barrier to accommodate anticipated movement at deflection and control joints as recommended by material Manufacturer.
14. Apply a bead or trowel coat of mastic along membrane seams at reverse lapped seams, rough cuts, and / or as otherwise recommended by the material Manufacturer.
15. Seal top edge of the self-adhered membrane to substrate with termination mastic at end of each working day.
16. Inspect installation prior to enclosing assembly and repair punctures, damaged areas and inadequately lapped seams with a patch of membrane lapped as recommended by material Manufacturer.
17. Install primer for fluid-applied air barrier if instructed by material Manufacturer.
18. Install fluid-applied membrane using equipment and methods recommended by Manufacturer to achieve a dry film thickness as required by the material Manufacturer.
19. Do not allow materials to come in contact with chemically incompatible materials.
20. Do not expose membrane to sunlight / ultraviolet light longer than as recommended by the Manufacturer.
21. Turn flashing membrane into window opening at sill, jambs and heads. Terminate just before interior sealant bead.

3.4 FIELD QUALITY CONTROL

- A. Owner's Inspection and Testing: Cooperate with Owner's testing agency as applicable. Allow access to work areas and staging. Notify Owner's testing agency in writing of schedule for Work of this Section to allow sufficient time for testing and inspection. Do not cover Work of this Section until testing and inspection is accepted.
- B. Manufacturer's Field Representative Review: Contractor is not to commence any work other than staging until contact and meeting with the Manufacturer's Field Representative on site. The Manufacturer's Field Representative is to visit the jobsite a minimum of four (4) times to review work processes and / or work completed prior to work commencement, at 10% completion, at 50% completion and prior to the work being covered by finish materials.

3.5 PROTECTING AND CLEANING

- A. Protect air barrier materials from damage during installation and the remainder of the construction period, according to material Manufacturer's written instructions.
 1. Coordinate with installation of materials which cover the air barrier assemblies, to ensure exposure period does not exceed that recommended by the air barrier Manufacturer.
- B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by Manufacturer of affected construction and acceptable to the primary material Manufacturer.

END OF SECTION 07 27 26

SECTION 07 42 13

METAL WALL PANELS

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, Instructions to Bidders, for substitution of materials and products.

1.2 SUMMARY

- A. Section includes concealed fastener profiled metal wall panels.
- B. Related Requirements
 - 1. Section 05 40 00, Cold-Formed Metal Framing
 - 2. Section 07 21 13.13, Foam Board Insulation
 - 3. Section 07 62 00, Sheet Metal Flashing and Trim
 - 4. Section 07 92 00, Joint Sealants
 - 5. Section 08 41 13, Aluminum-Framed Entrances and Storefronts

1.3 REFERENCES

- A. Use current editions unless noted otherwise.
- B. American Architectural Manufacturers Association (AAMA)
 - 1. AAMA 501, Standard Test Method for Water Penetration of Windows, Curtain Walls and Doors Using Dynamic Pressure
 - 2. AAMA 2604, Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels
 - 3. AAMA 2605, Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels
- C. ASTM International (ASTM)
 - 1. ASTM A653 / A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - 2. ASTM C734, Standard Test Method for Low-Temperature Flexibility of Latex Sealants After Artificial Weathering
 - 3. ASTM C920, Standard Specification for Elastomeric Joint Sealants
 - 4. ASTM E283, Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
 - 5. ASTM E330 / E330M, Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
 - 6. ASTM E331, Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
 - 7. ASTM E1592, Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference
- D. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
 - 1. Architectural Sheet Metal Manual
- E. Texas Health and Safety Code, Chapter 161, Subchapter Q, Installation of Asbestos
- F. Texas Occupations Code, Chapter 1954, Asbestos Health Protection

1.4 PERFORMANCE REQUIREMENTS

- A. Structural performance: provide exterior wall cladding assemblies capable of withstanding the effects of load and stresses from dead loads, wind loads, snow loads, and normal thermal movement without evidence of permanent defects of assemblies or components.

1. Dead load: As required by applicable building code
2. Live Load: As required by applicable building code
3. Wind Load: Determine loads based on uniform pressure, importance factor, exposure category, basic wind speed indicated on drawings, and requirements of authorities having jurisdiction.
4. Thermal Movements: Provide assemblies that allow for thermal movements resulting from the following maximum changes (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components and other detrimental effects:
 - a. Temperature Change (range): 120° F, ambient; 180° F, material surfaces
- B. Sealed joints shall allow free and silent movement of panels during expansion and contraction while preventing uncontrolled penetration of moisture.
- C. Manufacturing and installation shall prevent deformation of exposed surfaces.
- D. Design panel system to accommodate substructure tolerance of $\pm 1/8$ inch.
- E. Vibration harmonics; wind whistles; noises caused by thermal movement; thermal movement transmitted to other building elements; loosening, weakening or fracturing of attachments or components of system are not permitted.
- F. Structural Performance / Uniform Load Deflection Test: Provide panel system which has been tested in accordance with ASTM E330 at a design pressure of at least 60 psf without deformation or failures of structural members. Maximum allowable deflection of span: $L/180$.
- G. Panels shall be tested in accordance with ASTM E1592 structural testing at load span of at least 5'-0" o.c. and shall perform at a design pressure of pressure of no less than 35 psf without deformation or failures of structural members.
- H. Air Infiltration: Panel system shall not have air infiltration rate more than 0.06 cfm per sq. ft. of fixed wall area when tested in accordance with ASTM E283 at static air pressure differential of 6.24 psf.
- I. Static Water Penetration: Panel system shall have no water penetration as defined by in test method when tested in accordance with ASTM E331. The ASTM E331 test shall be conducted at inward static pressure differential of not less than 15.0 psf.
- J. Dynamic Water Penetration: Panel system shall have been tested in accordance with AAMA 501 and shall have passed with no uncontrolled water leakage at 15.00 psf dynamic pressure differential, with water application rate of 5 gallons/hr/sqft.

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00, Project Management and Coordination.
 1. Coordinate building framing in relation to metal wall panel assembly.
 2. Coordinate installation of building air and water barrier behind metal wall panel assembly.
 3. Coordinate window, door and louver, and other openings and penetrations of metal wall panel assembly.

1.6 ACTION SUBMITTALS

- A. Product Data: Submit for each type of product. Include data indicating compliance with performance requirements.
- B. Shop Drawings: Submit shop drawings prepared by manufacturer or manufacturer's authorized Installer. Include full elevations showing openings and penetrations. Include details of each condition of installation and attachment. Provide details at a minimum scale of 1½ inch per foot (1:8) of all required trim and extrusions needed for a complete installation.
 1. Indicate points of supporting structure that must coordinate with metal wall panel assembly installation.
 2. Indicate details of fastening, including clip spacing, supported by load span tables that include an evaluation of clip and panel side joint interaction.
- C. Samples for Initial Selection: Submit Manufacturer's color charts showing the full range of colors available for units with factory-applied color finishes. Provide three samples of not less than three available colors selected by the Architect.

1.7 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Submit product test reports indicating compliance of products with requirements, from a qualified independent testing agency
- B. Submit qualification information for installer firm.
- C. Manufacturer's warranty: Submit manufacturer's sample warranty.
- D. Submit Material Safety and Data Sheet (MSDS) for all materials, products, and parts.

1.8 QUALITY ASSURANCE

- A. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the jurisdiction where the project is located and who is experienced in providing engineering services of kind indicated.
- B. Manufacturer Qualifications: Minimum of 5 years experience in manufacturing roll formed wall panel systems similar to those specified.
- C. Installer Qualifications: Acceptable to manufacturer.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Protect metal wall panel products during shipping, handling, and storage to prevent staining, denting, deterioration of components or other damage.
- B. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
 - 1. Store materials in accordance with manufacturer's recommendations.
 - 2. Handle materials carefully to avoid damage to materials and finishes

1.10 WARRANTY

- A. Provide written warranty against defects in material and workmanship for the work of this Section for a period of one year from the Date of Substantial Completion. Refer to Section 01 77 00, Closeout Procedures, for Warranty form.
- B. Special Manufacturer's Warranty: Submit on manufacturer's standard form, in which manufacturer agrees to repair or replace components of metal wall panel assemblies that fail in materials and workmanship within **two** years from date of Substantial Completion.
- C. Special Panel Finish Warranty: Submit on manufacturer's standard form, in which manufacturer agrees to repair or replace metal wall panels that display evidence of deterioration of finish within **20** years from the date of substantial completion.

2 PRODUCTS**2.1 MANUFACTURERS**

- A. Berridge Manufacturing Co.
- B. CENTRIA Architectural Systems
- C. Firestone Building Products
- D. MBCI
- E. McElroy Metals

2.2 SYSTEM DESCRIPTION

- A. Provide factory-formed metal wall panels designed to be field assembled and mechanically attaching panels to supports using concealed fasteners in interlocking side laps. Include accessories required for weathertight installation.
- B. Basis-of-Design Product: Subject to compliance with requirements, provide Berridge Manufacturing Co. HS-12 Series panel profile or comparable product by one of the listed manufacturers.
 - 1. Panels shall be 7/8 inches in depth and coverage **shall be 8 and 12 inches** where indicated on the drawings.

2. The panels shall have an interlocking side lap feature which conceals the fasteners and is installed using clips to allow for thermal movement. Clips shall be designed to hold the panel ½ inch minimum from foam board insulation to create a drainage plane and ventilation cavity. Load span tables must include evaluation of clip and side joint interaction.
3. The panels shall have factory applied sealant concealed within the interlocking joint.
4. Panels shall have common interlocking side joints to allow for multiple panel profile combinations.
5. Exposed panel fasteners are unacceptable.
6. Panels are to be installed on both horizontal and vertical surfaces.

2.3 PANEL MATERIALS

- A. Steel Panels: ASTM A653, G90 (lock-forming quality), extra smooth, tension-leveled, galvanized steel, minimum spangle
- B. Thickness: 22 gauge
- C. Texture: Smooth
- D. Color: manufacturer's standard colors. Multiple panel colors required. Refer to drawings for additional information.

2.4 FABRICATION

- A. Tolerances
 1. Form panels in longest practical lengths, true to shape, accurate in size, square, and free from distribution or manufacturing defects.
 2. Bend lines, breaks, and angles shall be sharp and true, and surfaces shall be free from warp or buckle.
- B. Material surfaces shall be free of scratches or marks caused during fabrication.
- C. Panel shearing length to be: $\pm 1/16$ inch.
- D. Ensure that entire project is manufactured from single color coil paint run to ensure color uniformity.
- E. Provide factory applied strippable plastic film for protection during fabrication and installation.

2.5 ACCESSORIES

- A. All fasteners shall be non-corrosive type, as recommended by the panel manufacturer. Provide self-tapping screws and other suitable fasteners designed to withstand building design loads without damaging foam board insulation or compromising the air and water barrier system.
 1. Fasteners shall be minimum #14 diameter, self-tapping, with hex head.
 2. Fasteners to be either cadmium plated carbon steel or series 300 stainless steel with bonded neoprene washers.
 3. Fastener type, size and spacing to be engineered according to specific project conditions.
- B. Provide panel clips designed to engage into panel flange, providing for a minimum ½ inch drainage plane and ventilation cavity.
- C. Flashing: Unless noted otherwise, shall be same material and gauge as for panel where exposed.
- D. Panel Sealants:
- E. Hidden Sealant Tape: Pressure-sensitive, gray isobutylene compound sealant tape with release-paper backing. Provide permanently elastic, non-sag, non-toxic, non-staining tape ⅛ inch thick and 1 inch wide.
- F. Hidden Joint Sealant: ASTM C920; elastomeric polyurethane, polysulfide, or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal wall panels and remain weathertight; and as recommended in writing by metal wall panel manufacture.
- G. Non-Skinning Butyl Sealant: ASTM C734 Non-hardening, non-drying, non-oxidizing butyl rubber-based sealant.
- H. Accessory Attachment Tape: Pressure-sensitive ⅛ inch thick and 1 inch wide VHB tape.
- I. Foam Closure Strips: Closed-cell, expanded, cellular, rubber or cross-linked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1 inch thick, flexible closure strips; cut or pre-molded to match metal wall panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

- J. Metal Closure Strips: Unless noted otherwise, shall be same material and gauge as for panel.

2.6 FINISHES

- A. Comply with NAAMM's Metal Finishes Manual for architectural metal products for recommendations for applying and designating finishes.
- B. Panel Finish
 - 1. Coating shall be Spray-Applied Fluorocarbon Resin utilizing 70% Kynar 500 resins. Color as selected by the Architect from manufacturer's standard colors.
 - 2. Number of Coats: Two
 - a. Coating shall be factory applied on a continuous process paint line.
 - b. Coating shall consist of a 0.2 mil prime coat, a 0.75 mil barrier coat, a 0.75 mil metallic/color coat containing 70% Kynar resins, and a 0.5 mil clear coat containing 70% Kynar resins.
 - 3. Relevant to the color selected, material to be painted in accordance with either AAMA specification 2605 or 2604.
 - 4. Provide factory applied strippable plastic film for protection during fabrication and installation

3 EXECUTION

3.1 EXAMINATION

- A. Examine metal wall panel substrate with Installer present. Inspect for erection tolerances and other conditions that would adversely affect installation of metal wall panels.
- B. Wall Substrate: Confirm that wall substrate is within tolerances acceptable to metal wall panel system manufacturer.
- C. Framing: Inspect framing that will support metal wall panels to determine if support components are installed as indicated on approved shop drawings. Confirm presence of acceptable framing members at recommended spacing to match installation requirements of metal wall panels.
- D. Openings: Verify that window, door, louver and other penetrations match layout on shop drawings.
- E. Air/Moisture Barriers: Confirm that work has been completed, inspected, and tested as required.
- F. Correct out of tolerance work and other deficient conditions prior to proceeding with panel installation.

3.2 INSTALLATION

- A. General: Install metal wall panels according to manufacturer's written instructions in orientation, sizes and locations indicated on drawings.
- B. Erect panels level and plumb, in proper alignment in relation to substructure framing and established lines; follow SMACNA Architectural Sheet Metal manual and standard practices.
- C. Panels shall be erected in accordance with approved shop drawings.
- D. Panel anchorage shall be structurally sound and per engineering recommendations and shall not damage foam board insulation or compromise the air and water barrier system.
- E. Completed system shall be free from over bending, deforming, stretching, distortion, waves, and buckles.
- F. Install gaskets, joint fillers and sealants where indicated and where required for weathertight performance of metal wall panel assemblies. Provide types of gaskets, fillers and sealants indicated or if not indicated, types as recommended by metal wall panels manufacture.
- G. Seal side joints where recommended by metal wall panel manufacture.
- H. Prepare joints and apply sealants to comply with the requirements of Section 07 92 00, Joint Sealants.

3.3 CLEANING AND PROTECTION

- A. Clean exposed surfaces of panels that are not protected by temporary covering to remove fingerprints and soil during construction period.

- B. Clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.
- C. Protect panels from damage during construction. Use temporary protective coverings where needed as approved by the panel manufacturer.
- D. Clean and touch up minor abrasions in finish with air-dried coating that matches color and gloss, and is compatible with, factory-applied finish coating.
- E. Remove panels damaged beyond repair and replace with new panels to match adjacent undamaged panels.
- F. Remove protective film immediately after installation.

END OF SECTION 07 42 13

SECTION 07 42 13.14

EXTRUDED METAL WALL PANELS

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, Instructions to Bidders, for substitution of materials and products.

1.2 SUMMARY

- A. Section includes Extruded metal wall panel cladding installed using a “drained back ventilated rainscreen” method of installation, relying on air/moisture barrier behind panels to provide secondary moisture management and drainage to the exterior.
- B. Trim and accessories to complete installation
- C. Related Requirements
 - 1. Section 05 40 00, Cold-Formed Metal Framing
 - 2. Section 07 21 13.13, Foam Board Insulation
 - 3. Section 07 62 00, Sheet Metal Flashing and Trim
 - 4. Section 07 92 00, Joint Sealants
 - 5. Section 08 41 13, Aluminum-Framed Entrances and Storefronts

1.3 REFERENCES

- A. Use current editions unless noted otherwise.
- B. American Architectural Manufacturers Association (AAMA)
 - 1. AAMA 501, Standard Test Method for Water Penetration of Windows, Curtain Walls and Doors Using Dynamic Pressure
 - 2. AAMA 2604, Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels
 - 3. AAMA 2605, Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels
- C. ASTM International (ASTM)
 - 1. ASTM A653 / A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - 2. ASTM C734, Standard Test Method for Low-Temperature Flexibility of Latex Sealants After Artificial Weathering
 - 3. ASTM C920, Standard Specification for Elastomeric Joint Sealants
 - 4. ASTM E283, Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
 - 5. ASTM E330 / E330M, Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
 - 6. ASTM E331, Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
 - 7. ASTM E1592, Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference
- D. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
 - 1. Architectural Sheet Metal Manual
- E. Texas Health and Safety Code, Chapter 161, Subchapter Q, Installation of Asbestos
- F. Texas Occupations Code, Chapter 1954, Asbestos Health Protection

1.4 PERFORMANCE REQUIREMENTS

- A. Structural performance: provide exterior wall cladding assemblies capable of withstanding the effects of load and stresses from dead loads, wind loads, snow loads, and normal thermal movement without evidence of permanent defects of assemblies or components.
 - 1. Dead load: As required by applicable building code
 - 2. Live Load: As required by applicable building code
 - 3. Wind Load: Determine loads based on uniform pressure, importance factor, exposure category, basic wind speed indicated on drawings, and requirements of authorities having jurisdiction.
 - 4. Thermal Movements: Provide assemblies that allow for thermal movements resulting from the following maximum changes (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components and other detrimental effects:
 - a. Temperature Change (range): 120° F, ambient; 180° F, material surfaces
- B. Drainage: Provide positive drainage to exterior for moisture entering or condensation occurring within panel system.
- C. Flame Spread: Meets ATM E84, Class A.

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00, Project Management and Coordination.
 - 1. Meet with Contractor, Architect, metal wall and/or soffit panel Installer, metal wall panel manufacturer's representative, and related parties.
 - 2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 3. Review methods and procedures related to metal wall and/or soffit panel installation, including manufacturer's written instructions.
 - 4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
 - 5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that affect metal material panels.
 - 6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
 - 7. Review procedures for repair of panels damaged after installation.
 - 8. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.6 ACTION SUBMITTALS

- A. Product Data: Submit for each type of product. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of cladding and accessory.
- B. Shop Drawings: Submit shop drawings prepared by manufacturer or manufacturer's authorized Installer. Include full elevations showing openings and penetrations. Include details of each condition of installation and attachment. Provide details at a minimum scale of 1½ inch per foot (1:8) of all required trim and extrusions needed for a complete installation.
 - 1. Indicate points of supporting structure that must coordinate with metal wall panel assembly installation.
 - 2. Indicate details of fastening, including clip spacing, supported by load span tables that include an evaluation of clip and panel side joint interaction.
- C. Samples for Initial Selection: Submit Manufacturer's color charts showing the full range of colors available for units with factory-applied color finishes. Provide three samples of not less than three available colors selected by the Architect.
 - 1. Include similar Samples of trim and accessories involving color selection (typical 6" length) (152 mm).
 - 2. Verification Samples: 6 inches (152 mm) long by actual panel width. Include fasteners, closures, and other metal panel accessories.

1.7 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Submit product test reports indicating compliance of products with requirements, from a qualified independent testing agency
- B. Submit qualification information for installer firm.
- C. Manufacturer's warranty: Submit manufacturer's sample warranty.
- D. Submit Material Safety and Data Sheet (MSDS) for all materials, products, and parts.

1.8 QUALITY ASSURANCE

- A. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the jurisdiction where the project is located and who is experienced in providing engineering services of kind indicated.
- B. Manufacturer Qualifications: Minimum of 5 years experience in manufacturing roll formed wall panel systems similar to those specified.
- C. Installer Qualifications: Acceptable to manufacturer.
- D. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
 - 1. Build mockup of typical wall as indicated on Drawings; approximately four units wide (such as four 10" planks), including attachments and accessories.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, aluminum planks, and other manufactured items so as not to be damaged or deformed. Package aluminum planks for protection during transportation and handling.
- B. Unload, store, and erect aluminum planks in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack planks horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store planks to ensure dryness, with positive slope for drainage of water. Do not store planks in contact with other materials that might cause staining, denting, or other surface damage.

1.10 WARRANTY

- A. Provide written warranty against defects in material and workmanship for the work of this Section for a period of one year from the Date of Substantial Completion. Refer to Section 01 77 00, Closeout Procedures, for Warranty form.
- B. Special Manufacturer's Warranty: Submit on manufacturer's standard form, in which manufacturer agrees to repair or replace components of metal wall panel assemblies that fail in materials and workmanship within **two** years from date of Substantial Completion.
 - 1. Failures include, but are not limited to, the following:
 - 2. Buckling not associated with the substrate and/or structure to which the Mosaic system is attached. Defined as 1/16" out of plane per linear foot.
- C. Special Panel Finish Warranty: Submit on manufacturer's standard form, in which manufacturer agrees to repair or replace metal wall panels that display evidence of deterioration of finish within **20** years from the date of substantial completion.
 - 1. Woodgrain Finish Optional Deterioration includes, but is not limited to, the following:
 - a. Color Retention: Color fading more than 5 units from the original color, when tested in accordance with ASTM D2244.
 - b. Gloss Retention: The coated surface will exhibit gloss retention to a minimum of 30% from the original gloss.
 - c. Chalking Resistance: Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - d. Checking and Cracking: There will be no clearly visible checking or cracking of the painted finish on the products installed on the building.

- e. Paint Adhesion: Adhesion of Painted Finish when initially applied to test panels and measured by reference to AAMA 2604-02; Clause 7.4.2 will show no evidence of film removal.

2 PRODUCTS

2.1 MANUFACTURERS

- A. Lonboard Architectural Products
- B. Lumabuilt
- C. PAC Clad, Petersen

2.2 SYSTEM DESCRIPTION

- A. Provide metal wall or soffit claddings designed to be installed by interconnecting side edges of adjacent cladding and mechanically attaching through cladding clips to supports using concealed fasteners into the side lap clips. Include accessories required for a complete rainscreen system.
- B. Basis-of-Design Product: Subject to compliance with requirements, provide Soffit Cladding Lumabuilt Mosaic (Alumaboard) V groove series panel profile or comparable product by one of the listed manufacturers.
 - 1. Standard Panel Length: 24 feet (7.2 M).
 - 2. Panel Thickness: 1/2 inch (12 mm).
 - 3. System Depth: 5/8 inch (16 mm).
 - 4. Size and Joint Configuration:
 - a. 10 inch (250 mm) wide V groove

2.3 PANEL MATERIALS

- A. Extruded Aluminum Soffit Panels: Extruded aluminum meeting ASTM B221, Alloy 6063-T6.
- B. Thickness: 0.063 inch nominal
- C. Texture: Smooth
- D. Color: manufacturer's Premium wood finishes using a polyurethane powder coat with ink-based wood grain patterns sublimated into the base powder.

2.4 FABRICATION

- A. Tolerances
 - 1. Form panels in longest practical lengths, true to shape, accurate in size, square, and free from distribution or manufacturing defects.
 - 2. Bend lines, breaks, and angles shall be sharp and true, and surfaces shall be free from warp or buckle.
- B. Material surfaces shall be free of scratches or marks caused during fabrication.
- C. Fabricate and finish metal cladding and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- D. Sheet Metal Flashing: Fabricate flashing and trim to comply with manufacturer's written instructions and recommendations.
- E. Provide factory applied strippable plastic film for protection during fabrication and installation.

2.5 ACCESSORIES

- A. Panel Attachment Clips: Stainless steel with not less than 14% chromium content, alloy 304-2b (1/4 hard),
- B. 0.035 inch (0.889 mm) thickness.
- C. Miscellaneous Metal Sub framing and Furring: ASTM C645, cold-formed, metallic-coated steel sheet, ASTM A653/A653M, G90 hot-dip galvanized coating designation or ASTM A792/A792M, Class AZ50 aluminum-zinc-alloy coating designation unless otherwise indicated.

- D. Cladding Accessories: Provide components required for a complete cladding system including trim, clips, sealants, and similar items. Match material and finish of metal cladding unless otherwise indicated.
- E. Flashing and Trim: Provide aluminum flashing as required to seal against weather and to provide finished appearance. Match material and finish of metal cladding unless otherwise indicated.
- F. Cladding Fasteners: Screws (#8 screws) designed to withstand design loads.

2.6 FINISHES

- A. Comply with the following:
- B. Aluminum Panels, Soffits or Accessories:
 - 1. Pretreatment: Chrome Free five stage aluminum pretreatment system. Complies with AAMA 2603 AAMA 2604 and AAMA 2605 Superior Performance Standard and meets EPA, OSHA, State and Local environmental requirements and contains no chromates, cyanides or other heavy metals. Waste treatment is usually a simple pH neutralization and disposal to the sanitary sewer.
 - 2. Wood Grains: Premium wood finishes using a polyurethane powder coat with ink-based wood grain patterns sublimated into the base powder. The combined effect creates all the aesthetic aspects of real wood.

3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal cladding supports, and other conditions affecting performance of the Work.
 - 1. Examine framing to verify that girts, angles, channels, studs, and other structural cladding support members and anchorage have been installed within alignment tolerances of 1/4" within 20 feet, as required by metal cladding manufacturer.
 - 2. Examine sheathing to verify that sheathing joints are supported by framing or blocking, and that installation is within flatness tolerances required by metal cladding manufacturer.
 - a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Examine roughing-in for components and systems penetrating metal cladding to verify actual locations of penetrations relative to seam locations of metal cladding before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install metal cladding in accordance with manufacturer's written instructions in orientation, sizes, and locations indicated. Install cladding perpendicular to supports unless otherwise indicated. Anchor metal cladding and other components of the Work securely in place, with provisions for thermal and structural movement.
 - 1. Shim or otherwise plumb substrates receiving metal cladding.
 - 2. Flash and seal metal cladding at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal cladding are installed.
 - 3. Install trims according to manufacturer's guidelines.
 - 4. Install planks using stainless steel fastening clips and #8 screws, in accordance with manufacturer's guidelines, hard pinning in certain conditions may be required.
 - 5. Locate and space fastenings in uniform vertical and horizontal alignment.
 - 6. Install flashing and trim as metal cladding work proceeds.
 - 7. Provide weathertight escutcheons for pipe- and conduit-penetrating cladding.
- B. Miscellaneous Supports (by others): Install sub framing, furring, and other miscellaneous cladding support members and anchorages in accordance with ASTM C754 (standard specification for steel framing) and metal cladding manufacturer's written recommendations.

3.3 CLEANING AND PROTECTION

- A. Clean exposed surfaces of panels that are not protected by temporary covering to remove fingerprints and soil during construction period.
- B. Clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.
- C. Protect panels from damage during construction. Use temporary protective coverings where needed as approved by the panel manufacturer.
- D. Replace metal cladding that has been damaged or has deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 42 13.14

SECTION 07 52 16

SBS MODIFIED BITUMINOUS MEMBRANE ROOFING

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 72 00, General Conditions, and Document 00 73 00, Supplementary Conditions, for substitution of materials and products.
- C. Addenda issued prior to establishing the Guaranteed Maximum Price that affect this section of the specifications.

1.2 SUMMARY

- A. Section includes a three ply styrene-butadiene-styrene (SBS)-modified bituminous membrane roofing.
- B. Related Requirements
 - 1. Section 01 23 00, Alternates
 - 2. Section 03 52 16, Lightweight Insulating Concrete
 - 3. Section 05 31 00, Steel Decking
 - 4. Section 05 50 00, Metal Fabrications
 - 5. Section 06 10 53, Miscellaneous Rough Carpentry
 - 6. Section 07 62 00, Sheet Metal Flashing and Trim
 - 7. Section 07 92 00, Joint Sealants

1.3 REFERENCES

- A. Use current editions unless indicated otherwise.
- B. American Society of Civil Engineers (ASCE) / Structural Engineering Institute (SEI)
 - 1. ASCE/SEI 7, Minimum Design Loads for Buildings and Other Structures
- C. ASTM International (ASTM)
 - 1. ASTM C728, Standard Specification for Perlite Thermal Insulation Board
 - 2. ASTM C1177 / C1177M, Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing
 - 3. ASTM D41 / D41M, Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
 - 4. ASTM D1079, Standard Terminology Relating to Roofing and Waterproofing
 - 5. ASTM D3617 / D3617M, Standard Practice for Sampling and Analysis of Built-Up Roof Systems During Application
 - 6. ASTM D3746, Standard Test Method for Impact Resistance of Bituminous Roofing Systems
 - 7. ASTM D4263, Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method
 - 8. ASTM D4272, Standard Test Method for Total Energy Impact of Plastic Films By Dart Drop
 - 9. ASTM D4586 / D4586M, Standard Specification for Asphalt Roof Cement, Asbestos-Free
 - 10. ASTM D6163 / D6163M, Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements
 - 11. ASTM D6298, Standard Specification for Fiberglass Reinforced Styrene-Butadiene-Styrene (SBS) Modified Bituminous Sheets with a Factory Applied Metal Surface
 - 12. ASTM E108, Standard Test Methods for Fire Tests of Roof Coverings
 - 13. ASTM E1980, Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces
 - 14. ASTM G152, Standard Practice for Operating Open Flame Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials

15. ASTM G154, Standard Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Nonmetallic Materials
16. ASTM G155, Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials
- D. FM Global (FM)
 1. FM Approval Standard 4450, Class I Insulated Steel Deck Roofs
 2. FM Approval Standard 4470, Single-Ply, Polymer-Modified Bitumen Sheet, Built-Up Roof (BUR) and Liquid Applied Roof Assemblies for use in Class 1 and Noncombustible Roof Deck Construction
- E. National Roofing Contractors Association (NRCA)
 1. The NRCA Roofing Manual
 2. NRCA Quality Control Guidelines for Application of Polymer-modified Bitumen Roofing
- F. Underwriters Laboratories Inc. (UL)
 1. UL 790, Standard for Standard Test Methods for Fire Tests of Roof Coverings
- G. Texas Health and Safety Code, Chapter 161, Subchapter Q, Installation of Asbestos
- H. Texas Occupations Code, Chapter 1954, Asbestos Health Protection

1.4 DEFINITIONS

- A. Roofing Terminology: See ASTM D1079 and glossary in "The NRCA Roofing Manual" for definitions of terms related to roofing work in this Section.

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00, Project Management and Coordination.
 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 affects 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.

1.6 ACTION SUBMITTALS

- A. Submit product data for each type of product indicated.
- B. Submit shop drawings for roofing system. Include plans, elevations, sections, details, and attachments to other work, including:
 1. Base flashings and membrane terminations
 2. Tapered insulation, including slopes
 3. Crickets, saddles, and tapered edge strips, including slopes
 4. Insulation fastening patterns for corner, perimeter, and field-of-roof locations
- C. Submit samples for verification for the following products:
 1. Cap sheet, of color required
 2. Flashing sheet, of color required
 3. Aggregate surfacing material in gradation and color required

1.7 INFORMATIONAL SUBMITTALS

- A. Submit samples of manufacturer's special warranties.
- B. Submit Material Safety and Data Sheet (MSDS) for all materials, products, and parts.
- C. Temperature Charts: Bitumen heating devices 24-hour temperature charts.
- D. Test Reports: Bitumen manufacturer's test reports relative to the following for each batch of bitumen furnished:
 - 1. Softening Point: ASTM D312.
 - 2. Flashpoint: ASTM D92.
 - 3. Acceptable Bitumen Temperature: As recommended by the bitumen manufacturer and EVT label on containers.
 - 4. Thermometers: Two (2) handheld, "8F" thermometers complying with ASTM E1 to Architect for his checking kettle temperature.

1.8 CLOSEOUT SUBMITTALS

- A. Submit maintenance data for roofing system to include in maintenance manuals.

1.9 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is UL listed or FM Approvals approved for membrane roofing system identical to that used for this Project.
- B. Installer Qualifications
 - 1. Installer shall be a qualified firm that is approved, authorized, or licensed by membrane roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.
 - 2. Installer shall have not less than five years' experience and not less than three projects of comparable size installing specified system.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
 - 1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

1.11 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions (precipitation and temperature) permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.
- B. Installer shall ensure that base sheet fastener pull out resistance tests on new lightweight insulating concrete fill were performed and approved by Architect and coordinated with Roofing Consultant prior to starting roofing application.

1.12 WARRANTY

- A. Special Warranty: Manufacturer's standard or customized form, without deductibles or limitations on coverage amount, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period. Failure includes roof leaks.

1. Special warranty includes membrane roofing, base flashings, roof insulation, fasteners, cover boards, and roofing accessories, and other components of membrane roofing system.
2. Warranty Period: 20 years from date of Substantial Completion
- B. Provide Installer's written warranty against defects in material and workmanship for the work of this Section (including all components of membrane roofing system such as membrane roofing, base flashing, roof insulation, fasteners, and cover boards) for a period of **Five** years from the Date of Substantial Completion. Refer to Section 01 77 00, Closeout Procedures, for Warranty form.

2 PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with requirements, provide only products by the manufacturers listed below.
- B. Roofing System
 1. Elevate (Formerly Firestone Building Products)
 2. Johns Manville; a Berkshire Hathaway company
- C. Insulation
 1. Refer to Section 03 52 16, Lightweight Insulating Concrete

2.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roofing and base flashings shall remain watertight.
 1. Accelerated Weathering: Roofing system shall withstand 2000 hours of exposure when tested according to ASTM G152, ASTM G154, or ASTM G155.
 2. Impact Resistance: Roofing system shall resist impact damage when tested according to ASTM D3746 or ASTM D4272.
- B. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.
- C. Roofing System Design: Tested by a qualified testing agency to resist the following uplift pressures:
 1. Corner Uplift Pressure: Refer to structural drawings
 2. Perimeter Uplift Pressure: Refer to structural drawings
 3. Field-of-Roof Uplift Pressure: Refer to structural drawings
- D. Classification by Underwriters' Laboratories, Inc. as a Class A roof covering.
- E. Roofing system shall be installed in accordance with ASCE-7-10 wind uplift requirements for geographical location exposure B, 138 MPH 3-second gust wind speed zone and risk category III based on IBC building code requirements.
- F. Solar Reflectance Index (SRI): Three-year-aged SRI not less than 70 when calculated according to ASTM E1980, based on testing identical products by a qualified testing agency. Required only at roof areas not covered by pavers.
- G. Exterior Fire-Test Exposure: ASTM E108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

2.3 ROOFING SHEET MATERIALS

- A. Modified Base/Anchor Sheet: A fiberglass reinforced, Styrene-Butadiene-Styrene (SBS) modified asphalt coated sheet, having an average weight of 28 pounds per square.
Approved Products:
 1. Elevate Product: MB Base, base sheet
 2. JM Product: Perma Ply 28, base sheet

- B. Roofing Mid-Ply Membrane Sheet: ASTM D6163, Grade S, Type I, 90 mil SBS-modified asphalt sheet (reinforced with glass fibers); smooth surfaced; suitable for hot asphalt application.
Approved Product:
 - 1. Elevate Product: SBS Base
 - 2. JM Product: DynaBase
- C. Granule-Surfaced Roofing Cap Sheet: Solar Reflective ASTM D 6163, Grade G, Type I, 155 mil SBS-modified asphalt sheet (reinforced with glass fibers); granule surfaced; suitable for torch application, and as follows:
Approved Products:
 - 1. Elevate Product: SBS Glass FR Torch Ultrawhite
 - 2. JM Product: Dynaweld Cap FR CR

2.4 BASE FLASHING SHEET MATERIALS

- A. Backer Sheet: ASTM D6163, Grade S, Type I, SBS-modified asphalt sheet (reinforced with glass fibers); smooth surfaced; suitable for hot asphalt application.
- B. Metal-Foil-Surfaced Flashing Sheet: ASTM D6298, glass-fiber-reinforced SBS-modified asphalt sheet (reinforced with glass fibers); metal-foil surfaced; suitable for application method specified, and as follows:
Approved Products:
 - 1. Elevate Product: SBS Metal Flash AL
 - 2. JM Product: DynaClad AL

2.5 AUXILIARY ROOFING MATERIALS

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
- B. Asphalt Primer: ASTM D41/D41M
- C. Asphalt Roofing Cement: ASTM D4586, asbestos free, of consistency required by roofing system manufacturer for application
- D. Mastic Sealant: Polyisobutylene, plain or modified bitumen; nonhardening, nonmigrating, nonskinning, and nondrying
- E. 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.
 - 1. Approved Product: Trumbull Fume asphalt or as required by membrane.
- F. Roofing Granules: Ceramic-coated roofing granules, No. 11 screen size with 100 percent passing No. 8 sieve and 98 percent of mass retained on No. 40 sieve, color to match roofing.
- G. Miscellaneous Accessories: Provide those recommended by roofing system manufacturer.

2.6 ROOF INSULATION

- A. Refer to Section 03 52 16, Lightweight Insulating Concrete

2.7 ACCESSORIES

- A. General: Accessories recommended by manufacturer for intended use and compatibility with roofing
- B. Lightweight Insulating Concrete Base Sheet Fasteners: Shall be approved by the fastener manufacturer, membrane manufacturer and FM for use with lightweight insulating concrete as follows:
 - 1. Fastener shall be a single unit, precision formed, of electro zinc coated steel having a 2.7-inch diameter rib reinforced cap and 1.7-inch-long rectangular legs, designed to expand when fully driven into the lightweight insulating concrete. Fasteners for lightweight insulating concrete shall meet FM Standard 4470 requirements for corrosion resistance.

- C. Fastener for Brick: Shall be 1/4-inch x 2 inches, stainless steel nail, one piece unit, flat head, as manufactured by Rawl Zamac Nailin, or approved equal.
- D. Cant Strips: ASTM C728, perlite insulation board.
- E. Wood Nailer Strips: Comply with requirements in Section 06 10 53, Miscellaneous Rough Carpentry.
- F. Liquid Flashings: One-Part Liquid Flashing is a one-component polyurethane / bitumen resin that provides a liquid flashing solution for asphaltic roofing systems. Utilize fabric in three-part system at all penetrations.

3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work:
 - 1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
 - 2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
 - 3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Section 05 31 00, Steel Decking.
 - 4. Verify that minimum concrete drying period recommended by roofing system manufacturer has passed.
 - 5. Verify that concrete substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D4263.
 - 6. Verify that concrete-curing compounds that impair adhesion of roofing components to roof deck have been removed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system 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. Comply with roofing system manufacturer's written instructions.
- B. Substrate-Joint Penetrations: Prevent roofing asphalt and adhesives from penetrating substrate joints, entering building, or damaging roofing system components or adjacent building construction.

3.4 APPLICATION OF BASE/ANCHOR SHEET AT LIGHTWEIGHT CONCRETE DECK

- A. Lightweight concrete deck shall be covered with a base/anchor sheet, mechanically fastened as follows:
 - 1. Install in accordance with manufacturer's current published application instructions and to meet ASCE-7 wind uplift requirements. Fasteners and fastening patterns shall be determined by building height, pull out values from lightweight insulating concrete decks (more stringent applies), location and geographical area of the United States. It is the contractor's responsibility to consult current ASCE-7 publications, literature, and bulletins that are in effect at the time of this project. Submit perimeter, field and corner fastening patterns and cite all ASCE-7 data pertaining to the fastening pattern to the Architect for review.

3.5 ACCESSORY INSTALLATION

- A. Insulation Cant Strips: Install and secure preformed 45 degree insulation cant strips at junctures of roofing system with vertical surfaces or angle changes greater than 45 degrees.
- B. Primed cant strips shall be installed at the intersection of the deck and the vertical surfaces.
- C. All plumbing and pipe penetrations shall be flashed with manufacturers liquid flashings.

3.6 ROOFING INSTALLATION, GENERAL

- A. Install roofing system according to roofing system manufacturer's written instructions and applicable recommendations in ARMA/NRCA's "Quality Control Guidelines for Application of Polymer-modified Bitumen Roofing" and as follows:
- B. Start installation of roofing in presence of manufacturer's technical personnel.
- C. Coordinate installation of roofing system so insulation and other 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 sheets and insulation with a course of coated felt set in roofing cement 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.
- D. Protect adjacent areas with tarpaulin or other durable materials.
- E. Contractor shall prevent overspray and be responsible for parking lot areas and/or adjoining areas not part of this contract.
- F. Contractor shall be responsible for sealing, as required, all openings that may allow bitumen migration or drippage, i.e., pitch dams, envelopes, and filler strips.
- G. Prepare surfaces according to manufacturer's or applicator's published instructions. All metal that is to receive bitumen, or come in contact with bitumen or adhesive, shall be first primed with appropriate primer. All Kynar 500 or Hylar 5000 finished metal shall be buff sanded on the surface which is to be primed prior to the application.
- H. Use cleaning materials or primers necessary to render an acceptable surface/substrate.
- I. All surfaces/substrates shall be clean and dry prior to application of materials. Roof deck substrates shall be inspected for moisture in accordance with the manufacturer's recommendations. Architect's representative shall witness inspection. Roofing installed before inspection by Architect's representative shall be removed to allow inspection.
- J. Prior to application of felts and membrane, all foreign matter, gravel, etc., shall be removed from the substrate. Gravel or debris between the substrate and plies is not acceptable.
- K. Ambient temperature shall be 45 degrees F and rising.
- L. Bitumen kettles or tankers shall have a visible thermometer and thermostatic control to provide positive monitoring of the bitumen temperature when it is heated in accordance with manufacturer's instructions. Kettle shall be kept a minimum of 20 feet away from building, placed so that fumes, odors, and smoke, do not enter building through windows, doors, fresh air vents or similar entrances; are not directed towards freshly painted or anodized surfaces, glass or other glazing materials. Do not place kettle under trees or near vegetation. The assigned kettle man shall remain in close attendance, within 25 feet of ground level, while burners are lit. Kettle lids are to remain closed except for loading. Level of bitumen shall be kept within eight (8) inches from top of kettle. All kettles are to have afterburners installed to reduce fume emissions.
- M. Asphalt Bitumen Heating: Heat and apply bitumen in accordance with equiviscous temperature method ("EVT Method") as recommended by the manufacturer. Discard bitumen that has been held at temperature, exceeding finished blowing temperature (FBT) for a period exceeding three hours. Do NOT heat bitumen to a temperature higher than 25 degrees F (14 degrees C) below flash point.
- N. Asphalt Temperatures: If the EVT information is not provided, the following asphalt temperature shall be observed. Maximum heating temperature shall be 525 degrees F. Minimum application temperature shall be 400 degrees F.
- O. Asphalt Moppings: Ensure that all moppings do not exceed a maximum of 25 pounds per square. Mopping shall be total in coverage, leaving no breaks or voids.

- P. Membrane Adhesive Application: Apply cold adhesive in a smooth, even, continuous layer without breaks or voids at the rate of 1-1/2 gallons per square per ply. (The porosity of some substrates may require a heavier application to ensure full adhesion.)
- Q. Bitumen Consistency: Cutting or alterations of bitumen, primer, and sealants will not be permitted.
- R. Circulate bituminous materials, do not allow bituminous materials to stand in luggers for long periods. Use insulated hot transport lines and luggers.
- S. Keep kettle lid closed except when adding bitumen.
- T. Wrinkles, buckles, kinks, and fishmouths are not acceptable when laying felt and membrane.
- U. Dry voids of felt on felt are not acceptable.
- V. All flashings shall be mechanically top-fastened with a termination bar a minimum of six (6) inches on center at the top leading edge and be a minimum of eight (8) inches in height above the finished membrane height.
- W. On slopes greater than one (1) inch in 12 inches, refer to NRCA and/or manufacturer's guidelines for backnailing procedures and follow the more stringent guidelines for all specified materials.
- X. Correct all errors in application the same workday they occur, including voids, fishmouths, dry laps or spots, wrinkles, ridges, blisters, bare spots, improper application, physical damage and all work not meeting specifications.

3.7 ROOF MEMBRANE INSTALLATION

- A. Membrane Application: Install roofing in accordance with roofing system manufacturer's current published instructions and the following requirements. Application of roofing membrane components shall immediately follow application of insulation as a continuous operation.
- B. Aesthetic Considerations: An aesthetically pleasing overall appearance of the finished roof application is a standard requirement for this Project. Make necessary preparations, utilize recommended application techniques, apply the specified materials (i.e., granules, metallic powder, etc.) and exercise care in ensuring that the finished application is acceptable to the Owner.
- C. Bitumen Consistency: Cutting or alterations of bitumen, primer, and sealants will not be permitted.
- D. Roofing Application: Apply all layers of roofing free of wrinkles, creases or fishmouths. Exert sufficient pressure on the roll during application to ensure prevention of air pockets. Lap seams between the mid-ply layer and the cap-ply layer shall not coincide. Stagger the courses to ensure this.
 - 1. Apply all layers of roofing so that water flows over or along lap seams, but never against laps.
 - 2. Mechanically attached the base/anchor sheet to the lightweight concrete per manufacturers fastening pattern. Each sheet shall have minimum three (3) inch side laps and six (6) inch end laps.
 - 3. Fully bond the mid-ply to base/anchor sheet with hot asphalt. Each sheet shall have minimum three (3) inch side laps and six (6) inch end laps. Each sheet shall be applied directly behind the hot asphalt applicator. Stagger end laps a minimum of three (3) feet.
 - 4. Fully bond the cap-ply to the mid-ply with torch. Each sheet shall have a minimum of three (3) inch side and six (6) end laps. Each sheet shall be applied directly behind the torch applicator. Stagger end laps of the cap-ply a minimum of three (3) feet. Stagger side laps of the cap-ply a minimum of 12 inches from side laps in the underlying mid-ply. Stagger end laps of the cap-ply a minimum of three (3) feet from end laps in the underlying mid-ply.
 - 5. Maximum sheet lengths and special fastening of the specified roof membrane system may be required at various slope increments where the roof deck slope exceeds 1/2 inch per foot. The manufacturer shall provide acceptable sheet lengths and the required fastening schedule for all roofing sheet applications to applicable roof slopes.
 - 1. Lap Treatment: A 20-pound roller shall be used on all side and end laps, following immediately behind application, apply uniform pressure across lap area to achieve a continuous visible bleed out.

- E. Granule Embedment: Broadcast mineral granules over all bitumen overruns on the cap-ply surface, while the bitumen is still hot, to ensure a monolithic color and adhesion.

3.8 FLASHING AND STRIPPING INSTALLATION

- A. Install base flashing over cant strips and other sloped and vertical surfaces, at roof edges, and at penetrations through roof, and secure to substrates according to roofing system manufacturer's written instructions and as follows:
 - 1. Prime substrates with asphalt primer if required by roofing system manufacturer.
 - 2. Backer-Sheet Application: Adhere backer sheet to substrate in hot asphalt.
 - 3. Flashing-Sheet Application: Torch apply flashing sheet to substrate.
- B. Extend base flashing up walls or parapets a minimum of 8 inches above roofing membrane and 4 inches onto field of roofing membrane.
- C. Mechanically fasten top of base flashing securely at terminations and perimeter of roofing. Seal top termination of base flashing.
- D. Install roofing cap-sheet stripping where metal flanges and edgings are set on roofing according to roofing system manufacturer's written instructions.
- E. Roof Drains: Set 30 inch by 30 inch metal flashing in bed of asphaltic adhesive on completed roofing membrane. Cover metal flashing with roofing cap-sheet stripping, and extend a minimum of 4 inches beyond edge of metal flashing onto field of roofing membrane. Clamp roofing membrane, metal flashing, and stripping into roof-drain clamping ring.
 - 1. Install stripping ply according to roofing system manufacturer's written instructions.

3.9 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to inspect substrate conditions, surface preparation, membrane application, flashings, protection, and drainage components, and to furnish reports to Architect.
- B. Test Cuts: Remove test specimens to evaluate problems observed during quality-assurance inspections of roofing membrane as follows:
 - 1. Determine approximate quantities of components within roofing membrane according to ASTM D3617.
 - 2. Examine test specimens for interply voids according to ASTM D3617 and to comply with criteria established in Appendix 3 of ARMA/NRCA's "Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing."
 - 3. Repair areas where test cuts were made according to roofing system manufacturer's written instructions.
- C. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion. Notify Architect and Owner 72 hours in advance of date and time of inspection.
- D. Roofing system will be considered defective if it does not pass tests and inspections. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

3.10 OVERNIGHT SEAL / WATER CUT-OFF

- A. Over Night Seal: Shall be performed according to accepted roofing practice as outlined in the NRCA Roofing Manual.
- B. Water Cut-Off: At the end of day's work or when precipitation is imminent, construct a water cut-off at all open edges. Cut-offs can be built using asphalt or plastic cement and roofing felts, constructed to withstand protracted periods of service. Cut-offs must be completely removed prior to resumption of roofing.

3.11 PROTECTING AND CLEANING

- A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

- B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 07 52 16

SECTION 07 62 00

SHEET METAL FLASHING AND TRIM

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, 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 SUMMARY

- A. Section includes formed low-slope roof sheet metal fabrications, wall sheet metal fabrications, and equipment support flashing.
- B. Related Requirements
 - 1. Section 04 20 00, Unit Masonry
 - 2. Section 05 50 00, Metal Fabrications
 - 3. Section 06 10 53, Miscellaneous Rough Carpentry
 - 4. Section 07 52 16, SBS Modified Bituminous Membrane Roofing
 - 5. Section 07 65 26, Self-Adhering Sheet Flashing
 - 6. Section 07 72 33, Roof Hatches
 - 7. Section 07 92 00, Joint Sealants

1.3 REFERENCES

- A. Use current editions unless indicated otherwise.
- B. American Society for Testing and Materials (ASTM)
 - 1. ASTM A240 / A240M, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
 - 2. ASTM A666, Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar
 - 3. ASTM B32, Standard Specification for Solder Metal
 - 4. ASTM C920, Standard Specification for Elastomeric Joint Sealants
 - 5. ASTM C1311, Standard Specification for Solvent Release Sealants
 - 6. ASTM D226 / D226M, Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
 - 7. ASTM D1187 / D1187M, Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal
 - 8. ASTM D4397, Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications
 - 9. ASTM D4586 / D4586M, Standard Specification for Asphalt Roof Cement, Asbestos-Free
- C. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
 - 1. Architectural Sheet Metal Manual
- D. Texas Health and Safety Code, Chapter 161, Subchapter Q, Installation of Asbestos
- E. Texas Occupations Code, Chapter 1954, Asbestos Health Protection

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00, Project Management and Coordination.
 - 1. Meet with Owner, Architect, Installer, and installers whose work interfaces with or affects sheet metal flashing and trim including installers of roofing materials, roof accessories, unit skylights, and roof-mounted equipment.
 - 2. Review methods and procedures related to sheet metal flashing and trim.

3. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
4. Review special roof details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect sheet metal flashing.
5. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.5 ACTION SUBMITTALS

- A. Submit product data for each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.
- B. Submit shop drawings indicating fabrication and installation layouts of sheet metal flashing and trim, including plans, elevations, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work. Include the following:
 1. Identification of material, thickness, weight, and finish for each item and location in Project
 2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions
 3. Details for joining, supporting, and securing sheet metal flashing and trim, including layout of fasteners, cleats, clips, and other attachments and pattern of seams
 4. Details of termination points and assemblies, including fixed points
 5. Details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction
 6. Details of edge conditions, including counterflashings, as applicable
 7. Details of special conditions
 8. Details of connections to adjoining work
 9. Detail flashing and trim at a scale of not less than 3 inches per 12 inches.

1.6 INFORMATIONAL SUBMITTALS

- A. Submit Material Safety and Data Sheet (MSDS) for all materials, products, and parts.

1.7 CLOSEOUT SUBMITTALS

- A. Submit maintenance data for sheet metal flashing, trim, and accessories to include in maintenance manuals.

1.8 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.
- B. Sheet Metal Flashing and Trim Standard: Comply with SMACNA "Architectural Sheet Metal Manual" unless more stringent requirements are specified or shown on Drawings.
- C. Sheet metal flashing and trim assemblies indicated shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
- D. Thermal Movements: Provide sheet metal flashing and trim that allows for thermal movements from ambient and surface temperature changes.
 1. Temperature Change (Range): 120° F (67° C), ambient; 180° F (100° C), material surfaces

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
- B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to the extent necessary for the period of sheet metal flashing and trim installation.

1.10 WARRANTY

- A. Provide written warranty against defects in material and workmanship for the work of this Section for a period of one year from the Date of Substantial Completion.
- B. Refer to Section 01 77 00, Closeout Procedures, for Warranty form.

2 PRODUCTS**2.1 SHEET METALS**

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.
- B. Stainless-Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304, dead soft, fully annealed.
 - 1. Finish: 2D (dull, cold rolled)
 - 2. Surface: Smooth, flat

2.2 UNDERLAYMENT MATERIALS

- A. Polyethylene Sheet: 6 mil thick polyethylene sheet complying with ASTM D4397
- B. Felt: ASTM D226, Type II (No. 30), asphalt-saturated organic felt, nonperforated
- C. Slip Sheet: Building paper, 3-lb/100 sq. ft. minimum, rosin sized

2.3 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and recommended by manufacturer of primary sheet metal unless otherwise indicated.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal.
 - 1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head
 - a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating
 - b. Blind Fasteners: Stainless-steel rivets suitable for metal being fastened
 - 2. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel
- C. Solder
 - 1. For Stainless Steel: ASTM B32, Grade Sn60, with an acid flux of type recommended by stainless-steel sheet manufacturer
 - 2. For Zinc-Coated (Galvanized) Steel: ASTM B32, Grade Sn50, 50 percent tin and 50 percent lead or Grade Sn60, 60 percent tin and 40 percent lead
- D. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape ½ inch wide and ⅛ inch thick.
- E. Elastomeric Sealant: ASTM C920, elastomeric polyurethane polymer sealant; low modulus; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- F. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement
- G. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D1187
- H. Asphalt Roofing Cement: ASTM D4586, asbestos free, of consistency required for application

2.4 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA "Architectural Sheet Metal Manual" that apply to design, dimensions, geometry, metal thickness, and other characteristics of item indicated. Fabricate items at the shop to greatest extent possible.

1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
2. Obtain field measurements for accurate fit before shop fabrication.
3. Form sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces exposed to view.
- B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of ¼ inch in 20 feet on slope and location lines as indicated and within ⅛ inch offset of adjoining faces and of alignment of matching profiles.
- C. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant.
- D. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
- E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- F. Fabricate cleats and attachment devices of sizes as recommended by SMACNA "Architectural Sheet Metal Manual" and by FMG Loss Prevention Data Sheet 1-49 for application, but not less than thickness of metal being secured.
- G. Seams: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
- H. Do not use graphite pencils to mark metal surfaces.

2.5 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

- A. Roof-Edge Flashing: Fabricate from prefinished Galvanized Steel: ASTM A653, Grade A, G90, 24 gage minimum core steel, prefinished with fluorocarbon type coating (Kynar®), color as selected by Architect.
- B. Roof and Roof to Wall Transition Expansion-Joint Cover: Fabricate from 0.024 inch (24 gauge) stainless steel.
- C. Counterflashing and Flashing Receivers: Fabricate from 0.024 inch (24 gauge) stainless steel.
- D. Roof-Penetration Flashing: Fabricate from 0.024 inch (24 gauge) stainless steel.
- E. Roof-Drain Flashing: Fabricate from 4.0 lb/sq. ft. hard tempered lead.

2.6 WALL SHEET METAL FABRICATIONS

- A. Through-Wall Flashing: Fabricate continuous flashings in minimum 96 inch long, but not exceeding 12 foot long, sections, under copings, at shelf angles, and where indicated. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches beyond each side of wall openings. Form with 2 inch high, end dams where flashing is discontinuous. Fabricate from 0.024 inch (24 gauge) stainless steel.

2.7 MISCELLANEOUS SHEET METAL FABRICATIONS

- A. Equipment Support Flashing: Fabricate from 0.024 inch (24 gauge) stainless steel.

3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of the Work.
 1. Verify compliance with requirements for installation tolerances of substrates.
 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
- B. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLAYMENT INSTALLATION

- A. General: Install underlayment as indicated on Drawings.
- B. Polyethylene Sheet: Install polyethylene sheet with adhesive for anchorage to minimize use of mechanical fasteners under sheet metal flashing and trim. Apply in shingle fashion to shed water, with lapped and taped joints of not less than 2 inches.
- C. Felt Underlayment: Install felt underlayment with adhesive for temporary anchorage to minimize use of mechanical fasteners under sheet metal flashing and trim. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches.

3.3 INSTALLATION, GENERAL

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
 - 1. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
 - 2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
 - 3. Space cleats not more than 12 inches apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
 - 4. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
 - 5. Install sealant tape where indicated.
 - 6. Torch cutting of sheet metal flashing and trim is not permitted.
 - 7. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by SMACNA.
 - 1. Coat back side of stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
 - 2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene sheet.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
- D. Seal joints as shown and as required for watertight construction.
 - 1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40° F and 70° F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40° F.
 - 2. Prepare joints and apply sealants to comply with requirements in Section 07 92 00, Joint Sealants.
- E. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1½ inches, except reduce pre-tinning where pre-tinned surface would show in completed Work.
 - 1. Do not solder metallic-coated steel sheet.
 - 2. Pre-tinning is not required for lead.
 - 3. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

4. Stainless-Steel Soldering: Tin edges of uncoated sheets using solder recommended for stainless steel and acid flux. Promptly remove acid flux residue from metal after tinning and soldering. Comply with solder manufacturer's recommended methods for cleaning and neutralization.

3.4 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
- B. Roof Edge Flashing and Copings: Provide edge details as indicated on the Drawings. Install in accordance with the membrane manufacturer's requirements. Join individual sections in accordance with the membrane manufacturer's requirements.
- C. Pipe or Post Counterflashing: At locations where prefabricated TPO sheet membranes cannot be used, install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.
- D. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints a minimum of 4 inches and bed with sealant. Secure in a waterproof manner by means of snap-in installation and sealant or lead wedges and sealant.
- E. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric sealant and clamp flashing to pipes that penetrate roof.

3.5 WALL FLASHING INSTALLATION

- A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.
- B. Through-Wall Flashing: Installation of through-wall flashing is specified in Section 04 20 00, Unit Masonry.

3.6 MISCELLANEOUS FLASHING INSTALLATION

- A. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.

3.7 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8 inch offset of adjoining faces and of alignment of matching profiles.

3.8 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder.
- C. Clean off excess sealants.
- D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of installation, remove unused materials and clean finished surfaces. Maintain in a clean condition during construction.
- E. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures

END OF SECTION 07 62 00

SECTION 07 72 33

ROOF HATCHES

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, 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 SUMMARY

- A. Section includes roof hatches.
- B. Related Requirements
 - 1. Section 03 52 16, Lightweight Insulating Concrete
 - 2. Section 05 12 00, Structural Steel Framing
 - 3. Section 05 21 00, Steel Joist Framing
 - 4. Section 05 31 00, Steel Decking
 - 5. Section 05 50 00, Metal Fabrications
 - 6. Section 06 10 53, Miscellaneous Rough Carpentry
 - 7. Section 07 54 23, Thermoplastic Polyolefin Roofing
 - 8. Section 07 62 00, Sheet Metal Flashing and Trim
 - 9. Section 09 91 00, Painting

1.3 REFERENCES

- A. Use current editions unless noted otherwise.
- B. ASTM International (ASTM)
 - 1. ASTM A780 / A780M, Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
- C. Texas Health and Safety Code, Chapter 161, Subchapter Q, Installation of Asbestos
- D. Texas Occupations Code, Chapter 1954, Asbestos Health Protection

1.4 COORDINATION

- A. Coordinate layout and installation of roof hatches with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.
- B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00, Project Management and Coordination.

1.6 ACTION SUBMITTALS

- A. Submit product data for each type of product indicated.

1.7 INFORMATIONAL SUBMITTALS

- A. Submit Material Safety and Data Sheet (MSDS) for all materials, products, and parts.

1.8 CLOSEOUT SUBMITTALS

- A. Submit operation and maintenance data to include in maintenance manuals.

1.9 QUALITY ASSURANCE

- A. General Performance: Roof hatches shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Manufacturer: A minimum of 5 years experience manufacturing similar products.
- C. Installer: A minimum of 2 years experience installing similar products.
- D. Manufacturer's Quality System: Registered to ISO 9001 Quality Standards including in-house engineering for product design activities.

1.10 WARRANTY

- A. Provide written warranty against defects in material and workmanship for the work of this Section for a period of five years from the Date of Substantial Completion. Should a part fail to function in normal use within this period, manufacturer shall furnish a new part at no charge.
- B. Refer to Section 01 77 00, Closeout Procedures, for Warranty form.

2 PRODUCTS**2.1 MANUFACTURERS**

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Type NB-50TB Roof Hatch by The BILCO Company or equivalent by one of the manufacturers listed below.
 - 1. Babcock-Davis
 - 2. Custom Solution Roof and Metal Products
 - 3. Dur-Red Products
 - 4. J. L. Industries, Inc.
 - 5. Metallic Products Corp.
 - 6. Milcor Inc.; Commercial Products Group of Hart & Cooley, Inc.
 - 7. Nystrom, Inc.
 - 8. Precision Ladders, LLC

2.2 ROOF HATCHES

- A. Metal roof-hatch units with lids and insulated double walled curbs, welded or mechanically fastened and sealed corner joints, continuous lid-to-curb counterflashing and weathertight perimeter gasketing, integral metal cant, and integrally formed deck-mounting flange at perimeter bottom
- B. Type: Single leaf lid
- C. Size: 30 by 54 inches
- D. Loads: Minimum 40 lbf/sq. ft. external live load and 20-lbf/sq. ft. internal uplift load.
- E. Construction
 - 1. Cover: Shall be 11 gauge (2.3mm) aluminum with a 5" (127mm) beaded flange with formed reinforcing members. Interior and exterior surfaces shall be thermally broken to minimize heat transfer and to resist condensation. Cover shall have a heavy extruded EPDM rubber gasket bonded to the cover interior to assure a continuous seal when compressed to the top surface of the curb.
 - 2. Cover insulation: Shall be 3" (75mm) thick polyisocyanurate with an R-value = 20.3 (U=0.279 W/m²K), fully covered and protected by an 18 gauge (1mm) aluminum liner.
 - 3. Curb: Shall be 12" (305mm) in height and of 11 gauge (2.3mm) aluminum. Interior and exterior surfaces shall be thermally broken to minimize heat transfer and to resist condensation. The curb shall be formed with a 5-1/2" (140mm) flange with 7/16" (11mm) holes provided for securing to the roof deck. The curb shall be equipped with an integral metal capflashing of the same gauge and material as the curb, fully welded at the corners, that features the Bil-Clip® flashing system, including stamped tabs, 6" (153mm) on center, to be bent inward to hold single ply roofing membrane securely in place.
 - 4. Curb insulation: Shall be 3" (75mm) thick polyisocyanurate with an R-value = 20.3 (U=0.279 W/m²K).

5. Lifting mechanisms: Manufacturer shall provide compression spring operators enclosed in telescopic tubes to provide, smooth, easy, and controlled cover operation throughout the entire arc of opening and closing. The upper tube shall be the outer tube to prevent accumulation of moisture, grit, and debris inside the lower tube assembly. The lower tube shall interlock with a flanged support shoe welded to the curb assembly.
- F. Hardware:
 1. Heavy stainless steel pintle hinges shall be provided
 2. Cover shall be equipped with a spring latch with interior and exterior turn handles
 3. Roof hatch shall be equipped with interior and exterior padlock hasps.
 4. The latch strike shall be a stamped component bolted to the curb assembly.
 5. Cover shall automatically lock in the open position with a rigid hold open arm equipped with a 1" (25mm) diameter red vinyl grip handle to permit easy release for closing.
 6. All hardware shall be zinc plated and chromate sealed.
 7. Cover hardware shall be bolted into heavy gauge channel reinforcing welded to the underside of the cover and concealed within the insulation space.
 8. Coordinate door contact with Div. 08.
- G. Finish: Factory finish shall be mill finish aluminum.

3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.
- B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
- C. Verify dimensions of roof openings for roof hatches.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install roof hatches according to manufacturer's written instructions.
 1. Install roof hatches level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.
 2. Anchor roof hatches securely in place so they are capable of resisting indicated loads.
 3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof hatches and fit them to substrates.
 4. Install roof hatches to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.
- B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
 1. Coat concealed side of roof hatches with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
 2. Underlayment: Where installing roof hatches directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet, or install a course of polyethylene sheet.
 3. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof accessories for waterproof performance.
- C. Install roof hatch so top surface of hatch curb is level.
- D. Verify that roof hatch operates properly. Clean, lubricate, and adjust operating mechanism and hardware.
- E. Seal joints with sealant as required by roof hatch manufacturer.

3.3 REPAIR AND CLEANING

- A. Clean exposed surfaces using methods acceptable to the manufacturer which will not damage finish.

- B. Clean off excess sealants.
- C. Replace roof hatches that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 07 72 33

SECTION 07 92 00

JOINT SEALANTS

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, 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 SUMMARY

- A. Section includes urethane joint sealants, latex joint sealants, sealant backings, bond-breaker tape, primers, cleaners, and masking tape.
- B. Related Sections
 - 1. Section 04 20 00, Unit Masonry
 - 2. Section 07 42 93, Soffit Panels
 - 3. Section 08 11 13.16, Custom Hollow Metal Doors and Frames
 - 4. Section 08 41 13, Aluminum-Framed Entrances and Storefronts
 - 5. Section 08 44 13, Glazed Aluminum Curtain Walls
 - 6. Section 08 80 00, Glazing
 - 7. Section 09 29 00, Gypsum Board
 - 8. Section 09 30 00, Tiling
 - 9. Section 09 91 00, Painting
 - 10. Section 12 32 16, Manufactured Plastic-Laminate-Clad Casework
 - 11. Section 32 13 73, Concrete Paving Joint Sealants

1.3 REFERENCES

- A. Use current editions unless noted otherwise.
- B. ASTM International (ASTM)
 - 1. ASTM C920, Standard Specification for Elastomeric Joint Sealants
 - 2. ASTM C834, Standard Specification for Latex Sealants
 - 3. ASTM C1193, Standard Guide for Use of Joint Sealants
 - 4. ASTM C1330, Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants
- C. Texas Health and Safety Code, Chapter 161, Subchapter Q, Installation of Asbestos
- D. Texas Occupations Code, Chapter 1954, Asbestos Health Protection

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00, Project Management and Coordination.

1.5 ACTION SUBMITTALS

- A. Submit product data for each joint-sealant product indicated.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

1.6 INFORMATIONAL SUBMITTALS

- A. Submit Material Safety and Data Sheet (MSDS) for all materials, products, and parts.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.
- C. Refer to Section 04 20 00, Unit Masonry, for requirements related to mockups.

1.8 PROJECT CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40° F.
 - 2. When joint substrates are wet.
 - 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 - 4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.9 WARRANTY

- A. Provide written warranty against defects in material and workmanship in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section for a period of **two** years from the Date of Substantial Completion. Refer to Section 01 77 00, Closeout Procedures, for Warranty form.
- B. Provide manufacturer's standard written form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section for a period of **five** years from the Date of Substantial Completion.

2 PRODUCTS**2.1 MANUFACTURERS**

- A. Urethane Joint Sealants
 - 1. BASF Building Systems
 - 2. Bostik, Inc.
 - 3. May National Associates, Inc.
 - 4. Pacific Polymers International, Inc.
 - 5. Pecora Corporation
 - 6. Sika Corporation, Construction Products Division
 - 7. Tremco Incorporated
- B. Latex Joint Sealant
 - 1. BASF Building Systems
 - 2. Bostik, Inc.
 - 3. May National Associates, Inc.
 - 4. Pecora Corporation
 - 5. Schnee-Morehead, Inc.
 - 6. Tremco Incorporated

2.2 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. Liquid-Applied Joint Sealants: Comply with ASTM C920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C920 classifications for type, grade, class, and uses related to exposure and joint substrates.
- C. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range

2.3 URETHANE JOINT SEALANTS

- A. Single-Component (Type S) or Multicomponent (Type M), Nonsag (Grade NS), Urethane Joint Sealant: ASTM C920; Class 25; for Use NT, Use M, Use O, or other Use as required.
- B. Provide at all exterior locations and all interior locations where sealant is required and width of joint is greater than ½ inch.

2.4 LATEX JOINT SEALANTS

- A. Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP or Type C (as appropriate), Grade NF.
- B. Provide at all interior locations where sealant is required and width of joint is ½ inch or less and at all exposed slab control joints whether shown or not.

2.5 JOINT SEALANT BACKING

- A. General: Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C1330, Type C (closed-cell material with a surface skin), Type O (open-cell material), Type B (bicellular material with a surface skin), or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.6 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

3 EXECUTION**3.1 EXAMINATION**

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include, but are not limited to, concrete, masonry, unglazed surfaces of ceramic tile, and exterior insulation and finish systems.
 3. Remove laitance and form-release agents from concrete.
 4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include, but are not limited to, metal, glass, porcelain enamel, glazed surfaces of ceramic tile.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
1. Do not leave gaps between ends of sealant backings.
 2. Do not stretch, twist, puncture, or tear sealant backings.
 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
1. Place sealants so they directly contact and fully wet joint substrates.
 2. Completely fill recesses in each joint configuration.
 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
1. Remove excess sealant from surfaces adjacent to joints.
 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 3. Provide concave joint profile per Figure 8A in ASTM C1193, unless otherwise indicated.

3.4 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION 07 92 00

SECTION 08 11 13.16

CUSTOM HOLLOW METAL DOORS AND FRAMES

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, 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 SUMMARY

- A. Section includes custom hollow metal work.
- B. Related Requirements
 - 1. Section 04 20 00, Unit Masonry
 - 2. Section 05 40 00, Cold-Formed Metal Framing
 - 3. Section 08 14 23.16, Plastic-Laminate-Faced Wood Doors
 - 4. Section 08 71 00, Door Hardware
 - 5. Section 08 80 00, Glazing
 - 6. Section 09 22 16, Non-Structural Metal Framing
 - 7. Section 09 29 00, Gypsum Board
 - 8. Section 09 91 00, Painting
 - 9. Section 12 21 13, Horizontal Louver Blinds

1.3 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings according to HMMA 803 or SDI A250.8

1.4 REFERENCES

- A. Use current editions unless noted otherwise.
- B. ASTM International (ASTM)
 - 1. ASTM A153 / A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
 - 2. ASTM A653 / A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - 3. ASTM A879 / A879M, Standard Specification for Steel Sheet, Zinc Coated by the Electrolytic Process for Applications Requiring Designation of the Coating Mass on Each Surface
 - 4. ASTM A1008 / A1008M, Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
 - 5. ASTM A1011 / A1011M, Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
 - 6. ASTM C143 / C143M, Standard Test Method for Slump of Hydraulic-Cement Concrete
 - 7. ASTM C476, Standard Specification for Grout for Masonry
 - 8. ASTM C665, Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
 - 9. ASTM E136, Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C
- C. Builders Hardware Manufacturers Association (BHMA)
 - 1. BHMA A156.115, Hardware Preparation in Steel Doors and Steel Frames

- D. Hollow Metal Manufacturers Association (HMMA) Division of National Association of Architectural Metal Manufacturers (NAAMM)
 - 1. HMMA 803, Steel Tables
 - 2. HMMA 840, Installation and Storage of Hollow Metal Doors and Frames
 - 3. NAAMM HMMA 861, Guide Specifications for Commercial Hollow Metal Doors and Frames
- E. Steel Door Institute (SDI)
 - 1. SDI A250.4, Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors and Hardware Reinforcing
 - 2. SDI A250.6, Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames
 - 3. SDI A250.8, Recommended Specifications for Standard Steel Doors and Frames
 - 4. SDI A250.10, Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames
- F. 2010 ADA Standards for Accessible Design (SAD)
- G. 2012 Texas Accessibility Standards (TAS)
- H. Texas Health and Safety Code, Chapter 161, Subchapter Q, Installation of Asbestos
- I. Texas Occupations Code, Chapter 1954, Asbestos Health Protection

1.5 COORDINATION

- A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.6 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00, Project Management and Coordination.

1.7 ACTION SUBMITTALS

- A. Submit product data for each type of product. Include construction details, material descriptions, core descriptions, fire-resistance ratings, temperature-rise ratings, and finishes.
- B. Shop Drawings: Include the following:
 - 1. Elevations of each door and panel type
 - 2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses
 - 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses
 - 4. Locations of reinforcement and preparations for hardware
 - 5. Details of each different wall opening condition
 - 6. Details of anchorages, joints, field splices, and connections
 - 7. Details of accessories
 - 8. Details of moldings, removable stops, and glazing
 - 9. Details of conduit and preparations for power, signal, and control systems
- C. Schedule: Provide a schedule of hollow-metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule.

1.8 INFORMATIONAL SUBMITTALS

- A. Submit Material Safety and Data Sheet (MSDS) for all materials, products, and parts.

1.9 QUALITY ASSURANCE

- A. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic. Provide additional protection to prevent damage to factory-finished units.

- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow-metal work vertically under cover at Project site with head up to be protected from weather and damage. Place on minimum 4 inch high wood blocking. Provide minimum ¼ inch space between each stacked door to permit air circulation.

1.11 WARRANTY

- A. Provide written warranty against defects in material and workmanship for the work of this Section for a period of one year from the Date of Substantial Completion.
- B. Refer to Section 01 77 00, Closeout Procedures, for Warranty form.

2 PRODUCTS

2.1 MANUFACTURERS

- A. American Door Products Inc.
- B. Ceco Door Products
- C. CURRIES Division of Assa Abloy Door Group
- D. Door Pro Systems
- E. Mesker Openings Group
- F. Metal Products, Inc.
- G. Pioneer Industries
- H. Republic Doors and Frames
- I. Steelcraft

2.2 INTERIOR FRAMES

- A. Construct interior frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Commercial Frames: NAAMM-HMMA 861
 - 1. Physical Performance: Level A according to SDI A250.4
 - 2. Materials: Uncoated steel sheet, minimum thickness of 0.053 inch (16 gauge) for door or window frames 48 inches wide or less; minimum thickness of 0.067 inch (14 gauge) for door or window frames of widths greater than 48 inches
 - 3. Construction: Full profile welded
 - 4. Exposed Finish: Prime

2.3 EXTERIOR HOLLOW-METAL DOORS AND FRAMES

- A. Construct exterior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Commercial Doors and Frames: NAAMM-HMMA 861
 - 1. Physical Performance: Level A according to SDI A250.4
 - 2. Doors
 - a. Type: As indicated in the Door and Frame Schedule
 - b. Thickness: 1¾ inches
 - c. Face: Metallic-coated steel sheet, minimum thickness of 0.053 inch (16 gauge), with minimum G60 or A60 coating
 - d. Edge Construction: Continuously welded with no visible seam
 - e. Core: Steel stiffened
 - 3. Frames:
 - a. Materials: Metallic-coated steel sheet, minimum thickness of 0.067 inch (14 gauge), with minimum G60 or A60 coating
 - b. Construction: Full profile welded
 - 4. Exposed Finish: Prime

2.4 FRAME ANCHORS

- A. Jamb Anchors:
 - 1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch (18 gauge) thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick
 - 2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch (18 gauge) thick
- B. Floor Anchors: Clip-type anchors, with two holes to receive fasteners formed from same material as frames, minimum thickness of 0.042 inch (18 gauge)

2.5 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications
- B. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled
- C. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B
- D. Frame Anchors: ASTM A879/A879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized
 - 1. For anchors built into exterior walls, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M, hot-dip galvanized according to ASTM A153/A153M, Class B
- E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A153/A153M.
- F. Power-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 hollow-metal frames of type indicated
- G. Grout: ASTM C476, except with a maximum slump of 4 inches, as measured according to ASTM C143/C143M
- H. Mineral-Fiber Insulation: ASTM C665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E136 for combustion characteristics.
- I. Glazing: Comply with requirements in Section 08 80 00, Glazing.
- J. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15 mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.6 FABRICATION

- A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Hollow-Metal Doors
 - 1. Steel-Stiffened Door Cores: Provide minimum thickness 0.026 inch (22 gauge), steel vertical stiffeners of same material as face sheets extending full-door height, with vertical webs spaced not more than 6 inches apart. Spot weld to face sheets no more than 5 inches o.c. Fill spaces between stiffeners with glass- or mineral-fiber insulation.
 - 2. Vertical Edges for Single-Acting Doors: Bevel edges $\frac{1}{8}$ inch in 2 inches.
 - 3. Top Edge Closures: Close top edges of doors with continuous inverted closures, except provide flush closures at exterior doors, of same material as face sheets.
 - 4. Bottom Edge Closures: Close bottom edges of doors with end closures or channels of same material as face sheets.
 - 5. Exterior Doors: Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
- C. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

1. Sidelight Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
3. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
4. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.
5. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate anchors not more than 16 inches from top and bottom of frame. Space anchors not more than 32 inches o.c., to match coursing, and as follows:
 - 1) Two anchors per jamb up to 60 inches high
 - 2) Three anchors per jamb from 60 to 90 inches high
 - 3) Four anchors per jamb from 90 to 120 inches high
 - b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Three anchors per jamb up to 60 inches high
 - 2) Four anchors per jamb from 60 to 90 inches high
 - 3) Five anchors per jamb from 90 to 96 inches high
 - 4) Five anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high
6. Head Anchors: Two anchors per head for frames more than 42 inches wide and mounted in metal-stud partitions
7. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
 - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
 - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
- D. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.
- E. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.
 1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
 2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.
- F. Stops and Moldings: Provide stops and moldings around glazed lites and louvers where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
 1. Provide fixed frame moldings on outside of exterior doors and secure side of interior doors.
 2. Provide fixed frame moldings on secure side of interior frames unless indicated otherwise where profile of frame is designed to allow blinds to pass in front of frame on secure side.
 3. Removable Glazing Stops
 - a. Where indicated, provide removable stops to secure glazing or in-fill panels.
 - b. Removable steel channel glazing stops shall be fabricated from metallic-coated steel sheet (A40 for interior frames, A60 or G60 for exterior openings) not less than 0.032 inch (20 gauge) thick, and butted at corners.
 - c. The frame section underneath the glazing stops and the inside of the glazing stops shall be treated for maximum paint adhesion and painted with a rust inhibitive primer prior to installation in the opening.
 - d. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

2.7 STEEL FINISHES

- A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure

2.8 ACCESSORIES

- A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- B. Grout Guards: Formed from same material as frames, not less than 0.016 inch (26 gauge) thick

3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
- C. Any rusted material shall be sanded and re-primed prior to installation.

3.3 INSTALLATION

- A. General: Install hollow-metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.
- B. Hollow-Metal Frames: Install hollow-metal frames of size and profile indicated. Comply with NAAMM-HMMA 840.
 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
 - b. Install frames with removable stops located on corridor side of opening unless indicated otherwise where profile of frame is designed to allow blinds to pass in front of muntin on secure side.
 - c. Install door silencers in frames before grouting.
 - d. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - e. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - f. Field apply bituminous coating to backs of frames that will be filled with grout containing antifreezing agents.
 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
 3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames.

4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
5. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.
- C. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.
 1. Between Door and Frame Jambs and Head: 1/8 inch plus or minus 1/16 inch
 2. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch
 3. Between Door Face and Stop: 1/16 inch to 1/8 inch plus or minus 1/32 inch
- D. Glazing: Comply with installation requirements in Section 08 80 00, Glazing, and with hollow-metal manufacturer's written instructions.
 1. Secure stops with countersunk flat or oval head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow-metal work immediately after installation.
- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- D. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.
- E. Any damage to frames and doors shall be repaired, replaced, re-primed at no cost to the owner.
- F.

END OF SECTION 08 11 13.16

SECTION 08 14 23.16

PLASTIC-LAMINATE-FACED WOOD DOORS

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, 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 SUMMARY

- A. Section includes solid-core doors with plastic-laminate faces, factory fitting doors to frames, and factory machining doors for hardware.
- B. Related Sections
 - 1. Section 08 11 13.16, Custom Hollow Metal Doors and Frames
 - 2. Section 08 71 00, Door Hardware
 - 3. Section 08 80 00, Glazing
 - 4. Section 09 91 00, Painting

1.3 REFERENCES

- A. Use current editions unless noted otherwise.
- B. American National Standards Institute (ANSI)
 - 1. ANSI 208.1, Particleboard
- C. Builders Hardware Manufacturers Association (BHMA)
 - 1. BHMA A156.115-W, Hardware Preparation in Wood Doors with Wood or Steel Frames
- D. Door and Hardware Institute (DHI)
 - 1. DHI WDHS-3, Recommended Hardware Locations for Wood Flush Doors
- E. National Electrical Manufacturers Association (NEMA)
 - 1. NEMA LD 3, High-Pressure Decorative Laminates (HPDL)
- F. Underwriters Laboratories Inc. (UL)
 - 1. UL 10B, Standard for Fire Tests of Door Assemblies
 - 2. UL 10C, Standard for Positive Pressure Fire Tests of Door Assemblies
- G. Window and Door Manufacturers Association (WDMA)
 - 1. WDMA I.S. 1A, Architectural Wood Flush Doors
- H. Texas Health and Safety Code, Chapter 161, Subchapter Q, Installation of Asbestos
- I. Texas Occupations Code, Chapter 1954, Asbestos Health Protection

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00, Project Management and Coordination.

1.5 ACTION SUBMITTALS

- A. Submit product data for each type of door indicated. Include details of core and edge construction and trim for openings.
- B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.
 - 1. Indicate dimensions and locations of mortises and holes for hardware.
 - 2. Indicate dimensions and locations of cutouts.

- C. Samples for Initial Selection: Submit samples of each color and pattern of plastic laminate available from the plastic laminate manufacturer preferred by the door manufacturer. If, in the opinion of the Architect, the selections available from the preferred manufacturer are not acceptable, the Architect may select plastic laminates from any of the manufacturers listed.

1.6 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty
- B. Submit Material Safety and Data Sheet (MSDS) for all materials, products, and parts.

1.7 QUALITY ASSURANCE

- A. Source Limitations: Obtain doors from single manufacturer.
- B. Quality Standard: In addition to requirements specified, comply with WDMA I.S. 1A.
- C. Fire-Rated Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252, UBC Standard 7-2, UL 10B, UL 10C, or other standard required by and acceptable to authorities having jurisdiction

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package doors individually in plastic bags.
- C. Mark each door with opening number used on Shop Drawings.

1.9 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.10 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Warping (bow, cup, or twist) more than ¼ inch in a 42-by-84-inch section
 - b. Telegraphing of core construction in face veneers
 - 2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
- B. Provide written warranty against defects in material and workmanship for the work of this Section for a period of one year from the Date of Substantial Completion.
- C. Refer to Section 01 77 00, Closeout Procedures, for Warranty form.

2 PRODUCTS**2.1 MANUFACTURERS**

- A. Plastic-Laminate-Faced Doors
 - 1. Algoma Hardwoods, Inc.
 - 2. Eggers Industries
 - 3. Haley Brothers, Inc.
 - 4. Marlite
 - 5. Marshfield Door Systems, Inc.
 - 6. Mesker Openings Group
 - 7. Oshkosh Architectural Door Company
 - 8. VT Industries Inc.
- B. High-Pressure Decorative Laminates
 - 1. Formica Corporation

2. Nevamar Decorative Surfaces
3. Wilsonart International

2.2 DOOR CONSTRUCTION, GENERAL

- A. WDMA I.S.1A Performance Grade: Extra Heavy Duty
- B. Particleboard-Core Doors:
 1. Particleboard: ANSI A208.1, Grade LD-2
 2. Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware.

2.3 PLASTIC-LAMINATE-FACED DOORS

- A. Interior Solid-Core Doors
 1. Grade: Premium
 2. Plastic-Laminate Faces: High-pressure decorative laminates complying with NEMA LD 3, Grade HGS
 3. Colors, Patterns, and Finishes: As selected by the Architect from full range of products from any of the laminate manufacturers listed
 4. Exposed Vertical and Top Edges: Hardwood edges for staining or painting to match surfaces
 5. Core: Particleboard
 6. Construction: Three plies. Stiles and rails are bonded to core, then entire unit abrasive planed before faces are applied. Faces are bonded to core using a hot press.

2.4 LIGHT FRAMES

- A. Metal Frames for Light Openings: Manufacturer's standard frame formed of 0.048 inch thick, cold-rolled steel sheet; factory primed for paint finish; capable of holding ¼" and 1" thick glazing per door schedules; and approved for use in doors of fire-protection rating indicated

2.5 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
- B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, BHMA A156.115-W, and hardware templates.
 1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
- C. Openings: Cut and trim openings through doors in factory.
 1. Light Openings: Trim openings with moldings of material and profile indicated.

3 EXECUTION

3.1 EXAMINATION

- A. Examine doors and installed door frames before hanging doors.
 1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
 2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Hardware: For installation, see Section 08 71 00, Door Hardware.
- B. Installation Instructions: Install doors to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.
- C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

3.3 ADJUSTING

- A. Operation: Rehang or replace doors that do not swing or operate freely.
- B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 08 14 23.16

SECTION 08 41 13

ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, 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 SUMMARY

- A. Section includes all aluminum entrances and storefront systems complete with reinforcing, fasteners, anchors, attachment devices and related hardware (excluding pulls, closers, exit devices, hinges, thresholds, and cylinders) and all manual sliding doors complete with reinforcing, fasteners, anchors, attachment devices and related hardware (excluding cylinders).
- B. Related Requirements
 - 1. Section 04 20 00, Unit Masonry
 - 2. Section 04 43 00, Anchored Stone Masonry Veneer
 - 3. Section 05 40 00, Cold-Formed Metal Framing
 - 4. Section 06 10 53, Miscellaneous Rough Carpentry
 - 5. Section 07 42 42, Composite Wall Panels
 - 6. Section 07 92 00, Joint Sealants
 - 7. Section 08 71 00, Door Hardware
 - 8. Section 08 80 00, Glazing
 - 9. Section 09 22 16, Non-Structural Metal Framing
 - 10. Section 09 29 00, Gypsum Board
 - 11. Section 09 30 13, Tiling

1.3 REFERENCES

- A. Use current editions unless noted otherwise.
- B. Aluminum Association (AA)
 - 1. AA DAF-45, Designation System for Aluminum Finishes
- C. American Architectural Manufacturers Association (AAMA)
 - 1. 501.2, Field Check of Metal Curtain Walls for Water Leakage
 - 2. 607.1, Specifications and Inspection Methods for Clear Anodic Finishes for Architectural Aluminum
 - 3. 611, Specification for Anodized Architectural Aluminum.
 - 4. 701.2, Specifications for Pile Weatherstripping
 - 5. Manual #10, Care and Handling of Architectural Aluminum From Shop to Site
 - 6. AAMA SFM-1, Aluminum Store Front and Entrance Manual (1987)
- D. American National Standards Institute (ANSI)
 - 1. ANSI A117.1-1998, Accessible and Usable Buildings and Facilities
- E. American Society for Testing and Materials (ASTM); current edition
 - 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 B209, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
 - 4. ASTM B221, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
 - 5. ASTM B308/B308M, Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles

6. ASTM C509, Standard Specification for Elastomeric Cellular Preformed Gasket and Sealing Material
7. ASTM C864, Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers
8. ASTM E283, Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure
9. ASTM E330, Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference
10. ASTM E331, Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference
- F. Federal Specifications (FS)
 1. FS TT-P-641G(1), Primer Coating; Zinc Dust-Zinc Oxide (for Galvanized Surfaces)
 2. FS TT-P-645A, Primer, Paint, Zinc Chromate, Alkyd Type
- G. Steel Structures Painting Council (SSPC)
 1. Paint 12, Cold-Applied Asphalt Mastic (Extra Thick Film)
- H. 2010 ADA Standards for Accessible Design (SAD)
- I. 2012 Texas Accessibility Standards (TAS)
- J. Texas Health and Safety Code, Chapter 161, Subchapter Q, Installation of Asbestos
- K. Texas Occupations Code, Chapter 1954, Asbestos Health Protection

1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design internal reinforcing for storefront framing members at exterior openings capable of resisting wind loads and loads imposed by Exterior Sun Control Devices and capable of accommodating Exterior Sun Control Devices fasteners, including comprehensive engineering analysis by a qualified professional engineer registered in the State of Texas, using performance requirements and design criteria indicated herein those included in applicable codes and ordinances.

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00, Project Management and Coordination.

1.6 ACTION SUBMITTALS

- A. Submit product data for each type of product indicated. Include information for factory finishes, hardware, accessories, and other required components.
- B. Shop Drawings
 1. Submit shop drawings covering fabrication, installation and finish of specified systems. Shop drawings shall include fully dimensioned plans and elevations with detail coordination keys.
 2. Submit detailed drawings of composite members, joint connections for framing systems and entrance doors, anchorage, reinforcing, provisions for expansion and contraction, hardware (including locations, mounting heights, reinforcements and special installation provisions), glazing methods and accessories, attachment of Exterior Sun Control Devices and internal reinforcing requirements and recommended types.
 3. Shop drawings (Delegated Design Submittal) shall include analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Samples:
 1. Submit color samples of any sealant required for frame connections.
 2. Submit manufacturers standard samples indicating quality of finish.
 3. Where normal texture or color variations are expected, include additional samples illustrating range of variation.
 4. Submit samples for each type of glass, 12 x 12 inch size.
- D. Submit certified copies of test reports substantiating performance of system. Previous test reports may be submitted in lieu of retesting of standard systems. Include other supportive data as necessary.

- E. Submit manufacturer's certification stating that systems are in compliance with specified requirements.
- F. Submit installer qualifications verifying years of experience.

1.7 INFORMATIONAL SUBMITTALS

- A. Obtain hardware templates from the finish hardware supplier.
- B. Submit Material Safety and Data Sheet (MSDS) for all materials, products, and parts.

1.8 QUALITY ASSURANCE

- A. All system materials shall be obtained from a single specified manufacturer or from manufacturer approved by systems manufacturer.
- B. Installer Qualifications: Certified in writing by system manufacturer as qualified for installation of specified systems.
- C. Refer to drawings and Section 04 20 00, Unit Masonry, for mockup requirements.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Store items in designated locations and protect from weather and damage.
- B. Do not use adhesive papers or sprayed coatings that become firmly bonded when exposed to sun.
- C. Do not leave coating residue on any surfaces.
- D. Replace damaged units.

1.10 WARRANTY

- A. Provide written warranty warranting work to be watertight, free from defective materials, defective workmanship, glass breakage due to defective design, and agreeing to replace components which fail within **two** years of the Date of Substantial Completion of the Project.
- B. Warranty shall include the following items.
 - 1. Complete watertight and airtight system installation within specified tolerances.
 - 2. Completed installation will remain free from rattles, wind whistles and noise due to thermal and structural movement and wind pressure.
 - 3. System is structurally sound and free from distortion.
 - 4. Glass and glazing gaskets will not break or "pop" from frames due to design wind, expansion or contraction movement or structural loading.
 - 5. Glazing sealants and gaskets will remain free from abnormal deterioration or dislocation due to sunlight, weather or oxidation.
- C. Refer to Section 01 77 00, Closeout Procedures, for Warranty form.

2 PRODUCTS

2.1 MANUFACTURERS

- A. Storefronts and Entrance Doors
 - 1. Oldcastle BuildingEnvelope®, Terrell, TX.
 - 2. Amarlite Architectural Products
 - 3. Arcadia, Inc.
 - 4. Columbia Commercial Building Products
 - 5. EFCO Corporation
 - 6. Kawneer Co., Inc.
 - 7. Premier Glass Products
 - 8. Vistawall Architectural Products
 - 9. Tubelite, Inc.
 - 10. YKK AP America, Inc.
- B. Fixed Sidelights
 - 1. Oldcastle BuildingEnvelope®, Terrell, TX.
 - 2. Amarlite Architectural Products

3. Columbia Commercial Building Products
 4. EFCO Corporation
 5. Horton Automatics
 6. Kawneer Co., Inc.
 7. Premier Glass Products
 8. Vistawall Architectural Products
 9. YKK AP America, Inc.
- C. Glass: Refer to Section 08 80 00, Glazing.
- D. Perimeter Sealant: Provided under Section 07 92 00, Joint Sealants.

2.2 MATERIALS

- A. Exterior Entrance Doors: Wide Stile with minimum stile width of 5½ inches, minimum bottom rail height of 10 inches, minimum top rail height of 8 inches, and minimum wall thickness of 3/16" inches and a thickness of 2 inch.
1. Basis of Design: Oldcastle BuildingEnvelope, Rugged Series MS System.
- B. Exterior Storefront Framing System
1. Front set, flush glazed system
 2. Mullion Profile
 - a. 2 inch x 4½ inch to accommodate 1 inch insulated glazing and 1 inch security glazing where scheduled
 3. Furnish and install thermally broken framing at all exterior locations.
 4. Basis of Design: Oldcastle BuildingEnvelope, Series 3000 Thermal Front Set
 5. Finish: Clear Anodized.
- C. Interior Entrance Doors: Wide Stile with minimum stile width of 5½ inches, minimum bottom rail height of 10 inches, minimum top rail height of 8 inches, and minimum wall thickness of 3/16" inches and a thickness of 1¾ inch.
1. Basis of Design: Oldcastle BuildingEnvelope, Rugged Series.
- D. Interior Storefront Framing System
1. Front set, flush glazed system
 2. Mullion Profile
 - a. 2 inch x 4½ inch to accommodate ¼ inch glazing and 7/16 inch security glazing where scheduled.
 3. Furnish and install thermally broken framing at all exterior locations.
 4. Basis of Design: Oldcastle BuildingEnvelope, Series 2000 Flush Glazed System, center Set, exterior loaded.
- E. Framing Materials and Accessories
1. Aluminum
 - a. ASTM B221, alloy 6063-T5 for extrusions; ASTM B209, alloy 5005-H16 for sheets; or other alloys and temper recommended by manufacturer appropriate for specified finish
 - b. Minimum thickness of 0.125 inch for framing members and rails, 0.090 inch for sheets, and 0.050 inch for glazing stops and similar components
 2. Internal Reinforcing
 - a. ASTM A36 for carbon steel or ASTM B308 for structural aluminum
 - b. Shapes and sizes to suit installation
 - c. Steel components factory coated with alkylid type zinc chromate primer complying with FS TT-P-645, applied after fabrication
 3. Anchorage Devices
 - a. Manufacturer's standard formed or fabricated steel or aluminum assemblies of shapes, plates, bars or tubes
 - b. Hot-dip galvanize steel assemblies after fabrication, comply with ASTM A123, 2.0 oz. minimum coating
 4. Fasteners
 - a. Aluminum, non-magnetic stainless steel or other non-corrosive materials compatible with items being fastened
 - b. Provide concealed fasteners wherever possible.

- c. For exposed locations, provide Phillips flathead screws with finish matching item fastened.
- d. For concealed locations, provide manufacturer's standard fasteners.
- 5. Expansion Anchor Devices: Lead-shield or toothed steel, drilled-in, expansion bolt anchors
- 6. Protective Coatings: Cold-applied asphalt mastic complying with SSPC-Paint 12, compounded for 30 mil thickness for each coat; or alkyd type zinc chromate primer complying with FS TT-P-645
- 7. Touch-Up Primer for Galvanized Components: Zinc oxide conforming with FS TT-P-641
- 8. Glazing Gaskets
 - a. Compression type design, replaceable, molded or extruded, of neoprene, polyvinyl chloride (PVC), or ethylene propylene diene monomer (EPDM) conforming to ASTM C509 or C864
 - b. Profile and hardness as required to maintain uniform pressure for watertight seal
- 9. Weatherstripping
 - a. Wool pile conforming to AAMA 701.2; or extruded elastomeric conforming to ASTM C509 or ASTM C864
 - b. Provide EPDM or vinyl-blade gasket weatherstripping in bottom door rail, adjustable for contact with threshold.
- 10. Internal Sealants and Baffles: Types recommended by systems manufacturer

2.3 FABRICATION

- A. Coordination of Fabrication
 - 1. Check actual frame or door openings required in construction work by accurate field measurements before fabrication.
 - 2. Fabricate units to withstand a minimum wind load of 20 pounds per square foot.
- B. General
 - 1. Conceal fasteners wherever possible.
 - 2. Reinforce work as necessary for performance requirements, and for support to structure.
 - 3. Separate dissimilar metals and aluminum in contact with concrete utilizing protective coating or preformed separators that will prevent contact and corrosion.
 - 4. Comply with Section 08810, Glass and Glazing for glazing requirements.
- C. Aluminum Framing
 - 1. Provide members of size, shape and profile indicated, designed to provide for glazing from interior.
 - 2. Fabricate frame assemblies with joints straight and tight fitting.
 - 3. Reinforce internally with structural members as necessary to support design loads.
 - 4. Maintain accurate relation of planes and angles with hairline fit of contacting members.
 - 5. Seal horizontals and direct moisture accumulation to exterior.
 - 6. Provide flashings and other materials used internally or externally that are corrosive resistant, non-staining, non-bleeding and compatible with adjoining materials.
 - 7. Provide manufacturer's extrusions and accessories to accommodate expansion and contraction due to temperature changes without detriment to appearance or performance.
 - 8. Make provisions in framing for minimum edge clearance, nominal edge cover and nominal pocket width for thickness and type of glazing or infill used in accordance with recommendations of manufacturer and FGMA Glazing Manual.
- D. Entrance Doors
 - 1. Fabricate with mechanical joints using internal reinforcing plates and shear blocks attached with fasteners and by welding.
 - 2. Provide extruded aluminum glazing stops of square design, permanently anchored on security side and removable on opposite side.
- E. Hardware
 - 1. Receive hardware supplied under Section 08 71 00, Door Hardware and install in accordance with requirements of this Section.
 - 2. Cut, reinforce, drill and tap frames and doors as required to receive hardware.
 - 3. Comply with hardware manufacturer's templates and instructions.

4. Use concealed fasteners wherever possible.
- F. Welding
 1. Comply with recommendations of the American Welding Society.
 2. Use recommended electrodes and methods to avoid distortion and discoloration.
 3. Grind exposed welds smooth and flush with adjacent surfaces; restore mechanical finish.
- G. Flashings: Form from sheet aluminum with same finish as extruded sections. Apply finish after fabrication. Material thickness as required to suit condition without deflection or "oilcanning".

2.4 FINISHES

- A. Clear Anodized
 1. Conforming to AA-M12C22A31 and AAMA 611.
 2. Architectural Class II, etched, medium matte, clear anodic coating, 0.4 mil minimum thickness.

3 EXECUTION

3.1 INSTALLATION

- A. Erection Tolerances
 1. Limit variations from plumb and level:
 - a. $\frac{1}{8}$ inch in 10'-0" vertically
 - b. $\frac{1}{8}$ inch in 20'-0" horizontally
 2. Limit variations from theoretical locations: $\frac{1}{4}$ inch for any member at any location.
 3. Limit offsets in theoretical end-to-end and edge-to-edge alignment: $\frac{1}{16}$ inch from flush surfaces not more than 2 inches apart or out-of-flush by more than $\frac{1}{4}$ inch.
- B. Install doors and hardware in accordance with manufacturer's printed instructions.
- C. Set units plumb, level and true to line, without warp or rack of frame.
- D. Anchor securely in place, allowing for required movement, including expansion and contraction.
- E. Separate dissimilar materials at contact points, including metal in contact with masonry or concrete surfaces, with bituminous paint or preformed separators to prevent contact and corrosion.
- F. Set sill members in bed of sealant. Set other members with internal sealants and baffles to provide weathertight construction.
- G. Coordinate installation of perimeter sealant and backing materials between assemblies and adjacent construction in accordance with requirements of Section 07 92 00, Joint Sealants.
- H. Glazing: Refer to requirements of Section 08 80 00, Glazing.

3.2 ADJUSTING

- A. Test door operating functions. Adjust closing and latching speeds and other hardware in accordance with manufacturer's instructions to ensure smooth operation.

3.3 CLEANING

- A. Clean surfaces in compliance with manufacturer's recommendations; remove excess mastic, mastic smears, foreign materials and other unsightly marks.
- B. Clean metal surfaces exercising care to avoid damage.

END OF SECTION 08 41 13

SECTION 08 44 13

GLAZED ALUMINUM CURTAIN WALLS

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, Instructions to Bidders, for substitution of materials and products.

1.2 SUMMARY

- A. Section includes conventionally glazed aluminum curtain walls installed as stick assemblies.
- B. Related Requirements
 - 1. Section 04 20 00, Unit Masonry
 - 2. Section 04 43 00, Anchored Stone Masonry Veneer
 - 3. Section 04 43 13.16, Adhered Stone Masonry Veneer
 - 4. Section 05 40 00, Cold-Formed Metal Framing
 - 5. Section 06 10 53, Miscellaneous Rough Carpentry
 - 6. Section 07 42 43, Composite Wall Panels
 - 7. Section 08 71 00, Door Hardware
 - 8. Section 08 41 13, Aluminum-Framed Entrances and Storefronts
 - 9. Section 08 80 00, Glazing
 - 10. Section 09 22 16, Non-Structural Metal Framing
 - 11. Section 09 29 00, Gypsum Board
 - 12. Section 10 71 13, Exterior Sun Control Devices

1.3 REFERENCES

- A. Use current editions unless noted otherwise.
- B. American Architectural Manufacturers Association (AAMA)
 - 1. AAMA 501.1, Standard Test Method for Water Penetration of Windows, Curtain Walls and Doors Using Dynamic Pressure
 - 2. AAMA 501.2, Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems
 - 3. AAMA 611, Voluntary Specification for Anodized Architectural Aluminum
- C. American Welding Society (AWS)
 - 1. AWS A5.10/A5.10M, Specification for Bare Aluminum and Aluminum-Alloy Welding Electrodes and Rods
- D. ASTM International (ASTM)
 - 1. ASTM A36 / A36M, Standard Specification for Carbon Structural Steel
 - 2. ASTM A1008 / A1008M, Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
 - 3. ASTM A1011 / A1011M, Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
 - 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 B308 / B308M, Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles
 - 7. ASTM B429 / B429M, Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube

8. ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials
9. ASTM E90, Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
10. ASTM E283, Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
11. ASTM E330, Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
12. ASTM E331, Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
13. ASTM E783, Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors
14. ASTM E1332, Standard Classification for Rating Outdoor-Indoor Sound Attenuation
- E. National Fenestration Rating Council, Inc. (NFRC)
 1. NFRC 100, Procedure for Determining Fenestration Product U-factors
 2. NFRC 200, Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence
 3. NFRC 500, Procedure for Determining Fenestration Product Condensation Resistance Values
- F. Society for Protective Coatings (SSPC)
 1. SSPC Paint 12, Cold Applied Asphalt Mastic Paint (Extra Thick Film)
 2. SSPC-PS Guide 12.00, Guide to Zinc-Rich Coating Systems
 3. SSPC-SP COM, Surface Preparation Commentary for Steel and Concrete Substrates
- G. 2010 ADA Standards for Accessible Design (SAD)
- H. 2012 Texas Accessibility Standards (TAS)
- I. Texas Health and Safety Code, Chapter 161, Subchapter Q, Installation of Asbestos
- J. Texas Occupations Code, Chapter 1954, Asbestos Health Protection

1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design glazed aluminum curtain walls framing members and internal reinforcing at exterior openings capable of resisting wind loads and loads imposed by Exterior Sun Control Devices and capable of accommodating Exterior Sun Control Devices fasteners, including comprehensive engineering analysis by a qualified professional engineer registered in the State of Texas, using performance requirements and design criteria indicated herein, and those included in applicable codes and ordinances.

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00, Project Management and Coordination.

1.6 ACTION SUBMITTALS

- A. Submit product data for each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Submit shop drawings for glazed aluminum curtain walls. Include plans, elevations, sections, full-size details, and attachments to other work.
 1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
 2. Include full-size isometric details of each vertical-to-horizontal intersection of glazed aluminum curtain walls, showing joinery (including concealed welds), anchorage, expansion provisions, glazing, attachment of Exterior Sun Control Devices, and flashing and drainage.
- C. Submit product test reports based on evaluation of comprehensive tests performed by a qualified preconstruction testing agency, for glazed aluminum curtain walls, indicating compliance with performance requirements.
- D. Delegated-Design Submittal: Submit for glazed aluminum curtain walls indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

- E. Submit copies to exterior sun control devices manufacturer and installer.

1.7 INFORMATIONAL SUBMITTALS

- A. Submit Material Safety and Data Sheet (MSDS) for all materials, products, and parts.

1.8 CLOSEOUT SUBMITTALS

- A. Submit maintenance data for glazed aluminum curtain walls to include in maintenance manuals.

1.9 QUALITY ASSURANCE

- A. Manufacturer shall be capable of fabricating glazed aluminum curtain walls that meet or exceed energy performance requirements indicated and of documenting this performance by certification, labeling, and inclusion in lists.
- B. Installer shall be manufacturer's authorized representative that is trained and approved for installation of units required for this Project and shall have not less than five years experience in the installation of glazed aluminum curtain walls similar to the systems specified herein.
- C. Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Do not revise intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If revisions are proposed, submit comprehensive explanatory data to Architect for review.
- D. Energy Performance Standards: Comply with NFRC for minimum standards of energy performance, materials, components, accessories, and fabrication. Comply with more stringent requirements if indicated.

1.10 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of structural supports for glazed aluminum curtain walls by field measurements before fabrication and indicate measurements on Shop Drawings.

1.11 WARRANTY

- A. Submit standard form special assembly warranty in which manufacturer agrees to repair or replace components of glazed aluminum curtain walls that do not comply with requirements or that fail in materials or workmanship within **two** years of the date of Substantial Completion. Failures include, but are not limited to, the following:
 - 1. Structural failures including, but not limited to, excessive deflection
 - 2. Noise or vibration created by wind and thermal and structural movements
 - a. Deterioration of metals, metal finishes, and other materials beyond normal weathering
 - b. Water penetration through fixed glazing and framing areas
 - c. Failure of operating components
- B. Provide installers written warranty against defects in material and workmanship for the work of this Section for a period of **two** years from the Date of Substantial Completion. Refer to Section 01 77 00, Closeout Procedures, for Warranty form.

2 PRODUCTS

2.1 MANUFACTURERS

- A. Aluminum Curtain Wall
 - 1. Arch Aluminum & Glass Co., Inc.
 - 2. EFCO Corporation
 - 3. Kawneer North America; an Alcoa company
 - 4. Oldcastle BuildingEnvelope®, Terrell, TX.
 - 5. United States Aluminum
 - 6. YKK AP America Inc.

2.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Comply with performance requirements specified, as determined by testing of manufacturer's standard glazed aluminum curtain walls representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
 - 1. Glazed aluminum curtain walls shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
 - 2. Failure also includes the following:
 - a. Thermal stresses transferring to building structure
 - b. Glass breakage
 - c. Noise or vibration created by wind and thermal and structural movements
 - d. Loosening or weakening of fasteners, attachments, and other components
- B. Delegated Design: Design glazed aluminum curtain walls, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- C. Structural Loads
 - 1. Wind Loads
 - a. Ultimate Design Wind Speed, V_{ult} (3 second gust): 150 mph
 - b. Nominal Design Wind Speed, V_{asd} (3 second gust): 117 mph
 - c. Risk Category: III
 - d. Exposure Factor: C
 - e. Internal Pressure Coefficient, GC_{pi} : ± 0.18
- D. Structural-Test Performance: Test according to ASTM E330 as follows:
 - 1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
 - 2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
 - 3. Test Durations: As required by design wind velocity, but not less than 10 seconds.
- E. Deflection of Framing Members: At design wind pressure, as follows:
 - 1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane not exceeding $L/175$ of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to $\frac{3}{4}$ inch, whichever is less.
 - 2. Deflection Parallel to Glazing Plane: Limited to $L/360$ of clear span or $\frac{1}{8}$ inch, whichever is smaller and an amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than $\frac{1}{8}$ inch.
 - a. Operable Units: Provide a minimum $1/16$ inch clearance between framing members and operable units.
 - 3. Cantilever Deflection: Where framing members overhang an anchor point, limit deflection to two times the length of cantilevered member, divided by 175.
- F. Water Penetration under Static Pressure: No evidence of water penetration through fixed glazing and framing areas when tested according to ASTM E331 at a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 12 lbf/sq. ft.
- G. Water Penetration under Dynamic Pressure: No evidence of water penetration through fixed glazing and framing areas when tested according to AAMA 501.1 at dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 12 lbf/sq. ft.
- H. Thermal Movements: Allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures:
 - 1. Temperature Change (Range): 120° F, ambient; 180° F, material surfaces
 - 2. Test Interior Ambient-Air Temperature: 75° F
- I. Energy Performance: Glazed aluminum curtain walls shall have certified and labeled energy performance ratings in accordance with NFRC.

1. Thermal Transmittance (U-factor): Fixed glazing and framing areas shall have U-factor of not more than 0.66 Btu/sq. ft. x h x deg F as determined according to NFRC 100.
2. Air Infiltration: Maximum air leakage through fixed glazing and framing areas of 0.30 cfm/sq. ft. of fixed wall area as determined according to ASTM E283 at a minimum static-air-pressure differential of 6.24 lbf/sq. ft.
1. Condensation Resistance: When tested to AAMA Specification 1503, the condensation resistance factor shall not be less than 71_{frame} and 71_{glass} (HP glass).
- J. Sound Transmission: Provide glazed aluminum curtain walls with fixed glazing and framing areas having the following sound-transmission characteristics:
 1. Outdoor-Indoor Transmission Class: Minimum 26 when tested for laboratory sound transmission loss according to ASTM E90 and determined by ASTM E1332.

2.3 MATERIALS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Oldcastle BuildingEnvelope; Reliance LT (2 inches x 7 1/4 inches as indicated on the drawings) and Reliance (2 1/2 inches x 10 1/8 inches as indicated in drawings) or comparable product by one of the listed manufacturers.
- B. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated
 1. Sheet and Plate: ASTM B209
 2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221
 3. Extruded Structural Pipe and Tubes: ASTM B429
 4. Structural Profiles: ASTM B308/B308M
 5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M
- C. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.
 1. Structural Shapes, Plates, and Bars: ASTM A36/A36M
 2. Cold-Rolled Sheet and Strip: ASTM A1008/A1008M
 3. Hot-Rolled Sheet and Strip: ASTM A1011/A1011M

2.4 FRAMING

- A. Framing Members: Manufacturer's standard extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
 1. Construction: Nonthermal
 2. Glazing System: Retained mechanically with gaskets on four sides
 3. Glazing Plane: Front
- B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components
- C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials
 1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
 2. Series 300 stainless steel for exposed locations. Cadmium plated steel with 0.0005 inch plating thickness and color chromate coated for concealed locations.
 3. Provide nuts or washers of design having the means to prevent disengagement; deforming of fastener threads is not acceptable.
 4. Reinforce members as required to receive fastener threads.
 5. For exposed locations, provide countersunk flathead fasteners with finish matching item fastened.
- D. Anchors: Three-way adjustable anchors that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.
- E. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials
- F. Framing Sealants: Manufacturer's standard sealants

2.5 GLAZING

- A. Glazing: Comply with Section 08 80 00, Glazing & 08 85 53, Security Glazing
- B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers
- C. Glazing Sealants: As recommended by manufacturer

2.6 ACCESSORY MATERIALS

- A. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30 mil thickness per coat; or alkyd type zinc chromate primer complying with FS TT-P-645.

2.7 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- C. Fabricate components that, when assembled, have the following characteristics:
 - 1. Profiles that are sharp, straight, and free of defects or deformations
 - 2. Accurately fitted joints with ends coped or mitered
 - 3. Physical and thermal isolation of glazing from framing members
 - 4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances
 - 5. Provisions for field replacement of glazing from exterior
 - 6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible
- D. Fabricate components that, when assembled, have internal guttering system or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.
- E. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.8 ALUMINUM FINISHES

- A. Clear Anodized:
 - 1. Conforming to AA-M12C22A31 and AAMA 611.
 - 2. Architectural Class I, etched, medium matte, clear anodic coating, 0.7 mil minimum thickness.

3 EXECUTION**3.1 EXAMINATION**

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General
 - 1. Comply with manufacturer's written instructions.
 - 2. Do not install damaged components.
 - 3. Fit joints to produce hairline joints free of burrs and distortion.
 - 4. Rigidly secure nonmovement joints.
 - 5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
 - 6. Seal joints watertight unless otherwise indicated.
- B. Metal Protection:

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape or installing nonconductive spacers as recommended by manufacturer for this purpose.
2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.
- D. Install components plumb and true in alignment with established lines and grades.
- E. Install glazing as specified in Section 08 80 00, Glazing.

3.3 ERECTION TOLERANCES

- A. Erection Tolerances: Install glazed aluminum curtain walls to comply with the following maximum tolerances:
 1. Plumb: $\frac{1}{8}$ inch in 10 feet; $\frac{1}{4}$ inch in 40 feet
 2. Level: $\frac{1}{8}$ inch in 20 feet; $\frac{1}{4}$ inch in 40 feet
 3. Alignment
 - a. Where surfaces abut in line or are separated by reveal or protruding element up to $\frac{1}{2}$ inch wide, limit offset from true alignment to $\frac{1}{16}$ inch.
 - b. Where surfaces are separated by reveal or protruding element from $\frac{1}{2}$ to 1 inch wide, limit offset from true alignment to $\frac{1}{8}$ inch.
 - c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to $\frac{1}{4}$ inch.
 4. Location: Limit variation from plane to $\frac{1}{8}$ inch in 12 feet; $\frac{1}{2}$ inch over total length.

3.4 FIELD QUALITY CONTROL

- A. Testing Services: Testing and inspecting of representative areas of glazed aluminum curtain walls shall take place as installation proceeds to determine compliance of installed assemblies with specified requirements.
 1. Air Infiltration: Areas shall be tested for air leakage of 1.5 times the rate specified for laboratory testing in "Performance Requirements" Article, but not more than 0.50 cfm/sq. ft., of fixed wall area when tested according to ASTM E783 at a minimum static-air-pressure differential of 6.24 lbf/sq. ft.
 - a. Test Area: One bay wide, but not less than 30 feet, by one story of glazed aluminum curtain wall
 - b. Perform a minimum of two tests in areas as directed by Architect.
 2. Water Spray Test: Before installation of interior finishes has begun, areas designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.
 - a. Test Area: A minimum area of 75 feet by one story of glazed aluminum curtain wall
- B. Glazed aluminum curtain walls will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.5 CLEANING

- A. Repair or replace damaged installed products.
- B. Clean install products in accordance with manufacturer's instructions prior to acceptance.
- C. Remove construction debris from site and legally dispose of debris.

3.6 PROTECTION

- A. Protect installed product's finish surfaces from damage during construction.
- B. Protect aluminum curtain wall system from damage from grinding and polishing compounds, lime, acid, cement, or other harmful contaminants.

END OF SECTION 08 44 13

SECTION 08 56 19

INTERIOR TRANSACTION WINDOWS

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, 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 SUMMARY

- A. Section includes self-closing sliding transaction windows complete with reinforcing, fasteners, anchors, attachment devices and related hardware (excluding pulls, closers, exit devices, hinges, thresholds, and cylinders).
- B. Related Requirements
 - 1. Section 05 40 00, Cold-Formed Metal Framing
 - 2. Section 06 10 53, Miscellaneous Rough Carpentry
 - 3. Section 08 71 00, Door Hardware
 - 4. Section 08 80 00, Glazing
 - 5. Section 09 22 16, Non-Structural Metal Framing
 - 6. Section 09 29 00, Gypsum Board

1.3 REFERENCES

- A. American National Standards Institute (ANSI):
 - 1. ANSI Z97.1 – American National Standard for Glazing Materials Used in Buildings – Safety Performance Specifications and Methods of Test.
- B. American Society for Testing and Materials (ASTM):
 - 1. ASTM A36/A36M – Standard Specification for Carbon Structural Steel.
 - 2. ASTM A307 – Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
 - 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 A666 – Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
 - 5. ASTM B221/B221M – Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
 - 6. ASTM C1036 – Standard Specification for Flat Glass.
 - 7. ASTM C1048 – Standard Specification for Heat-Treated Flat Glass-Kind HS, Kind FT Coated and Uncoated Glass.
 - 8. ASTM D790 – Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
 - 9. ASTM D1929 – Standard Test Method for Determining Ignition Temperature of Plastics.
 - 10. ASTM E2188 – Standard Test Method for Insulating Glass Unit Performance.
 - 11. ASTM E2189 – Standard Test Method for Testing Resistance to Fogging in Insulating Glass Units.
 - 12. ASTM E2190 – Standard Specification for Insulating Glass Unit Performance and Evaluation.
 - 13. ASTM F588 – Standard Test Methods for Resistance of Window Assemblies to Forced Entry Excluding Glazing.
 - 14. ASTM F2329 – Standard Specification for Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners.

- C. American Architectural Manufacturers Association:
 - 1. AAMA 611 – Voluntary Specification for Anodized Architectural Aluminum.
 - 2. AAMA 2603 – Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
- D. American Society Mechanical Engineers Standards:
 - 1. ASME SA-240/SA-240M – Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
- E. National Fire Protection Association (NFPA):
 - 1. NFPA 80 – Fire Doors and Windows.
 - 2. NFPA 252 – Fire Tests of Door Assemblies.
 - 3. NFPA 257 – Fire Tests of Window Assemblies.

1.4 PERFORMANCE REQUIREMENTS

- A. Requirements apply simultaneously through the most adverse conditions of each exterior application.
 - 1. Thermal Movement at Exterior Systems: Provide for noiseless expansion and contraction of all materials and assemblies due to temperature changes in a range between 10°F and 180°F, without detriment to appearance or performance.
 - 2. Water Infiltration at Exterior Systems: Drain water entering at joints and condensation occurring within the wall construction to the exterior face of the wall. Allow no uncontrolled water other than condensation on the interior face of the wall.
 - 3. Air Filtration at Exterior Locations: Limit air leakage to maximum 0.005 CFM/SF at 6.24 PSF.

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00, Project Management and Coordination.

1.6 ACTION SUBMITTALS

- A. Submit product data for each type of product indicated. Include information for factory finishes, hardware, accessories, and other required components.
- B. Shop Drawings
 - 1. Submit shop drawings covering fabrication, installation and finish of specified systems. Shop drawings shall include fully dimensioned plans and elevations with detail coordination keys.
 - a. Show profiles, sizes, spacing and locations of assembled components.
 - b. Show details of shop fabrications, connections and details.
 - c. Show details of field fabrications, connections and details.
- C. Samples:
 - 1. Submit color samples of any sealant required for frame connections.
 - 2. Submit manufacturers standard samples indicating quality of finish.
 - 3. Where normal texture or color variations are expected, include additional samples illustrating range of variation.
 - 4. Submit samples for frame and type of glass, 12 x 12 inch size.
- D. Submit installer qualifications verifying years of experience.

1.7 INFORMATIONAL SUBMITTALS

- A. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
 - 1. Installation details submitted for review shall be specific to the Work of this Contract and accurately depict interface within the assembly(s) indicated on the Drawings.
 - 2. Generic details that do not depict actual conditions shall not be acceptable. Submit manufacturer's certification stating that systems are in compliance with specified requirements.
- B. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
 - 1. Include recommended cleaning products and instructions for use.

2. Where applicable, provide recommended maintenance schedules and procedures.

1.8 QUALITY ASSURANCE

- A. Provide aluminum framing systems and windows from one source and supplied by a single manufacturer.
- B. Installer Qualifications: Certified in writing by system manufacturer as qualified for installation of specified systems.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Store items in designated locations and protect from weather and damage.
- B. Do not use adhesive papers or sprayed coatings that become firmly bonded when exposed to sun.
- C. Do not leave coating residue on any surfaces.
- D. Replace damaged units.

1.10 WARRANTY

- A. Warranty the Work specified herein for five (5) years against becoming unserviceable or causing an objectionable appearance, resulting from either defective or nonconforming materials and workmanship.
- B. Defects shall include, but not be limited to, the following:
 1. Operational issues that preclude smooth operation and functioning
 2. Noticeable deterioration of finish..
- C. Refer to Section 01 77 00, Closeout Procedures, for Warranty form.

2 PRODUCTS

2.1 MANUFACTURERS

- A. Design of special function windows is based on products manufactured by QuickServ Corp.
- B. Acceptable Manufacturers: The following manufacturers are acceptable. To provide alternate for this Section, all proposed products must meet or exceed the specified requirements.
 1. C.R. Lawrence
 2. QuickServ Corp.

2.2 MATERIALS

- A. Aluminum Extrusions: ASTM B221/B221M. Provide alloy and temper recommended by manufacturer for strength, corrosion resistance, and application of required finish, but not less than 22,000-psi ultimate tensile strength and not less than 0.125 inch thick at any location for main frame and sash members.
- B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- C. Metallic-Coated Steel Sheet:
 1. ASTM A653/A653M, CS (Commercial Steel), Type B; with G90 (Z275) zinc (galvanized) coating designation.
 2. AMS5511, steel, corrosion-resistant, sheet, strip, and plate, 19Cr - 9.5Ni (304L), solution heat treated.
 3. AMS5513, steel, corrosion-resistant, sheet, strip, and plate 19cr 9.2Ni (SAE 30304) solution heat treated.
- D. Stainless Steel Sheet, Strip, Plate, and Flat Bars:
 1. ASTM A666, austenitic stainless steel, Type 304, stretcher-leveled standard of flatness.
 2. ASME SA-240/SA-240M, chromium and chromium-nickel stainless steel plate, sheet, and strip for general applications.
- E. Concealed Bolts: ASTM A307, Grade A unless otherwise indicated.
- F. Embedded Plate Anchors: Fabricated from steel shapes and plates, minimum 3/16 inch (4.8 mm) thick; with minimum 1/2-inch- (12.7-mm-) diameter, headed studs welded to back of plate.

- G. Welding Rods and Bare Electrodes: Select according to AWS Specifications for metal alloy welded.
- H. Sealants: For sealants required within fabricated security windows, provide type recommended by manufacturer for joint size and movement.
 - 1. Sealant shall remain permanently elastic, non-shrinking, and non-migrating.
- I. Gaskets: For gaskets required within fabricated security windows, provide type recommended by manufacturer for joint size and movement. Gaskets shall remain permanently elastic, non-shrinking, and non-migrating.
- J. Inserts and Anchorage Devices:
 - 1. Manufacturer's standard formed or fabricated assemblies, steel or aluminum, of shapes, plates, bars or tubes.
 - 2. Provide all anchoring angles, plates, fasteners and accessories required for secure attachment to adjacent Work.
- K. Fasteners:
 - 1. Non-magnetic stainless steel or cadmium plated steel coated with yellow or silver iridescence plating, compatible with materials being fastened.
 - 2. Provide series 300 stainless steel for exposed locations.
 - 3. Provide cadmium plated steel with 0.0005 inch plating thickness and color chromate coated for concealed locations.
 - 4. Provide concealed fasteners wherever possible.
 - 5. For exposed locations, provide countersunk flathead fasteners with finish matching item fastened.
 - 6. Finish of sub-sill flashing shall match frame finish.
- L. Miscellaneous Materials:
 - 1. Provide material isolators at all dissimilar metals in contact with aluminum framing components.

2.3 FABRICATION

- A. Design of sliding transaction windows is based on QuickServ Self-Closing (SC-4030) series sliding window.
- B. Nominal Size:
 - 1. 48" w x 36" h
- C. Frames: Nominal 4-1/2" aluminum frame modules shall be constructed of 6063-T5 extruded aluminum.
 - 1. Replacement and servicing of glass shall be from the clerk side of the window by means of an access panel in the top header and does not require the removal of the frame from the opening.
- D. Glass Type G-1: Fully Tempered Clear Glass:
 - 1. 1/4" thick.
 - 2. Complying with ASTM C1048, Type 1, Class 1 (clear), Quality 3, Kind FT.
 - 3. Clear.
- E. Operation:
 - 1. Self-closing with hold open feature
 - 2. Track System: Top-hung ball bearing system providing smooth operation of operable window.
- F. Provide keyed lock.

2.4 FINISHES

- A. Clear Anodized
 - 1. Conforming to AA-M12C22A44 and AAMA 606.1 and 608.1.

3 EXECUTION

3.1 INSTALLATION

- A. Install all transaction windows in strict accordance with the manufacturer's installation standards and recommendations.
- B. Upon completion of installation, thoroughly test all functions of the window to verify proper operation.
- C. Windows are designed to be mounted with a cased opening of a larger aluminum and glass window system.
- D. Coordinate with glazing contractor as required to provide rough opening as required for proper installation of, and interface with transaction window; including anchoring of transaction window.
- E. Protect all windows during and after installation from marring, blemishes, scratches and damage due to incidental adjacent Work.
- F. If damaged, make all necessary repairs or replacements in accordance with the manufacturer's recommendations and as directed by the Architect.

3.2 ADJUSTING

- A. Test door operating functions. Adjust closing and latching speeds and other hardware in accordance with manufacturer's instructions to ensure smooth operation.

3.3 CLEANING

- A. Clean surfaces in compliance with manufacturer's recommendations; remove excess mastic, mastic smears, foreign materials and other unsightly marks.
- B. Clean metal surfaces exercising care to avoid damage.

END OF SECTION 08 56 19

SECTION 087100 – DOOR HARDWARE

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 includes commercial door hardware for the following:
 - 1. Swinging doors.
 - 2. Other doors to the extent indicated.
- B. Door hardware includes, but is not necessarily limited to, the following:
 - 1. Mechanical door hardware.
 - 2. Electromechanical door hardware.
 - 3. Cylinders specified for doors in other sections.
- C. Related Sections:
 - 1. Division 08 Section "Door Hardware Schedule".
 - 2. Division 08 Section "Hollow Metal Doors and Frames".
 - 3. Division 08 Section "Interior Aluminum Doors and Frames".
 - 4. Division 08 Section "Plastic Laminate Faced Wood Doors".
- D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
 - 1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
 - 2. ICC/IBC - International Building Code.
 - 3. NFPA 70 - National Electrical Code.
 - 4. NFPA 80 - Fire Doors and Windows.
 - 5. NFPA 101 - Life Safety Code.
 - 6. NFPA 105 - Installation of Smoke Door Assemblies.
 - 7. State Building Codes, Local Amendments.
- E. Standards: All hardware specified herein shall comply with the following industry standards:
 - 1. ANSI/BHMA Certified Product Standards - A156 Series
 - 2. UL10C – Positive Pressure Fire Tests of Door Assemblies

1.3 SUBMITTALS

- A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.
- B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 - 1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
 - 2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
 - 3. Content: Include the following information:
 - a. Type, style, function, size, label, hand, and finish of each door hardware item.
 - b. Manufacturer of each item.
 - c. Fastenings and other pertinent information.
 - d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
 - e. Explanation of abbreviations, symbols, and codes contained in schedule.
 - f. Mounting locations for door hardware.
 - g. Door and frame sizes and materials.
 - h. Warranty information for each product.
 - 4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.
- C. Shop Drawings: Details of electrified access control hardware indicating the following:
 - 1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:

- a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
 - b. Complete (risers, point-to-point) access control system block wiring diagrams.
 - c. Wiring instructions for each electronic component scheduled herein.
2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.
- D. Proof of Certification: Provide copy of manufacturer(s) official certification or accreditation document indicating proof of status as a qualified installer of Windstorm assemblies.
- E. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.
- F. Informational Submittals:
 1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.
- G. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Submittals.

1.4 QUALITY ASSURANCE

- A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.
- B. Installer Qualifications: A minimum 3 years documented experience hardware 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. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the

Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

- D. Integrated Wiegand, Wireless, and IP-Enabled Access Control Products Supplier Qualifications: Integrated access control products and accessories are required to be supplied and installed through current members of the ASSA ABLOY "Authorized Channel Partner" (ACP) and "Certified Integrator" (CI) programs. Suppliers are to be factory trained, certified prior to project bid, and a direct purchaser of the specified product. Installers are to be factory trained, certified prior to project bid, and are responsible for commissioning, servicing, and warranting the installed equipment specified for the project.
- E. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.
 - 1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
 - 2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated
- F. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.
- G. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:
 - 1. Function of building, purpose of each area and degree of security required.
 - 2. Plans for existing and future key system expansion.
 - 3. Requirements for key control storage and software.
 - 4. Installation of permanent keys, cylinder cores and software.
 - 5. Address and requirements for delivery of keys.
- H. **Pre-Submittal Conference:** Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Owner, Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.
 - 1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
 - 2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
 - 3. Review sequence of operation narratives for each unique access controlled opening.

4. Review and finalize construction schedule and verify availability of materials.
5. Review the required inspecting, testing, commissioning, and demonstration procedures

- I. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site.
- B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
- C. Deliver, as applicable, permanent keys, cylinders, cores and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.6 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.
- B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.
- C. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.7 WARRANTY

- A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

- B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
 - 1. Structural failures including excessive deflection, cracking, or breakage.
 - 2. Faulty operation of the hardware.
 - 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 4. Electrical component defects and failures within the systems operation.
- C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.
- D. Warranty Periods:
 - 1. 10 years mortise locks and latches.
 - 2. Five years for exit hardware.
 - 3. 7 years on cylindrical locks.
 - 4. 5 year for electric latch retraction exit motors
 - 5. Twenty five years for manual surface door closer bodies.
 - 6. Two years for electromechanical door hardware.

1.8 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

1.9 OWNER STOCK – Provide the following:

20 Construction Cores

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.
- B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:

- C. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.
- D. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 HANGING DEVICES

- A. Hinges: ANSI/BHMA A156.1 certified butt hinges with number of hinge knuckles as specified in the Door Hardware Sets.
 - 1. Quantity: Provide the following hinge quantity, unless otherwise indicated:
 - a. Two Hinges: For doors with heights up to 60 inches.
 - b. Three Hinges: For doors with heights 61 to 90 inches.
 - c. Four Hinges: For doors with heights 91 to 120 inches.
 - d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
 - 2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
 - a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
 - b. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.
 - 3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
 - a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
 - b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.
 - 4. Hinge Options: Comply with the following where indicated in the Hardware Sets or on Drawings:
 - a. Non-removable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.
 - 5. Acceptable Manufacturers:
 - a. Hager Companies (HA).

- b. McKinney Products (MK).
 - c. Stanley Hardware (ST).
 - d. Ives (IV)
- B. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 certified continuous geared hinge. with minimum 0.120-inch thick extruded 6060 T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Factory trim hinges to suit door height and prepare for electrical cut-outs.
 - 1. **Only** where specifically requested by Owner.
 - 2. Acceptable Manufacturers:
 - a. Pemko
 - b. Ives

2.3 POWER TRANSFER DEVICES

- A. Concealed Quick Connect Electric Power Transfers: Provide concealed wiring pathway housing mortised into the door and frame for low voltage electrified door hardware. Furnish with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 10) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.
 - 1. Acceptable Manufacturers:
 - a. Pemko Manufacturing (PE) – EL-CEPT Series.
 - b. Securitron (SU) - EL-CEPT Series.
 - c. Stanley Hardware (ST) EPT-12C Series.
 - d. Von Duprin (VD)– EPT10 Series
- B. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number and type of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.
 - 1. Provide one each of the following tools as part of the base bid contract:
 - a. McKinney Products (MK) - Electrical Connecting Kit: QC-R001.
 - b. McKinney Products (MK) - Connector Hand Tool: QC-R003.

- c. Von Duprin, Schlage (VD) SC) – Electrical Connector Kits: CON12 x Length required

2.4 DOOR OPERATING TRIM

- A. Flush Bolts : ANSI/BHMA A156.3 and A156.16, Grade 1, certified.
 - 1. Manual flush bolts to be furnished with top rod of sufficient length to allow bolt location approximately six feet from the floor.
 - 2. Furnish dust proof strikes for bottom bolts.
 - 3. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.
 - 4. Automatic flush bolts **ONLY** when specifically requested by owner or required by code (fire rated doors)
 - 5. Acceptable Manufacturers:
 - a. Ives (IV).
 - b. Rockwood Manufacturing (RO).
 - c. Trimco (TC).
- B. Door Push Plates and Pulls: ANSI/BHMA A156.6 certified door pushes and pulls of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.
 - 1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
 - 2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
 - 3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
 - 4. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.
 - 5. Acceptable Manufacturers:
 - a. Ives (IV).
 - b. Rockwood Manufacturing (RO).
 - c. Trimco (TC).

2.5 CYLINDERS AND KEYING

- A. General: Cylinder manufacturer to have minimum (10) years' experience designing secured master key systems and have on record a published security keying system policy.

- B. Source Limitations: Obtain each type of keyed cylinder and keys from the same source manufacturer as locksets and exit devices, unless otherwise indicated.
 - 1. Acceptable Manufacturers:
 - a. Schlage (SFIC) Everest T 29 Series
 - b. No Substitution.
- C. Cylinders: Original manufacturer cylinders complying with the following:
 - 1. Mortise Type: Threaded cylinders with rings and cams to suit hardware application.
 - 2. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
 - 3. Bored-Lock Type: Cylinders with tailpieces to suit locks.
 - 4. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
 - 5. Keyway: Match Facility Standard.
- D. Locksets and keyways must allow Everest T-29 (Owners pat. key system).
- E. Keying System: Each type of lock and cylinders to be factory keyed.
 - 1. Conduct specified "Keying Conference" to define and document keying system instructions and requirements.
 - 2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
 - 3. Existing System: Key locks to Owner's existing system.
- F. Visual Key Control:
 - 1. Stamp keys and core face with DHI key symbol
- G. Visual Core Control:
 - 1. Stamp on face of core.
- H. Key Quantity: Provide the following minimum number of keys:
 - 1. Change Keys per Cylinder: Two (2)
 - 2. Master Keys (per Master Key Level/Group): Five (5).
 - 3. Construction Keys (where required): Ten (10).
 - 4. Construction Control Keys (where required): Two (2).
 - 5. Permanent Control Keys (where required): Two (2).
- I. Construction Keying: Provide temporary keyed construction cores at exteriors only. Temporary plastic cores at remaining openings.
- J. Key Registration List (Bitting List):

1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
 2. Provide bitting list in written and electronic file as directed by the Owner.
- K. Key Control Cabinet: Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall have expansion capacity of 150% of the number of locks required for the project.
1. Acceptable Manufacturers:
 - a. Lund Equipment (LU).
 - b. MMF Industries (MM).
 - c. Telkee (TK).

2.6 MECHANICAL LOCKS AND LATCHING DEVICES

- A. Mortise Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.13. Locksets are to be manufactured with a corrosion resistant steel case and be field-reversible for handing without disassembly of the lock body.
1. Acceptable Manufacturers
 - a. Sargent Manufacturing (SA) 8200 Series (Mortise) (SC) Schlage L9000 Series
 - a) Staff Toilet accessible by student V20 8251 (always locked)
 - b) Staff Restroom not-accessible by student V20 8265
 - c) Student Gang Restroom LC-4878 (shelter in place) (No Sub due to function)
 - b. Sargent Manufacturing (SA) 10 line Series (SC) ND Series
 - a) Storeroom/Elec/Mech/IDF 10G04 (always locked)
 - b) Office 10G05 (push button)
 - c) Passage 10U15
 - d) Classroom 10G37 (locked or unlocked)
 - e) Privacy 10U65 (coin turn)
 - f) Public use restroom 10U65 (lock with coin turn outside)
 - g) Secure Vestibule 10G71 (fail secure)

2.7 AUXILIARY LOCKS

- A. Tubular Deadlocks: Acceptable Manufacturers:
- a. Sargent Manufacturing (SA) – 4870 Series. Schlage (SC) L460 Series
 - a) Student Gang Restroom 4878

- b) Locker Room Restroom 4878
- c) Serving Line Pair 4875

2.8 LOCK AND LATCH STRIKES

- A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:
 - 1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
 - 2. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
- B. Standards: Comply with the following:
 - 1. Strikes for Mortise Locks and Latches: BHMA A156.13.
 - 2. Strikes for Auxiliary Deadlocks: BHMA A156.5.
 - 3. Dustproof Strikes: BHMA A156.16.

2.9 CONVENTIONAL EXIT DEVICES

- A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:
 - 1. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
 - 2. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer's catalog and template book for specific requirements.
 - 3. Where specified, provide exit devices with cylinder dogging device to hold the push bar and latch in a retracted position. Provide cylinder dogging on devices where specified in Hardware Sets. Provide cylinder dogging at inactive leaf of electrified pairs.
 - 4. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.

5. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.
 - a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets. (Schlage - RHO)
 - b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.
 6. Vandal trim at all exteriors with exits.
 - a. Rockwood vandal trim VRT22/VRT22 CFC
 - b. Ives VR 910 Vandal Trim VR910 NL/VR910 DT
 7. Rail Sizing: Provide exit device rails factory sized for proper door width application.
 8. Through Bolt Installation: For all metal doors.
- B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 certified panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Exit device latch to be steel, pullman type, with deadlock feature.
1. Acceptable Manufacturers:
 - a. Sargent Manufacturing (SA) - 80 Series.
 - b. Von Duprin (VD) 99 Series
- C. Tube Steel Removable Mullions: ANSI/BHMA A156.3 removable steel mullions with malleable-iron top and bottom retainers and a primed paint finish.
1. Provide keyed removable feature where specified in the Hardware Sets.
 2. Provide stabilizers and mounting brackets as required.
 3. Provide wall mounting kits for all keyed removable mullions
 4. Provide electrical quick connection wiring options as specified in the hardware sets.
 5. Acceptable Manufacturers:
 - a. Sargent Manufacturing (SA) – L980S Series.
 - b. Von Duprin (VD) – KR4954/KR9954
- 2.10 INTEGRATED WIEGAND/RS485 OUTPUT ACCESS CONTROL EXIT DEVICES OR WIEGAND/RS485 EXIT DEVICE TRIM
- A. Wiegand Output Integrated Card Reader Exit Hardware: Wiegand output ANSI 156.3 Grade 1 rim, mortise, and vertical rod exit device hardware with integrated or lock installed proximity card reader, latchbolt and touchbar monitoring, and request-to-exit

signaling. Hard wired, solenoid driven locking/unlocking control of the lever handle exit trim with 3/4" throw latch bolt. U.L listed and labeled for either panic or "fire exit hardware" for use on up to 3 hour fire rated openings. Available with or without keyed high security cylinder override.

1. Open architecture, hard wired platform supports centralized control of locking units with new or existing Wiegand compatible access control systems. Inside push bar (request-to-exit) signaling and door position (open/closed status) monitoring (via separately connected or integrated DPS).
2. Reader supports either HID 125 kHz proximity (up to 39 bits, including Corporate 1000) or 13.56 MHz (2K-32K) iClass® credentials.
3. 12VDC or 24VDC external power supply required for reader, with optional 24VDC operation available with iClass® reader (125 kHz reader). 24VDC required for solenoid operated exit trim or entire lockset (12VDC if applicable). Fail safe or fail secure options.
4. Acceptable Manufacturers:
 - a. Sargent Manufacturing (SA) – SE LP10 – M1 80 Series Exits.
Sargent Manufacturing (SA) – SE LP10 - M1 8200 Series Locks.
 - b. Schlage AD300 Series

2.11 DOOR CLOSERS

A. All door closers specified herein shall meet or exceed the following criteria:

1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers including installation and adjusting information on inside of cover.
2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
3. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the physically handicapped, provide units complying with ANSI ICC/A117.1.
4. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
5. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.

6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets and spacers.
 7. Through Bolt Installation: For all metal doors , and as requested by owner.
 8. Provide cush stop arms (CPS) (CUSH)at all exterior
 9. Provide cush stop holder arms (CPSH) (HCUSH) as requested by owner
 10. No closers on classrooms, science labs, computer labs, custodial closets, and small rooms.
- B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.
1. Acceptable Manufacturers:
 - a. Sargent Manufacturing (SA) - 351 Series.
 - b. LCN (LC) 4050A Series

2.12 SURFACE MOUNTED WALL HOLDERS

- A. Electromagnetic Door Holders: Certified ANSI A156.15 electromagnetic door holder/releases with a minimum 20 to 40 pounds holding power and single coil construction able to accommodate.12VDC, 24VAC, 24VDC and 120VAC. Coils to be independently wound, employing an integral fuse and armatures to include a positive release button.
1. Acceptable Manufacturers:
 - a. Rixson (RF) - 980/990 Series.
 - b. Sargent Manufacturing (SA) - 1560 Series.
 - c. LCN (LC) – 7800 Series

2.13 ARCHITECTURAL TRIM

- A. Door Protective Trim

1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.
2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1" LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.
3. Protection Plates: ANSI/BHMA A156.6 certified protection plates (kick, armor, or mop), fabricated from the following:
 - a. Stainless Steel: 300 grade, .050-inch thick.
4. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.
5. Acceptable Manufacturers:
 - a. Ives (IV).
 - b. Rockwood Manufacturing (RO).
 - c. Trimco (TC).

2.14 DOOR STOPS AND HOLDERS

- A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.
- B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops . Provide dome stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic
 - a. No wall mounted stops
 - b. Floor stop equal to Rockwood 441CU
2. Acceptable Manufacturers:
 - a. Ives (IV).
 - b. Rockwood Manufacturing (RO).
 - c. Trimco (TC).
- C. Overhead Door Stops and Holders: ANSI/BHMA A156.6, Grade 1 certified overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.
 1. Acceptable Manufacturers:

- a. Only when requested by owner

2.15 ARCHITECTURAL SEALS

- A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.
- B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.
 - 1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.
- C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.
 - 1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and UBC 7-2, Fire Tests of Door Assemblies.
- D. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.
- E. Acceptable Manufacturers:
 - 1. National Guard Products (NG).
 - 2. Pemko Manufacturing (PE).
 - 3. Reese Enterprises, Inc. (RE).
 - 4. Zero Manufacturing (ZE)

2.16 ELECTRONIC ACCESSORIES

- A. Door Position Switches: Door position magnetic reed contact switches specifically designed for use in commercial door applications. On recessed models the contact and magnetic housing snap-lock into a 1" diameter hole. Surface mounted models include wide gap distance design complete with armored flex cabling. Provide SPDT, N/O switches with optional Rare Earth Magnet installation on steel doors with flush top channels.
 - 1. Acceptable Manufacturers:
 - a. Provided by Security

- B. Switching Power Supplies: Provide UL listed or recognized filtered and regulated power supplies. Provide single, dual, or multi-voltage units as shown in the hardware sets. Units must be expandable up to eight Class 2 power limited outputs. Units must include the capability to incorporate a battery backup option with integral battery charging capability in addition to operating the DC load in event of line voltage failure. Provide the least number of units, at the appropriate amperage level, sufficient to exceed the required total draw for the specified electrified hardware and access control equipment.

1. Acceptable Manufacturers:

- a. Provided by Security

2.17 OPERATING and PROTECTIVE TRIM UNITS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Metal Protective Trim Units:
 - a. Rockwood Manufacturing (RO).
 - b. Ives (IV).
 - c. Trimco Manufacturing (TR).
2. Mop Plate
 - a. Restrooms, Kitchen, Athletics
3. Kick Plate
 - a. At high traffic areas
4. Armor Plate
 - a. Mechanical rooms, Athletics, Kitchen

- B. Standard: Comply with BHMA A156.6.

- C. Materials: Fabricate protection plates from the following:

1. Brass/Bronze and Stainless Steel: .050 inches thick, beveled four sides (B4E) with countersunk screw holes.

- D. Fasteners: Provide manufacturer's designated fastener type as indicated in door hardware sets.

- 2.18 Furnish protection plates sized 1 1/2 inches less than door width (LDW) on push side and 1 inch less door width on pull side by height specified in door hardware sets.

2.19 FABRICATION

- A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.20 FINISHES

- A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.
- B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware.
- C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

- A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.
- B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

- A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.
 - 1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.
- B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:

1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
 2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
 3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
 4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.
- C. Assa Abloy locks Integrated Wiegand access control products are required to be installed through current members of the ASSA ABLOY "Certified Integrator" (CI) program. Allegion products can be installed by Liscensed Integrator – no proprietary certification required.
- D. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
- E. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."
- F. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

- A. Field Inspection: Supplier will perform a final inspection of installed door hardware and state in report whether work complies with or deviates from requirements, including whether door hardware is properly installed, operating and adjusted.

3.5 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
- B. Final Adjustment: Installer shall return and make final adjustment of all hardware once all air conditioning test and balance is complete. Final adjustment shall be made while air conditioner system is operating. Coordinate with General Contractor and Owner.

3.6 CLEANING AND PROTECTION

- A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.
- B. Clean adjacent surfaces soiled by door hardware installation.
- C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

- A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SETS

The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

DOOR HARDWARE**SECTION 08 71 00**

123871 OPT0331006 Version 6

Hardware Group No. 001 - OH DOOR/GRILL

For use on Door #(s):

Provide each RU door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	FSIC MORT CYLINDER	20-059 ICX W/CONST. CORE QTY/TYPE REQD	626	SCH
2	EA	FSIC PERM CORE	23-030 EVEREST T-29 SERIES QTY/TYPE REQD	626	SCH
	EA	KEY SWITCH	(WHERE REQUIRED) PROVIDED BY SECTY CONTRACTOR QTY/TYPE REQD	630	SCE
	EA	NOTE	REMAINDER OF HARDWARE BY DOOR MFR.		

-COORDINATE HARDWARE WITH DOOR MFR.

Hardware Group No. 001FLD - FOLDING DOOR

For use on Door #(s):

Provide each FLD door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	FSIC MORT CYLINDER	20-059 ICX W/CONST. CORE QTY/TYPE REQD	626	SCH
2	EA	FSIC PERM CORE	23-030 EVEREST T-29 SERIES QTY/TYPE REQD	626	SCH
	EA	KEY SWITCH	(WHERE REQUIRED) PROVIDED BY SECTY CONTRACTOR QTY/TYPE REQD	630	SCE
	EA	NOTE	REMAINDER OF HARDWARE BY DOOR MFR.		

-COORDINATE HARDWARE WITH DOOR MFR.

Hardware Group No. 103 - SGL OFFICE LK (OFFICES/CONF/WKRM/LOUNGE)

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	ENTRANCE LOCK	ND53TD RHO	626	SCH
1	EA	FSIC PERM CORE	23-030 EVEREST T-29 SERIES	626	SCH
1	EA	FLOOR STOP	FS13 X R14	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

Hardware Group No. 201 - SGL STORAGE CLOSER

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	STOREROOM LOCK	ND80TD RHO	626	SCH
1	EA	FSIC PERM CORE	23-030 EVEREST T-29 SERIES	626	SCH
1	EA	SURFACE CLOSER	4050A-RW/PA-TBSRT (MAXIMUM DEGREE OPNG WHERE POSSIBLE)	689	LCN
1	EA	FLOOR STOP	FS13 X R14	626	IVE
1	EA	GASKETING	488S PSA H & J (USE SILENCERS @ NON-RATED DOORS)	BK	ZER

Hardware Group No. 201K - SGL STORAGE CLOSER

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	STOREROOM LOCK	ND80TD RHO	626	SCH
1	EA	FSIC PERM CORE	23-030 EVEREST T-29 SERIES	626	SCH
1	EA	SURFACE CLOSER	4050A-RW/PA-TBSRT (MAXIMUM DEGREE OPNG WHERE POSSIBLE)	689	LCN
1	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS13 X R14	626	IVE
1	EA	GASKETING	488S PSA H & J (USE SILENCERS @ NON-RATED DOORS)	BK	ZER

Hardware Group No. 201R - SGL STORAGE CLOSER RATED

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	STOREROOM LOCK	ND80TD RHO	626	SCH
1	EA	FSIC PERM CORE	23-030 EVEREST T-29 SERIES	626	SCH
1	EA	SURFACE CLOSER	4050A-RW/PA-TBSRT (MAXIMUM DEGREE OPNG WHERE POSSIBLE)	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS13 X R14	626	IVE
1	EA	GASKETING	488S PSA H & J	BK	ZER

DOOR HARDWARE**SECTION 08 71 00**

Hardware Group No. 201RH - SGL STORAGE CLOSER RATED

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	STOREROOM LOCK	ND80TD RHO	626	SCH
1	EA	FSIC PERM CORE	23-030 EVEREST T-29 SERIES	626	SCH
1	EA	SURFACE CLOSER	4050A-RW/PA-TBSRT (MAXIMUM DEGREE OPNG WHERE POSSIBLE)	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FIRE/LIFE WALL MAG	SEM7800 SERIES AS REQUIRED	689	LCN
1	EA	GASKETING	488S PSA H & J	BK	ZER

DOOR TO RELEASE UPON FIRE ALARM ACTIVATION

Hardware Group No. 201W - SGL STORAGE CLOSER

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 5 X 4.5 NRP	652	IVE
1	EA	STOREROOM LOCK	ND80TD RHO	626	SCH
1	EA	FSIC PERM CORE	23-030 EVEREST T-29 SERIES	626	SCH
1	EA	SURFACE CLOSER	4050A-RW/PA-TBSRT (MAXIMUM DEGREE OPNG WHERE POSSIBLE)	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS WHERE APPLICABLE	630	IVE
1	EA	FLOOR STOP	FS13 X R14	626	IVE
1	EA	GASKETING	488S PSA H & J (USE SILENCERS @ NON-RATED DOORS)	BK	ZER

Hardware Group No. 203 - SGL STORAGE (SMALL)

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80TD RHO	626	SCH
1	EA	FSIC PERM CORE	23-030 EVEREST T-29 SERIES	626	SCH
1	EA	FLOOR STOP	FS13 X R14	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

Hardware Group No. 205 - SGL EXTERIOR HM - MECH/STORAGE/RISER

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	STOREROOM LOCK	ND80TD RHO	626	SCH
1	EA	FSIC PERM CORE	23-030 EVEREST T-29 SERIES	626	SCH
1	EA	SURFACE CLOSER	4050A-SCUSH-SNB	689	LCN
1	EA	RAIN DRIP	142A DW + 4"	AA	ZER
1	EA	JAMB SEAL	328AA-2PC-JAMB HEIGHT	AA	ZER
1	EA	HEADER SEAL	429AA-1PC-HEADER WIDTH	AA	ZER
1	EA	DOOR SWEEP	39A-DOOR WIDTH	A	ZER
1	EA	THRESHOLD	65A-V3-226 FRAME WIDTH	A	ZER

Hardware Group No. 210 - PAIR STORAGE/CLOSERS

For use on Door #(s):

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
2	EA	MANUAL FLUSH BOLT	FB458-LENGTH REQD	626	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	STOREROOM LOCK	ND80TD RHO	626	SCH
1	EA	FSIC PERM CORE	23-030 EVEREST T-29 SERIES	626	SCH
1	EA	COORDINATOR	3780	BLK	ABH
2	EA	SURFACE CLOSER	4050A-SHCUSH-TBSRT	689	LCN
1	EA	GASKETING	488S PSA H & J	BK	ZER
1	EA	OVERLAPPING ASTRAGAL	383AA-DOOR HEIGHT (OR AS REQD BY DR MFG)	AA	ZER

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Hardware Group No. 210RC - PAIR STORAGE RATED

For use on Door #(s):

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	AUTO FLUSH BOLT	FB31P/41P AS REQD	630	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	STOREROOM LOCK	ND80TD RHO	626	SCH
1	EA	FSIC PERM CORE	23-030 EVEREST T-29 SERIES	626	SCH
1	EA	COORDINATOR	3780	BLK	ABH
2	EA	SURFACE CLOSER	4050A-SCUSH-SNB	689	LCN
1	EA	GASKETING	488S PSA H & J	BK	ZER
1	EA	OVERLAPPING ASTRAGAL	383AA-DOOR HEIGHT (OR AS REQD BY DR MFG)	AA	ZER

Hardware Group No. 341 - SGL PRIVATE TOILET

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PRIVACY LOCK W/ OUTSIDE INDICATOR	ND40S RHO OS-OCC	626	SCH
1	EA	SURFACE CLOSER	4050A-RW/PA-TBSRT (MAXIMUM DEGREE OPNG WHERE POSSIBLE)	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS13 X R14	626	IVE
1	EA	GASKETING	488S PSA H & J	BK	ZER
1	EA	COAT AND HAT HOOK	582M	626	IVE

-INDICATOR ON OUTSIDE OF DOOR.

Hardware Group No. 501K - SGL CLSSRM LK/CLOSER (ENTRY AREAS - TO ADMIN/NURSES/OFFICE)

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	CLASSROOM LOCK	ND70TD RHO	626	SCH
1	EA	FSIC PERM CORE	23-030 EVEREST T-29 SERIES	626	SCH
1	EA	SURFACE CLOSER	4050A-RW/PA-TBSRT (MAXIMUM DEGREE OPNG WHERE POSSIBLE)	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS13 X R14	626	IVE
1	EA	GASKETING	488S PSA H & J (USE SILENCERS @ NON-RATED DOORS)	BK	ZER

Hardware Group No. 503 - SGL CLASSROOM LOCK

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	CLASSROOM LOCK	ND70TD RHO	626	SCH
1	EA	FSIC PERM CORE	23-030 EVEREST T-29 SERIES	626	SCH
1	EA	FLOOR STOP	FS13 X R14	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

Hardware Group No. 701 - SGL EXIT DEVICE L-TRIM

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	PANIC HARDWARE	LD-99-L-06	626	VON
1	EA	FSIC RIM CYLINDER	20-057 ICX W/CONST. CORE	626	SCH
1	EA	FSIC PERM CORE	23-030 EVEREST T-29 SERIES	626	SCH
1	EA	SURFACE CLOSER	4050A-RW/PA-TBSRT (MAXIMUM DEGREE OPNG WHERE POSSIBLE)	689	LCN
1	EA	FLOOR STOP	FS13 X R14	626	IVE
1	EA	GASKETING	488S PSA H & J (USE SILENCERS @ NON-RATED DOORS)	BK	ZER

Hardware Group No. 701R - SGL RATED EXIT DEVICE L-TRIM

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	FIRE EXIT HARDWARE	99-L-F-06	626	VON
1	EA	FSIC RIM CYLINDER	20-057 ICX W/CONST. CORE	626	SCH
1	EA	FSIC PERM CORE	23-030 EVEREST T-29 SERIES	626	SCH
1	EA	SURFACE CLOSER	4050A-RW/PA-TBSRT (MAXIMUM DEGREE OPNG WHERE POSSIBLE)	689	LCN
1	EA	FLOOR STOP	FS13 X R14	626	IVE
1	EA	GASKETING	488S PSA H & J	BK	ZER

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Hardware Group No. 701RH - SGL RATED EXIT DEVICE L-TRIM

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	FIRE EXIT HARDWARE	99-L-F-06	626	VON
1	EA	FSIC RIM CYLINDER	20-057 ICX W/CONST. CORE	626	SCH
1	EA	FSIC PERM CORE	23-030 EVEREST T-29 SERIES	626	SCH
1	EA	SURFACE CLOSER	4050A-RW/PA-TBSRT (MAXIMUM DEGREE OPNG WHERE POSSIBLE)	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FIRE/LIFE WALL MAG	SEM7800 SERIES AS REQUIRED	689	LCN
1	EA	GASKETING	488S PSA H & J	BK	ZER

DOOR TO RELEASE UPON FIRE ALARM ACTIVATION

Hardware Group No. 701RHW - SGL RATED EXIT DEVICE L-TRIM

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 5 X 4.5 NRP	652	IVE
1	EA	FIRE EXIT HARDWARE	99-L-F-06	626	VON
1	EA	FSIC RIM CYLINDER	20-057 ICX W/CONST. CORE	626	SCH
1	EA	FSIC PERM CORE	23-030 EVEREST T-29 SERIES	626	SCH
1	EA	SURFACE CLOSER	4050A-RW/PA-TBSRT (MAXIMUM DEGREE OPNG WHERE POSSIBLE)	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FIRE/LIFE WALL MAG	SEM7800 SERIES AS REQUIRED	689	LCN
1	EA	GASKETING	488S PSA H & J	BK	ZER

DOOR TO RELEASE UPON FIRE ALARM ACTIVATION

DOOR HARDWARE**SECTION 08 71 00**

Hardware Group No. 710EL - PAIR INTERIOR - ELEC RM

For use on Door #(s):

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	PANIC HARDWARE	LD-9947WDC-L-DT-LBR-06-SNB WDC AT WD DRS	626	VON
1	EA	PANIC HARDWARE	LD-9947WDC-L-NL-LBR-06-SNB WDC AT WD DRS	626	VON
1	EA	FSIC RIM CYLINDER	20-057 ICX W/CONST. CORE	626	SCH
1	EA	FSIC PERM CORE	23-030 EVEREST T-29 SERIES	626	SCH
2	EA	SURFACE CLOSER	4050A-RW/PA-TBSRT (MAXIMUM DEGREE OPNG WHERE POSSIBLE)	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
2	EA	FLOOR STOP	FS13 X R14	626	IVE
1	EA	GASKETING	488S PSA H & J	BK	ZER
1	EA	ASTRAGAL	328AA (2 PCS - 1 SET) HEIGHT AS REQUIRED	AL	ZER

Hardware Group No. 710ELR - PAIR RTD INTERIOR - ELEC RM

For use on Door #(s):

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	FIRE EXIT HARDWARE	9947WDC-L-DT-F-LBR-06-SNB	626	VON
1	EA	FIRE EXIT HARDWARE	9947WDC-L-NL-F-LBR-06-SNB	626	VON
1	EA	FSIC RIM CYLINDER	20-057 ICX W/CONST. CORE	626	SCH
1	EA	FSIC PERM CORE	23-030 EVEREST T-29 SERIES	626	SCH
2	EA	SURFACE CLOSER	4050A-RW/PA-TBSRT (MAXIMUM DEGREE OPNG WHERE POSSIBLE)	689	LCN
2	EA	KICK PLATE	8402 10" X 1" LDW B-CS	630	IVE
2	EA	FLOOR STOP	FS13 X R14	626	IVE
1	EA	GASKETING	488S PSA H & J	BK	ZER
1	EA	ASTRAGAL	328AA (2 PCS - 1 SET) HEIGHT AS REQUIRED	AL	ZER

DOOR HARDWARE**SECTION 08 71 00**

Hardware Group No. 710RH - PAIR RTD INTERIOR - 4040SE HO

For use on Door #(s):

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
2	EA	FIRE EXIT HARDWARE	9947WDC-L-F-LBR-06-SNB	626	VON
2	EA	FSIC RIM CYLINDER	20-057 ICX W/CONST. CORE	626	SCH
2	EA	FSIC PERM CORE	23-030 EVEREST T-29 SERIES	626	SCH
2	EA	FIRE/LIFE CLOSER	4040SE TBWMS (MTG PLATES AS REDQ)	689	LCN
1	EA	GASKETING	488S PSA H & J	BK	ZER
1	EA	ASTRAGAL	328AA (2 PCS - 1 SET) HEIGHT AS REQUIRED	AL	ZER

Hardware Group No. 714MELCR - PAIR EXTERIOR ELEC RM EXIT DEVICES

For use on Door #(s):

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	FIRE RATED REMOVABLE MULLION	9954-154	689	VON
1	EA	FIRE EXIT HARDWARE	99-EO-F-SNB	626	VON
1	EA	FIRE EXIT HARDWARE	99-NL-OP-F-110MD-SNB	626	VON
1	EA	FSIC RIM CYLINDER	20-057 ICX W/CONST. CORE	626	SCH
1	EA	FSIC MORT CYLINDER	20-059 ICX W/CONST. CORE	626	SCH
2	EA	FSIC PERM CORE	23-030 EVEREST T-29 SERIES	626	SCH
1	EA	DOOR PULL	VR910 DT	630	IVE
1	EA	DOOR PULL	VR910 NL	630	IVE
2	EA	SURFACE CLOSER	4050A-SCUSH-SNB	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
1	EA	MULLION SEAL	139N PSA HEIGHT AS REQ		ZER
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
2	EA	DOOR SWEEP	39A-DOOR WIDTH	A	ZER
1	EA	THRESHOLD	65A-V3-226 FRAME WIDTH	A	ZER

Hardware Group No. 715ELCR - SGL EXTERIOR RTD HM EXIT DEVICE

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	FIRE EXIT HARDWARE	99-NL-OP-F-110MD-SNB	626	VON
1	EA	FSIC RIM CYLINDER	20-057 ICX W/CONST. CORE	626	SCH
1	EA	FSIC PERM CORE	23-030 EVEREST T-29 SERIES	626	SCH
1	EA	DOOR PULL	VR910 NL	630	IVE
1	EA	SURFACE CLOSER	4050A-SCUSH-SNB	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142A DW + 4"	AA	ZER
1	EA	JAMB SEAL	328AA-2PC-JAMB HEIGHT	AA	ZER
1	EA	HEADER SEAL	429AA-1PC-HEADER WIDTH	AA	ZER
1	EA	DOOR SWEEP	39A-DOOR WIDTH	A	ZER
1	EA	THRESHOLD	65A-V3-226 FRAME WIDTH	A	ZER

Hardware Group No. 801L - PUSH/PULL/ DEADLOCK (GANG STUDENT RESTROOMS)

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	CLASSROOM DEADBOLT	B663T	626	SCH
1	EA	FSIC PERM CORE	23-030 EVEREST T-29 SERIES	626	SCH
1	EA	PUSH PLATE	8200 8" X 16"	630	IVE
1	EA	PULL PLATE	8305 8" 4" X 16"	630	IVE
1	EA	SURFACE CLOSER	4050A-RW/PA-TBSRT (MAXIMUM DEGREE OPNG WHERE POSSIBLE)	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS13 X R14	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

DOOR HARDWARE**SECTION 08 71 00**

Hardware Group No. C201 - SGL INTERIOR WD - ACCESS CONTROLLED (INCLUDING RECPT FROM ADMIN & SECURE VEST TO RECPT)

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	POWER TRANSFER	EPT10	689	VON
1	EA	VANDL EU STOREROOM	ND96TDEU RHO RX 12V/24V DC	626	SCH
1	EA	FSIC PERM CORE	23-030 EVEREST T-29 SERIES	626	SCH
1	EA	SURFACE CLOSER	4050A-RW/PA-TBSRT (MAXIMUM DEGREE OPNG WHERE POSSIBLE)	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS13 X R14	626	IVE
1	EA	GASKETING	488S PSA H & J (USE SILENCERS @ NON-RATED DOORS)	BK	ZER
	EA	CREDENTIAL READER	BY SECURITY CONTRACTOR		B/O
	EA	POWER SUPPLY	BY SECURITY CONTRACTOR		B/O

OPERATION: DOOR NORMALLY CLOSED AND LOCKED WITH FAIL SECURE ELECTRIC LOCK. CREDENTIAL READER RELEASES ELEC LOCK FOR ENTRY. FREE EGRESS AT ALL TIMES. DOOR STATUS MONITORED.

Hardware Group No. C201K - SGL INTERIOR WD - ACCESS CONTROLLED (INCLUDING RECPT FROM ADMIN & SECURE VEST TO RECPT)

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	POWER TRANSFER	EPT10	689	VON
1	EA	VANDL EU STOREROOM	ND96TDEU RHO RX 12V/24V DC	626	SCH
1	EA	FSIC PERM CORE	23-030 EVEREST T-29 SERIES	626	SCH
1	EA	SURFACE CLOSER	4050A-RW/PA-TBSRT (MAXIMUM DEGREE OPNG WHERE POSSIBLE)	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS13 X R14	626	IVE
1	EA	GASKETING	488S PSA H & J (USE SILENCERS @ NON-RATED DOORS)	BK	ZER
	EA	CREDENTIAL READER	BY SECURITY CONTRACTOR		B/O
	EA	POWER SUPPLY	BY SECURITY CONTRACTOR		B/O

OPERATION: DOOR NORMALLY CLOSED AND LOCKED WITH FAIL SECURE ELECTRIC LOCK. CREDENTIAL READER RELEASES ELEC LOCK FOR ENTRY. FREE EGRESS AT ALL TIMES. DOOR STATUS MONITORED.

Hardware Group No. C710 - PAIR INTERIOR EXIT DEVICE (ACCESS CONTROLLED)

For use on Door #(s):

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
2	EA	POWER TRANSFER	EPT10	689	VON
1	EA	ELEC PANIC HARDWARE	LD-RX-9947WDC-EO-LBR-SNB	626	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-9947WDC-NL-OP-LBR-110WD-SNB 24 VDC	626	VON
1	EA	FSIC RIM CYLINDER	20-057 ICX W/CONST. CORE	626	SCH
1	EA	FSIC PERM CORE	23-030 EVEREST T-29 SERIES	626	SCH
2	EA	90 DEG OFFSET PULL	8190-O 10"	630	IVE
2	EA	SURFACE CLOSER	4050A-RW/PA-TBSRT (MAXIMUM DEGREE OPNG WHERE POSSIBLE) MNT PLTS REQD	689	LCN
2	EA	FLOOR STOP	FS13 X R14	626	IVE
1	EA	GASKETING	488S PSA H & J	BK	ZER
1	EA	ASTRAGAL	328AA (2 PCS - 1 SET) HEIGHT AS REQUIRED	AL	ZER
	EA	CREDENTIAL READER	BY SECURITY CONTRACTOR		B/O
	EA	POWER SUPPLY	BY SECURITY CONTRACTOR		B/O

NOTES: OPERATION: DOORS NORMALLY CLOSED AND LOCKED. VALID CARD AT THE CARD READER RETRACTS THE LATCH ON THE ACTIVE LEAF FOR ENTRY. FREE EGRESS AT ALL TIMES. DOOR STATUS MONITORED.

CYLINDER DOGGING INDICATOR AT INACTIVE LEAF ONLY AT SECURITY DOORS.

DOOR HARDWARE**SECTION 08 71 00**

Hardware Group No. C711 - SGL EXIT DEVICE (WD) ACCESS CONTROLLED

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	POWER TRANSFER	EPT10	689	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-99-NL-OP-110MD-SNB 24 VDC	626	VON
1	EA	FSIC RIM CYLINDER	20-057 ICX W/CONST. CORE	626	SCH
1	EA	FSIC PERM CORE	23-030 EVEREST T-29 SERIES	626	SCH
1	EA	90 DEG OFFSET PULL	8190-O 10"	630	IVE
1	EA	SURFACE CLOSER	4050A-RW/PA-TBSRT (MAXIMUM DEGREE OPNG WHERE POSSIBLE)	689	LCN
1	EA	FLOOR STOP	FS13 X R14	626	IVE
1	EA	GASKETING	488S PSA H & J (USE SILENCERS @ NON-RATED DOORS)	BK	ZER
	EA	CREDENTIAL READER	BY SECURITY CONTRACTOR		B/O
	EA	POWER SUPPLY	BY SECURITY CONTRACTOR		B/O

OPERATION: DOOR IS NORMALLY CLOSED AND LOCKED. CREDENTIAL READER RETRACTS THE LATCH FOR ENTRY. FREE EGRESS AT ALL TIMES.

Hardware Group No. C714MA - PAIR EXTERIOR ENTRANCE (ALUM SF) ACCESS CONTROLLED NON-KRM

For use on Door #(s):

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
2	EA	POWER TRANSFER	EPT10	689	VON
1	EA	REMOVABLE MULLION	4954-STAB	689	VON
			NON-KEYED MULL		
1	EA	ELEC PANIC HARDWARE	LD-RX-99-EO-SNB	626	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-99-NL-OP-110MD-SNB 24 VDC	626	VON
1	EA	FSIC RIM CYLINDER	20-057 ICX W/CONST. CORE	626	SCH
1	EA	FSIC MORT CYLINDER	20-059 ICX W/CONST. CORE	626	SCH
2	EA	FSIC PERM CORE	23-030 EVEREST T-29 SERIES	626	SCH
1	EA	DOOR PULL	VR910 DT	630	IVE
1	EA	DOOR PULL	VR910 NL	630	IVE
2	EA	SURFACE CLOSER	4050A-SCUSH-SNB	689	LCN
2	EA	PA MOUNTING PLATE	4050A-18PA TBSRT (WHERE APPLICABLE)	689	LCN
2	EA	CUSH SHOE SUPPORT	4050A-30 TBSRT	689	LCN
1	EA	MULLION SEAL	139N PSA HEIGHT AS REQ		ZER
1	EA	RAIN DRIP	142A DW + 4"	AA	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	65A-V3-226 FRAME WIDTH	A	ZER
	EA	BALANCE HARDWARE	BY DOOR MFG		B/O
	EA	CREDENTIAL READER	BY SECURITY CONTRACTOR		B/O
	EA	POWER SUPPLY	BY SECURITY CONTRACTOR		B/O

NOTES: OPERATION: DOORS NORMALLY CLOSED AND LOCKED. VALID CARD AT THE CARD READER RETRACTS THE LATCH ON THE ACTIVE LEAF FOR ENTRY. FREE EGRESS AT ALL TIMES. DOOR STATUS MONITORED.

CYLINDER DOGGING INDICATOR AT INACTIVE LEAF ONLY AT SECURITY DOORS.

DOOR HARDWARE**SECTION 08 71 00**

Hardware Group No. C714MA.2 - PAIR EXTERIOR ENTRANCE (ALUM SF) ACCESS CONTROLLED KRM

For use on Door #(s):

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
2	EA	POWER TRANSFER	EPT10	689	VON
1	EA	KEYED MULLION	KR4954-STAB-MT54	689	VON
		KEYED MULL/W-KIT			
1	EA	ELEC PANIC HARDWARE	LD-RX-99-EO-SNB	626	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-99-NL-OP-110MD-SNB 24 VDC	626	VON
1	EA	FSIC RIM CYLINDER	20-057 ICX W/CONST. CORE	626	SCH
1	EA	FSIC MORT CYLINDER	20-059 ICX W/CONST. CORE	626	SCH
2	EA	FSIC PERM CORE	23-030 EVEREST T-29 SERIES	626	SCH
1	EA	DOOR PULL	VR910 DT	630	IVE
1	EA	DOOR PULL	VR910 NL	630	IVE
2	EA	SURFACE CLOSER	4050A-SCUSH-SNB	689	LCN
2	EA	PA MOUNTING PLATE	4050A-18PA TBSRT (WHERE APPLICABLE)	689	LCN
2	EA	CUSH SHOE SUPPORT	4050A-30 TBSRT	689	LCN
1	EA	MULLION SEAL	139N PSA HEIGHT AS REQ		ZER
1	EA	RAIN DRIP	142A DW + 4"	AA	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	65A-V3-226 FRAME WIDTH	A	ZER
	EA	BALANCE HARDWARE	BY DOOR MFG		B/O
	EA	CREDENTIAL READER	BY SECURITY CONTRACTOR		B/O
	EA	POWER SUPPLY	BY SECURITY CONTRACTOR		B/O

NOTES: OPERATION: DOORS NORMALLY CLOSED AND LOCKED. VALID CARD AT THE CARD READER RETRACTS THE LATCH ON THE ACTIVE LEAF FOR ENTRY. FREE EGRESS AT ALL TIMES. DOOR STATUS MONITORED.

CYLINDER DOGGING INDICATOR AT INACTIVE LEAF ONLY AT SECURITY DOORS.

Hardware Group No. C715A - SGL EXTERIOR ENTRANCE (ALUM SF) ACCESS CONTROLLED

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	POWER TRANSFER	EPT10	689	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-99-NL-OP-110MD-SNB 24 VDC	626	VON
1	EA	FSIC RIM CYLINDER	20-057 ICX W/CONST. CORE	626	SCH
1	EA	FSIC PERM CORE	23-030 EVEREST T-29 SERIES	626	SCH
1	EA	DOOR PULL	VR910 NL	630	IVE
1	EA	SURFACE CLOSER	4050A-SCUSH-SNB	689	LCN
1	EA	PA MOUNTING PLATE	4050A-18PA TBSRT (WHERE APPLICABLE)	689	LCN
1	EA	CUSH SHOE SUPPORT	4050A-30 TBSRT	689	LCN
1	EA	RAIN DRIP	142A DW + 4"	AA	ZER
	SET	SEAL	PERIMETER SEAL BY FRAME MFR.		
1	EA	DOOR SWEEP	39A-DOOR WIDTH	A	ZER
1	EA	THRESHOLD	65A-V3-226 FRAME WIDTH	A	ZER
	EA	BALANCE HARDWARE	BY DOOR MFG		B/O
	EA	CREDENTIAL READER	BY SECURITY CONTRACTOR		B/O
	EA	POWER SUPPLY	BY SECURITY CONTRACTOR		B/O

OPERATION: DOOR NORMALLY CLOSED AND LOCKED. VALID CARD AT THE CARD READER RETRACTS THE LATCH FOR ENTRY. FREE EGRESS AT ALL TIMES. DOOR STATUS MONITORED.

DOOR HARDWARE**SECTION 08 71 00**

Hardware Group No. CR710AMV - PAIR SECURE VESTIBULE (ALUM SF) ACCESS CONTROLLED/REMOTE RELEASE

For use on Door #(s):

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
2	EA	POWER TRANSFER	EPT10	689	VON
1	EA	KEYED MULLION	KR4954-STAB-MT54 KEYED MULL/W-KIT	689	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-99-EO-SNB 24 VDC	626	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-99-NL-OP-110MD-SNB 24 VDC	626	VON
1	EA	FSIC RIM CYLINDER	20-057 ICX W/CONST. CORE	626	SCH
1	EA	FSIC MORT CYLINDER	20-059 ICX W/CONST. CORE	626	SCH
2	EA	FSIC PERM CORE	23-030 EVEREST T-29 SERIES	626	SCH
2	EA	90 DEG OFFSET PULL	8190-O 10"	630	IVE
2	EA	SURFACE CLOSER	4050A-SCUSH-SNB	689	LCN
2	EA	PA MOUNTING PLATE	4050A-18PA TBSRT (WHERE APPLICABLE)	689	LCN
2	EA	CUSH SHOE SUPPORT	4050A-30 TBSRT	689	LCN
1	EA	MULLION SEAL	139N PSA HEIGHT AS REQ		ZER
	SET	SEAL	PERIMETER SEAL BY FRAME MFR.		
	SET	ASTRAGAL	MEETING STILE SEAL BY DOOR MFR.		
1	EA	DESK MOUNT BUTTON	660-PB OR SIM (PROVIDED BY SEC 28)	628	SCE
	EA	BALANCE HARDWARE	BY DOOR MFG		B/O
	EA	CREDENTIAL READER	BY SECURITY CONTRACTOR		B/O
	EA	POWER SUPPLY	BY SECURITY CONTRACTOR		B/O

NOTES: OPERATION: DOORS NORMALLY CLOSED AND LOCKED. VALID CARD AT THE CARD READER RETRACTS THE LATCH ON THE ACTIVE LEAF FOR ENTRY. REMOTE RELEASE-BUTTON LOCATED PER ARCHITECT. FREE EGRESS AT ALL TIMES. DOOR STATUS MONITORED. CYLINDER DOGGING INDICATOR AT INACTIVE LEAF ONLY AT SECURITY DOORS.

Hardware Group No. CR711A - SGL EXIT DEVICE (ALSF) ACCESS CONTROLLED/REMOTE RELEASE

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	POWER TRANSFER	EPT10	689	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-99-L-NL-06-SNB 24 VDC	626	VON
1	EA	FSIC RIM CYLINDER	20-057 ICX W/CONST. CORE	626	SCH
1	EA	FSIC PERM CORE	23-030 EVEREST T-29 SERIES	626	SCH
1	EA	SURFACE CLOSER	4050A-RW/PA-TBSRT (MAXIMUM DEGREE OPNG WHERE POSSIBLE) MNT PLT AS REQD	689	LCN
1	EA	FLOOR STOP	FS13 X R14	626	IVE
	SET	SEAL	PERIMETER SEAL BY FRAME MFR.		
1	EA	DESK MOUNT BUTTON	660-PB OR SIM (PROVIDED BY SEC 28)	628	SCE
	EA	CREDENTIAL READER	BY SECURITY CONTRACTOR		B/O
	EA	POWER SUPPLY	BY SECURITY CONTRACTOR		B/O

OPERATION: DOOR IS NORMALLY CLOSED AND LOCKED. CREDENTIAL READER RETRACTS THE LATCH FOR ENTRY. FREE EGRESS AT ALL TIMES.

DOOR HARDWARE**SECTION 08 71 00**

Hardware Group No. CR714MA-2 - PAIR EXTERIOR ENTRANCE (ALUM SF) ACCESS CONTROLLED NON-KRM

For use on Door #(s):

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
2	EA	POWER TRANSFER	EPT10	689	VON
1	EA	KEYED MULLION	KR4954-STAB-MT54 KEYED MULL/W-KIT	689	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-99-EO-SNB 24 VDC	626	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-99-NL-OP-110MD-SNB 24 VDC	626	VON
1	EA	FSIC RIM CYLINDER	20-057 ICX W/CONST. CORE	626	SCH
1	EA	FSIC MORT CYLINDER	20-059 ICX W/CONST. CORE	626	SCH
2	EA	FSIC PERM CORE	23-030 EVEREST T-29 SERIES	626	SCH
1	EA	DOOR PULL	VR910 DT	630	IVE
1	EA	DOOR PULL	VR910 NL	630	IVE
2	EA	SURFACE CLOSER	4050A-SCUSH-SNB	689	LCN
2	EA	PA MOUNTING PLATE	4050A-18PA TBSRT (WHERE APPLICABLE)	689	LCN
2	EA	CUSH SHOE SUPPORT	4050A-30 TBSRT	689	LCN
1	EA	MULLION SEAL	139N PSA HEIGHT AS REQ		ZER
1	EA	RAIN DRIP	142A DW + 4"	AA	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	65A-V3-226 FRAME WIDTH	A	ZER
	EA	DESK MOUNT BUTTON	660-PB OR SIM (PROVIDED BY SEC 28)	628	SCE
	EA	BALANCE HARDWARE	BY DOOR MFG		B/O
	EA	CREDENTIAL READER	BY SECURITY CONTRACTOR		B/O
	EA	POWER SUPPLY	BY SECURITY CONTRACTOR		B/O

NOTES: OPERATION: DOORS NORMALLY CLOSED AND LOCKED. VALID CARD AT THE CARD READER RETRACTS THE LATCH ON THE ACTIVE LEAF FOR ENTRY. FREE EGRESS AT ALL TIMES. DOOR STATUS MONITORED.

CYLINDER DOGGING INDICATOR AT INACTIVE LEAF ONLY AT SECURITY DOORS.

Hardware Group No. J715 - SGL EXTER GATE PANIC

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	SET	HINGE/CLOSER	MAMMOTH180-ZILV 180-GATE COMBINED (LOCINOX)		
1	EA	PANIC HARDWARE	PA-98-NL-OP-110MD-WH-SNB-SEC	630	VON
1	EA	FSIC RIM CYLINDER	20-057 ICX W/CONST. CORE	626	SCH
1	EA	FSIC PERM CORE	23-030 EVEREST T-29 SERIES	626	SCH
1	EA	DOOR PULL	VR910 NL	630	IVE
1	EA	FLOOR STOP	FS18L	BLK	IVE
1	EA	GATE PANIC SHIELD (LOCKEYUSA OR SIM)	TYPE/SIZE/FINISH AS APPLICABLE (GC TO COORD W/RELATED TRADES)		
	EA		REMAINDER OF HARDWARE BY GATE FABRICATOR		

HARDWARE SET IS A GUIDELINE.

GC AND HARDWARE SUPPLIER TO REVIEW OPENING WITH OWNER/ARCHITECT AT LATER DATE TO DETERMINE EXACT REQUIREMENTS.

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. J-1PL - SGL GATE PADLOCK

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	PADLOCK (LFIC/SFIC AS REQD)	KS41D1200 / KS43D3200 X 1-1/2" SHACKLE		SCH
1	EA	FSIC PERM CORE	23-030 EVEREST T-29 SERIES	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.

DOOR HARDWARE**SECTION 08 71 00**

Hardware Group No. V710MA - PAIR VEST ENTRANCE (ALUM SF) EXIT DEVICES

For use on Door #(s):

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	REMOVABLE MULLION	KR4954 STAB KEYED MULL/NO-KIT	689	VON
1	EA	PANIC HARDWARE	CDSI-99-EO-SNB	626	VON
1	EA	PANIC HARDWARE	CDSI-99-NL-OP-110MD-SNB	626	VON
1	EA	FSIC RIM CYLINDER	20-057 ICX W/CONST. CORE	626	SCH
3	EA	FSIC MORT CYLINDER	20-059 ICX W/CONST. CORE	626	SCH
4	EA	FSIC PERM CORE	23-030 EVEREST T-29 SERIES	626	SCH
2	EA	90 DEG OFFSET PULL	8190-O 10"	630	IVE
2	EA	SURFACE CLOSER	4050A-SCUSH-SNB	689	LCN
2	EA	PA MOUNTING PLATE	4050A-18PA TBSRT (WHERE APPLICABLE)	689	LCN
2	EA	CUSH SHOE SUPPORT	4050A-30 TBSRT	689	LCN
	EA	MULLION SEAL	139N PSA HEIGHT AS REQ		ZER
	SET	SEAL	PERIMETER SEAL BY FRAME MFR.		
	SET	ASTRAGAL	MEETING STILE SEAL BY DOOR MFR.		
	EA	BALANCE HARDWARE	BY DOOR MFG		B/O

Hardware Group No. V714MA - PAIR EXTERIOR ENTRANCE (ALUM SF) EXIT DEVICES

For use on Door #(s):

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	REMOVABLE MULLION	KR4954 STAB KEYED MULL/NO-KIT	689	VON
1	EA	PANIC HARDWARE	CDSI-99-EO-SNB	626	VON
1	EA	PANIC HARDWARE	CDSI-99-NL-OP-110MD-SNB	626	VON
1	EA	FSIC RIM CYLINDER	20-057 ICX W/CONST. CORE	626	SCH
3	EA	FSIC MORT CYLINDER	20-059 ICX W/CONST. CORE	626	SCH
4	EA	FSIC PERM CORE	23-030 EVEREST T-29 SERIES	626	SCH
1	EA	DOOR PULL	VR910 DT	630	IVE
1	EA	DOOR PULL	VR910 NL	630	IVE
2	EA	SURFACE CLOSER	4050A-SCUSH-SNB	689	LCN
2	EA	PA MOUNTING PLATE	4050A-18PA TBSRT (WHERE APPLICABLE)	689	LCN
2	EA	CUSH SHOE SUPPORT	4050A-30 TBSRT	689	LCN
1	EA	MULLION SEAL	139N PSA HEIGHT AS REQ		ZER
1	EA	RAIN DRIP	142A DW + 4"	AA	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	65A-V3-226 FRAME WIDTH	A	ZER
	EA	BALANCE HARDWARE	BY DOOR MFG		B/O

END OF SECTION

SECTION 08 80 00

GLAZING

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, 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 SUMMARY

- A. Section includes glazing for doors, aluminum-framed entrances and storefronts, glazed aluminum curtain walls, and interior borrowed lites where glazing requirements are specified by reference to this Section.
- B. Related Sections
 - 1. Section 04 20 00, Unit Masonry
 - 2. Section 08 11 13.16, Custom Hollow Metal Doors and Frames
 - 3. Section 08 14 23.16, Plastic-Laminate-Faced Wood Doors
 - 4. Section 08 41 13, Aluminum-Framed Entrances and Storefronts
 - 5. Section 08 44 13, Glazed Aluminum Curtain Walls

1.3 REFERENCES

- A. Use current editions unless noted otherwise.
- B. American Architectural Manufacturers Association (AAMA)
 - 1. AAMA 800, Voluntary Specifications and Test Methods for Sealants
- C. American National Standards Institute (ANSI)
 - 1. ANSI Z97.1, Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test
- D. ASTM International (ASTM)
 - 1. ASTM C509, Standard Specification for Elastomeric Cellular Preformed Gasket and Sealing Material
 - 2. ASTM C542, Standard Specification for Lock-Strip Gaskets
 - 3. ASTM C864, Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers
 - 4. ASTM C1036, Standard Specification for Flat Glass
 - 5. ASTM C1048, Standard Specification for Heat-Treated Flat Glass—Kind HS, Kind FT Coated and Uncoated Glass
 - 6. ASTM C1115, Standard Specification for Dense Elastomeric Silicone Rubber Gaskets and Accessories
 - 7. ASTM C1281, Standard Specification for Preformed Tape Sealants for Glazing Applications
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 - 9. ASTM E1996, Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes
 - 10. ASTM E2190, Standard Specification for Insulating Glass Unit Performance and Evaluation
- E. Glass Association of North America (GANA)
 - 1. GANA Glazing Manual
 - 2. GANA Laminated Glazing Reference Manual
 - 3. GANA Engineering Standards Manual
- F. Insulating Glass Manufacturers Alliance (IGMA)

1. IGMA TM-3000, North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use
- G. National Fenestration Rating Council (NFRC)
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- I. 2012 Texas Accessibility Standards (TAS)
- J. Texas Health and Safety Code, Chapter 161, Subchapter Q, Installation of Asbestos
- K. Texas Occupations Code, Chapter 1954, Asbestos Health Protection

1.4 DEFINITIONS

- A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C1036
- C. Interspace: Space between lites of an insulating-glass unit

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00, Project Management and Coordination.

1.6 ACTION SUBMITTALS

- A. Submit product data for each glass product and glazing material indicated.
- B. Submit 4 inch or 6 inch square samples of each glass product indicated.

1.7 INFORMATIONAL SUBMITTALS

- A. Submit Material Safety and Data Sheet (MSDS) for all materials, products, and parts.

1.8 QUALITY ASSURANCE

- A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved by coated-glass manufacturer.
- B. Source Limitations for Glass: Obtain each glass type from single source from single manufacturer.
- C. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.
- D. Glazing Publications: Comply with published recommendations of glass product manufacturers, American Architectural Manufacturers Association (AAMA), Glass Association of North America (GANA), and Insulating Glass Manufacturers Alliance (IGMA), unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
- E. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the Safety Glazing Certification Council (SGCC) or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- F. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of Insulating Glass Certification Council (IGCC).
- G. Refer to Section 04 20 00, Unit Masonry, for requirements related to mockups.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

- B. Comply with insulating-glass manufacturer's written recommendations for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.10 WARRANTY

- A. Provide manufacturer's written warranty for coated-glass products in which manufacturer agrees to replace coated-glass units that deteriorate within **10** years from date of Substantial Completion. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
- B. Provide manufacturer's written warranty on laminated glass in which laminated-glass manufacturer agrees to replace laminated-glass units that deteriorate within **10** years from date of Substantial Completion. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
- C. Provide manufacturer's written warranty on insulating glass in which insulating-glass manufacturer agrees to replace insulating-glass units that deteriorate within **10** years from date of Substantial Completion. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is obstruction of vision by dust, moisture, or film on interior surfaces of glass.
- D. Provide glazier's written warranty against defects in material and workmanship for the work of this Section for a period of **two** years from the Date of Substantial Completion. Refer to Section 01 77 00, Closeout Procedures, for Warranty form.

2 PRODUCTS

2.1 MANUFACTURERS

- A. Insulated Glass Units
 - 1. AFG Industries, Inc.
 - 2. Guardian Industries Corp.
 - 3. Oldcastle Building Envelope
 - 4. Pilkington North America
 - 5. Vitro Architectural Glass (formerly PPG Industries, Inc.)
- B. Decorative Tempered Laminated Glass
 - 1. 3form LLC
 - 2. S. A. Bendheim, Ltd.
 - 3. Vanceva
 - 4. Vitro Architectural Glass (formerly PPG Industries, Inc.)

2.2 PERFORMANCE REQUIREMENTS

- A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
 - 1. Temperature Change: 120° F (67° C), ambient; 180° F (100° C), material surfaces

2.3 GLASS PRODUCTS, GENERAL

- A. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.
 - 1. Minimum Glass Thickness for Exterior Lites: Not less than 6.0 mm
 - 2. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.
- A. Strength: Where float glass, heat-strengthened glass, or fully tempered glass is indicated, provide Kind FT heat-treated float glass.
- B. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
 - 1. For monolithic-glass lites, properties are based on units with lites 6.0 mm thick.
 - 2. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
 - 3. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F (W/sq. m x K).
 - 4. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
 - 5. Visible Reflectance: Center-of-glazing values, according to NFRC 300

2.4 GLASS PRODUCTS

- A. Float Glass: ASTM C1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated
- B. Heat-Treated Float Glass: ASTM C1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition indicated
 - 1. For uncoated glass, comply with requirements for Condition A.
 - 2. For coated vision glass, comply with requirements for Condition C (other coated glass).

2.5 INSULATING GLASS

- A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E2190, and complying with other requirements specified.
 - 1. Sealing System: Dual seal, with manufacturer's standard primary and secondary
 - 2. Spacer: Manufacturer's standard spacer material and construction
 - 3. Desiccant: Molecular sieve or silica gel, or blend of both
- B. Glass: Comply with applicable requirements in "Glass Products" Article as indicated by designations in "Insulating-Glass Types" Article

2.6 GLAZING GASKETS

- A. Dense Compression Gaskets: Molded or extruded gaskets of profile and hardness required to maintain watertight seal, made from one of the following:
 - 1. Neoprene complying with ASTM C864
 - 2. EPDM complying with ASTM C864
 - 3. Silicone complying with ASTM C1115
 - 4. Thermoplastic polyolefin rubber complying with ASTM C1115
- B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned neoprene, EPDM, silicone, or, thermoplastic polyolefin rubber gaskets complying with ASTM C509, Type II, black; of profile and hardness required to maintain watertight seal.
 - 1. Application: Use where soft compression gaskets will be compressed by inserting dense compression gaskets on opposite side of glazing or pressure applied by means of pressure-glazing stops on opposite side of glazing.
- C. Lock-Strip Gaskets: Neoprene extrusions in size and shape indicated, fabricated into frames with molded corner units and zipper lock-strips, complying with ASTM C542, black.

2.7 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:
 - 1. AAMA 804.3 tape, where indicated
 - 2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure
 - 3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure
- B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
 - 1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant
 - 2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant

2.8 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
- F. Perimeter Insulation for Fire-Resistive Glazing: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire-protection rating indicated.

2.9 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
- B. Grind smooth and polish exposed glass edges and corners.

2.10 MONOLITHIC-GLASS TYPES

- A. Glass Type G1: Clear fully tempered float glass
 - 1. Thickness: 6.0 mm
 - 2. Provide safety glazing labeling.
- B. Glass Type G1A: Clear fully tempered float glass with impact rated window film:
 - 1. Thickness: 12.0 mm
 - 2. Provide safety glazing labeling.
 - 3. Window film:
 - 1) 3M™ Scotchcal™ ElectroCut™ Graphic Film 7725SE-324, Frosted Crystal
- C. Glass Type G2: Translucent laminated tempered Etched Glass
 - 1. Thickness: 9/16 inch

2.11 INSULATING-GLASS TYPES

- A. Glass Type G3: Low-e-coated, Tinted Insulating Glass
 - 1. SOLARBAN 60 Solar Control Low-E Glass (SOLARBAN 60 (2) Solargray + Clear) as manufactured by Vitro Architectural Glass or an equivalent by a listed manufacturer
 - 2. Overall Unit Thickness: 1 7/8 inch (1/4" (6mm) glass + 1/2" (13mm) air space + 7/8" impact resistant laminate + 1/4" (6mm) glass)
 - 3. Thickness of Each Glass Ply: 6.0 mm

4. Outdoor Lite: Tinted fully tempered float glass
 5. Interlayer: Clear Forced entry-resistant laminated glass, 7/16inch nominal thickness.
 6. Interspace Content: Air
 7. Indoor Lite: Clear fully transparent tempered float glass
 8. Low-E Coating: 60 Solar Control sputtered on second surface
 9. Visible Light Transmittance: 35 percent minimum
 10. Winter Nighttime U-Factor: 0.29 maximum
 11. Summer Daytime U-Factor: 0.27 maximum
 12. Solar Heat Gain Coefficient: 0.25 maximum
 13. Provide safety glazing labeling.
- B. Glass Type G4: Low-e-coated, Tinted Insulating Glass
1. SOLARBAN 60 Solar Control Low-E Glass (SOLARBAN 60 (2) Solargray + Clear) as manufactured by Vitro Architectural Glass or an equivalent by a listed manufacturer
 2. Overall Unit Thickness: 1 inch
 3. Thickness of Each Glass Ply: 6.0 mm
 4. Outdoor Lite: Tinted fully tempered float glass
 5. Interspace Content: Air
 6. Indoor Lite: Clear fully transparent tempered float glass
 7. Low-E Coating: 60 Solar Control sputtered on second surface
 8. Visible Light Transmittance: 35 percent minimum
 9. Winter Nighttime U-Factor: 0.29 maximum
 10. Summer Daytime U-Factor: 0.27 maximum
 11. Solar Heat Gain Coefficient: 0.25 maximum
- C. Glass Types G4A: Low-e-coated, Tinted Insulating Spandrel Glass
1. SOLARBAN 60 Solar Control Low-E Glass (SOLARBAN 60 (2) Solargray + Clear (4) warm gray) as manufactured by Vitro Architectural Glass or an equivalent by a listed manufacturer
 2. Overall Unit Thickness: 1 inch
 3. Thickness of Each Glass Ply: 6.0 mm
 - a. Outdoor Lite: fully tempered float glass 6.0mm
 - b. Interspace Content: Air
 4. Indoor Lite: Ultraclear Low-Iron Float Glass
 5. Colors:

3 EXECUTION

3.1 EXAMINATION

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners
 2. Presence and functioning of weep systems
 3. Minimum required face and edge clearances
 4. Effective sealing between joints of glass-framing members
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
- B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.

3.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.
- C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
- D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- F. Provide spacers for glass lites where length plus width is larger than 50 inches.
 - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 - 2. Provide $\frac{1}{8}$ inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

3.4 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until right before each glazing unit is installed.
- F. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

3.5 GASKET GLAZING (DRY)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

- D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- E. Install gaskets so they protrude past face of glazing stops.

3.6 CLEANING AND PROTECTION

- A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.
- C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.
- D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.
- E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION 08 80 00

SECTION 08 80 00

GLAZING

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, Instructions to Bidders, for substitution of materials and products.
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 - 3. Oldcastle Building Envelope
 - 4. Pilkington North America
 - 5. Vitro Architectural Glass (formerly PPG Industries, Inc.)
- B. Decorative Tempered Laminated Glass
 - 1. 3form LLC
 - 2. S. A. Bendheim, Ltd.
 - 3. Vanceva
 - 4. Vitro Architectural Glass (formerly PPG Industries, Inc.)

2.2 PERFORMANCE REQUIREMENTS

- A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
 - 1. Temperature Change: 120° F (67° C), ambient; 180° F (100° C), material surfaces

2.3 GLASS PRODUCTS, GENERAL

- A. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.
 - 1. Minimum Glass Thickness for Exterior Lites: Not less than 6.0 mm
 - 2. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.
- A. Strength: Where float glass, heat-strengthened glass, or fully tempered glass is indicated, provide Kind FT heat-treated float glass.
- B. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
 - 1. For monolithic-glass lites, properties are based on units with lites 6.0 mm thick.
 - 2. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
 - 3. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F (W/sq. m x K).
 - 4. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
 - 5. Visible Reflectance: Center-of-glazing values, according to NFRC 300

2.4 GLASS PRODUCTS

- A. Float Glass: ASTM C1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated
- B. Heat-Treated Float Glass: ASTM C1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition indicated
 - 1. For uncoated glass, comply with requirements for Condition A.
 - 2. For coated vision glass, comply with requirements for Condition C (other coated glass).

2.5 INSULATING GLASS

- A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E2190, and complying with other requirements specified.
 - 1. Sealing System: Dual seal, with manufacturer's standard primary and secondary
 - 2. Spacer: Manufacturer's standard spacer material and construction
 - 3. Desiccant: Molecular sieve or silica gel, or blend of both
- B. Glass: Comply with applicable requirements in "Glass Products" Article as indicated by designations in "Insulating-Glass Types" Article

2.6 GLAZING GASKETS

- A. Dense Compression Gaskets: Molded or extruded gaskets of profile and hardness required to maintain watertight seal, made from one of the following:
 - 1. Neoprene complying with ASTM C864
 - 2. EPDM complying with ASTM C864
 - 3. Silicone complying with ASTM C1115
 - 4. Thermoplastic polyolefin rubber complying with ASTM C1115
- B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned neoprene, EPDM, silicone, or, thermoplastic polyolefin rubber gaskets complying with ASTM C509, Type II, black; of profile and hardness required to maintain watertight seal.
 - 1. Application: Use where soft compression gaskets will be compressed by inserting dense compression gaskets on opposite side of glazing or pressure applied by means of pressure-glazing stops on opposite side of glazing.
- C. Lock-Strip Gaskets: Neoprene extrusions in size and shape indicated, fabricated into frames with molded corner units and zipper lock-strips, complying with ASTM C542, black.

2.7 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:
 - 1. AAMA 804.3 tape, where indicated
 - 2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure
 - 3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure
- B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
 - 1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant
 - 2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant

2.8 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
- F. Perimeter Insulation for Fire-Resistive Glazing: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire-protection rating indicated.

2.9 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
- B. Grind smooth and polish exposed glass edges and corners.

2.10 MONOLITHIC-GLASS TYPES

- A. Glass Type G1: Clear fully tempered float glass
 - 1. Thickness: 1/4 inch (6.0 mm)
 - 2. Provide safety glazing labeling.
- B. Glass Type G1A: Clear fully tempered laminated safety glazing:
 - 1. Refer to 08 85 53 Security Glazing
- C. Glass Type G2: Translucent laminated tempered Etched Glass
 - 1. Thickness: 9/16 inch

2.11 INSULATING-GLASS TYPES

- A. Glass Type G3: Low-e-coated, Tinted Insulating Security Glass
 - 1. Refer to 08 85 53 Security Glazing
- B. Glass Type G4: Low-e-coated, Tinted Insulating Glass
 - 1. SOLARBAN 60 Solar Control Low-E Glass (SOLARBAN 60 (2) Solargray + Clear) as manufactured by Vitro Architectural Glass or an equivalent by a listed manufacturer
 - 2. Overall Unit Thickness: 1 inch
 - 3. Thickness of Each Glass Ply: 6.0 mm
 - 4. Outdoor Lite: Tinted fully tempered float glass
 - 5. Interspace Content: Air

6. Indoor Lite: Clear fully transparent tempered float glass
7. Low-E Coating: 60 Solar Control sputtered on second surface
8. Visible Light Transmittance: 35 percent minimum
9. Winter Nighttime U-Factor: 0.29 maximum
10. Summer Daytime U-Factor: 0.27 maximum
11. Solar Heat Gain Coefficient: 0.25 maximum
- C. Glass Types G4A: Low-e-coated, Tinted Insulating Spandrel Glass
 1. SOLARBAN 60 Solar Control Low-E Glass (SOLARBAN 60 (2) Solargray + Clear (4) warm gray) as manufactured by Vitro Architectural Glass or an equivalent by a listed manufacturer
 2. Overall Unit Thickness: 1 inch
 3. Thickness of Each Glass Ply: 6.0 mm
 - a. Outdoor Lite: fully tempered float glass 6.0mm
 - b. Interspace Content: Air
 4. Indoor Lite: Ultraclear Low-Iron Float Glass
 5. Colors:

3 EXECUTION

3.1 EXAMINATION

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners
 2. Presence and functioning of weep systems
 3. Minimum required face and edge clearances
 4. Effective sealing between joints of glass-framing members
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
- B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.

3.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.
- C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
- D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- F. Provide spacers for glass lites where length plus width is larger than 50 inches.

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 2. Provide 1/8 inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

3.4 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until right before each glazing unit is installed.
- F. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

3.5 GASKET GLAZING (DRY)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- E. Install gaskets so they protrude past face of glazing stops.

3.6 CLEANING AND PROTECTION

- A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.
- C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.

- D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.
- E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION 08 80 00

SECTION 08 88 53

SECURITY GLAZING

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, 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 SUMMARY

- A. Section includes window film for doors, aluminum-framed entrances and storefronts, glazed aluminum curtain walls, and interior borrowed lites where glazing requirements are specified by reference to this Section.
- B. Related Sections
 - 1. Section 08 11 13.16, Custom Hollow Metal Doors and Frames
 - 2. Section 08 14 23.16, Plastic-Laminate-Faced Wood Doors
 - 3. Section 08 41 13, Aluminum-Framed Entrances and Storefronts
 - 4. Section 08 44 13, Glazed Aluminum Curtain Walls

1.3 REFERENCES

- A. Use current editions unless noted otherwise.
- B. American Architectural Manufacturers Association (AAMA)
 - 1. AAMA 800, Voluntary Specifications and Test Methods for Sealants
- C. American National Standards Institute (ANSI)
 - 1. ANSI Z97.1, Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test
- D. ASTM International (ASTM)
 - 1. ASTM C509, Standard Specification for Elastomeric Cellular Preformed Gasket and Sealing Material
 - 2. ASTM C542, Standard Specification for Lock-Strip Gaskets
 - 3. ASTM C864, Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers
 - 4. ASTM C1036, Standard Specification for Flat Glass
 - 5. ASTM C1048, Standard Specification for Heat-Treated Flat Glass—Kind HS, Kind FT Coated and Uncoated Glass
 - 6. ASTM C1115, Standard Specification for Dense Elastomeric Silicone Rubber Gaskets and Accessories
 - 7. ASTM C1281, Standard Specification for Preformed Tape Sealants for Glazing Applications
 - 8. ASTM E1886, Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials
 - 9. ASTM E1996, Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes
 - 10. ASTM E2190, Standard Specification for Insulating Glass Unit Performance and Evaluation
 - 11. ASTM E-1886, Standard Test Method for Missile Impact and Cycling on Exterior Windows, Shutters, Doors and Curtain Walls – Large Missile C (4.5 lb.)
 - 12. ASTM E-1996, Standard Specification for Missile Impact and Cycling On Exterior Windows, Shutters, Doors and Curtain Wall – Large Missile C.
- E. Glass Association of North America (GANA)
 - 1. GANA Glazing Manual

2. GANA Laminated Glazing Reference Manual
3. GANA Engineering Standards Manual
- F. Insulating Glass Manufacturers Alliance (IGMA)
 1. IGMA TM-3000, North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use
- G. National Fenestration Rating Council (NFRC)
 1. NFRC 100, Procedure for Determining Fenestration Product U-factors
 2. NFRC 200, Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence
 3. NFRC 300, Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems
- H. Underwriters Laboratories (UL)
 1. UL 752, Protection Standards for Bullet Resistant Glass Products
- I. MIAMI DADE Protocol PA 201 and 203
- J. 2010 ADA Standards for Accessible Design (SAD)
- K. 2012 Texas Accessibility Standards (TAS)
- L. Texas Health and Safety Code, Chapter 161, Subchapter Q, Installation of Asbestos
- M. Texas Occupations Code, Chapter 1954, Asbestos Health Protection

1.4 DEFINITIONS

- A. Glazing Manufacturers: Firms that produce primary glass, monolithic plastic glazing, or fabricated security glazing, as defined in referenced glazing publications.
- B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C1036
- C. Interspace: Space between lites of air-gap security glazing or insulating security glazing.
- D. Sealed Insulating Glass Unit Surfaces and Coating Orientation:
 1. Surface 1: Exterior surface of outer pane (facing outdoors of outboard lite).
 2. Surface 2: Interior surface of outer pane (facing indoors of outboard lite).
 3. Surface 3: Exterior surface of inner pane (facing outdoors of inboard lite).
 4. Surface 4: Room side surface of inner pane (facing indoors of inboard lite).

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00, Project Management and Coordination.

1.6 ACTION SUBMITTALS

- A. Submit product data for each glass product and glazing material indicated.
- B. Submit 12 inch square samples of each glass product indicated.
- C. Glazing Accessory Samples: For sealants and colored spacers, in 12-inch (300-mm) lengths. Install sealant Samples between two strips of material representative in color of the adjoining framing system.
- D. Security Glazing Schedule: List security glazing types and thicknesses for each size opening and location. Use same designations indicated on Drawings. Indicate coordinated dimensions of security glazing and construction that receives security glazing, including clearances and glazing channel dimensions.
- E. Delegated-Design Submittal: For security glazing indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation

1.7 INFORMATIONAL SUBMITTALS

- A. Submit Material Safety and Data Sheet (MSDS) for all materials, products, and parts.
- B. Qualification Data: For installers, manufacturers of insulating security glazing with sputter-coated, low-e coatings, glazing testing agency, and sealant testing agency.
- C. Product Certificates: For each type of product indicated, from manufacturer.
- D. Product Test Reports: For each type of security glazing, for tests performed by manufacturer and witnessed by a qualified testing agency.

- E. Product Test Reports: For each type of glazing sealant, for tests performed by a qualified testing agency.
- F. Provide test reports based on testing current sealant formulations within previous 36-month period.
- G. Preconstruction adhesion and compatibility test reports.
- H. Sample Warranties: For special warranties.

1.8 QUALITY ASSURANCE

- A. Manufacturer Qualifications for Insulating Security Glazing Units with Sputter-Coated, Low-E Coatings: A qualified insulating glazing manufacturer who is approved by coated-glass manufacturer.
- B. Source Limitations for Glass: Obtain each glass type from single source from single manufacturer.
- C. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.
- D. Glazing Publications: Comply with published recommendations of glass product manufacturers, American Architectural Manufacturers Association (AAMA), Glass Association of North America (GANA), and Insulating Glass Manufacturers Alliance (IGMA), unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
- E. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the Safety Glazing Certification Council (SGCC) or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- F. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of Insulating Glass Certification Council (IGCC).
- G. Installer Qualifications: A qualified installer who employs glazing installers for this Project who are certified under the National Glass Association Glazier Certification Program.
- H. Security Glazing Testing Agency Qualifications: Subject to compliance with requirements, testing agency is one of the following:
 - 1. Intertek Group plc.
 - 2. H. P. White Laboratory, Inc.
 - 3. Underwriters Laboratories, Inc.
 - 4. Wiss, Janney, Elstner Associates, Inc.
- I. Sealant Testing Agency Qualifications: Qualified according to ASTM C1021 for testing indicated.
- J. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation. Refer to Section 04 20 00, Unit Masonry, for requirements related to mockups.

1.9 PRECONSTRUCTION TESTING

- A. Preconstruction Adhesion and Compatibility Testing: Test each security glazing type, tape sealant, gasket, glazing accessory, and glazing-framing member for adhesion to and compatibility with elastomeric glazing sealants.
- B. Testing will not be required if data based on previous testing of current sealant products and glazing materials match those submitted.
- C. Use ASTM C1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to security glazing, tape sealants, gaskets, and glazing channel substrates.
- D. Test no fewer than four Samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.
- E. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
- F. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures, including the use of specially formulated primers.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
- B. Comply with insulating-glass manufacturer's written recommendations for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.11 WARRANTY

- A. Manufacturer's Special Warranty on Insulating Security Glazing: Manufacturer agrees to replace insulating security glazing that deteriorates within specified warranty period. Deterioration of insulating security glazing is defined as defects in individual lites developed from normal use or failure of hermetic seal under normal use. Deterioration does not include defects in individual lites or failure of hermetic seal that is attributed to glass breakage or to maintaining and cleaning insulating security glazing contrary to manufacturer's written instructions.
 - 1. Defects in coated-glass lites include peeling, cracking, and other indications of deterioration in coating.
 - 2. Defects in laminated-glass lites include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
 - 3. Defects in glass-clad polycarbonate lites include edge separation, delamination materially obstructing vision through glazing, blemishes exceeding those allowed by referenced glass-clad polycarbonate standard, yellowing, and loss of light transmission.
 - 4. Evidence of hermetic seal failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glazing.
- B. Warranty Period: 10 years from date of Substantial Completion. Provide glazier's written warranty against defects in material and workmanship for the work of this Section for a period of **two** years from the Date of Substantial Completion. Refer to Section 01 77 00, Closeout Procedures, for Warranty form.

2 PRODUCTS**2.1 MANUFACTURERS**

- A. Insulated Security Glazing
 - 1. Global Security Solutions
 - 2. Insulguard
 - 3. Oldcastle Building Envelope, Inc.
 - 4. Saftifirst
 - 5. Trulite Glass & Aluminum Solutions
 - 6. Vitro Architectural Glass (formerly PPG Industries, Inc.)
 - 7. Armoured One, LLC.
- B. Laminated Security Glazing
 - 1. Global Security Solutions
 - 2. Insulguard
 - 3. Oldcastle Building Envelope, Inc.
 - 4. Saftifirst
 - 5. Trulite Glass & Aluminum Solutions
 - 6. Vitro Architectural Glass (formerly PPG Industries, Inc.)
 - 7. Armoured One, LLC.
- C. Security Glazing Sealants
 - 1. General Electric
 - 2. Dow

2.2 PERFORMANCE REQUIREMENTS

- A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
 - 1. Temperature Change: 120° F (67° C), ambient; 180° F (100° C), material surfaces

2.3 GLASS PRODUCTS, GENERAL

- A. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.
 - 1. Minimum Glass Thickness for Exterior Lites: Not less than 6.0 mm
 - 2. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.
- A. Strength: Where float glass, heat-strengthened glass, or fully tempered glass is indicated, provide Kind FT heat-treated float glass.
- B. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
 - 1. For monolithic-glass lites, properties are based on units with lites 6.0 mm thick.
 - 2. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
 - 3. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F (W/sq. m x K).
 - 4. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
 - 5. Visible Reflectance: Center-of-glazing values, according to NFRC 300

2.4 INSULATING GLASS

- A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E2190, and complying with other requirements specified.
 - 1. Sealing System: Dual seal, with manufacturer's standard primary and secondary
 - 2. Spacer: Manufacturer's standard spacer material and construction
 - 3. Desiccant: Molecular sieve or silica gel, or blend of both
- B. Glass: Comply with applicable requirements in "Glass Products" Article as indicated by designations in "Insulating-Glass Types" Article

2.5 GLAZING GASKETS

- A. Dense Compression Gaskets: Molded or extruded gaskets of profile and hardness required to maintain watertight seal, made from one of the following:
 - 1. Neoprene complying with ASTM C 864
 - 2. EPDM complying with ASTM C 864
 - 3. Silicone complying with ASTM C 1115
 - 4. Thermoplastic polyolefin rubber complying with ASTM C 1115
- B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned neoprene, EPDM, silicone, or, thermoplastic polyolefin rubber gaskets complying with ASTM C 509, Type II, black; of profile and hardness required to maintain watertight seal.
 - 1. Application: Use where soft compression gaskets will be compressed by inserting dense compression gaskets on opposite side of glazing or pressure applied by means of pressure-glazing stops on opposite side of glazing.
- C. Lock-Strip Gaskets: Neoprene extrusions in size and shape indicated, fabricated into frames with molded corner units and zipper lock-strips, complying with ASTM C 542, black.

2.6 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:
1. AAMA 804.3 tape, where indicated
 2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure
 3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure

2.7 SECURITY GLAZING SEALANTS

- A. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant
 2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant
 3. GLAZING SEALANTS
 - a. General:
 - 1) Compatibility: Provide glazing sealants that are compatible with one another and with other materials they contact, including security glazing, seals of insulating security glazing and air-gap security glazing, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
 - 2) Suitability: Comply with sealant and security glazing manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
 - 3) Colors of Exposed Glazing Sealants: [As indicated by manufacturer's designations] [Match Architect's samples] [As selected by Architect from manufacturer's full range].
 - b. Security Sealant: Manufacturer's standard, nonsag, tamper-resistant sealant for joints with low movement complying with ASTM C920, Grade NS, Class 12.5 or 25, Use NT, and with a Shore A hardness of at least 45 when tested according to ASTM C661.

2.8 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
- F. Perimeter Insulation for Fire-Resistive Glazing: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire-protection rating indicated.

2.9 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
- B. Grind smooth and polish exposed glass edges and corners.

2.10 INSULATING-GLASS TYPES

- A. Glass Type G1A: Clear Tempered Laminated Security Glass
 - 1. Basis of Design: ArmorGarde as manufactured by Oldcastle BuildingEnvelope or other manufacturer listed above that meets the following test requirements:
 - 1) Applications: Locations as indicated on drawings.
 - 2) Tint: Clear
 - 3) Thickness: 7/16 inch (nominal)
 - 4) Outer Lite: Fully Tempered Glass
 - 5) Interlayer: Manufacturers custom security interlayer, thickness as required to meet performance criteria.
 - 6) Inside Lite: Fully Tempered Glass.
 - 7) Force Entry Resistance: Must comply with the following impact test:
 - a) ASTM F1233 Standard Method for Security Glazing Materials and Systems, Class 1.3 – 6 minutes.
- B. Glass Type G3: Low-e-coated, Tinted Insulating Security Glass
 - 1. Basis of Design: SOLARBAN 60 Solar Control Low-E Glass (SOLARBAN 60 (2) Solargray + Clear) with ArmorGarde as manufactured by Oldcastle BuildingEnvelope or other manufacturer listed above that meets the following test requirements:
 - 1) Applications: Locations as indicated on drawings.
 - 2) Outboard Lite: Tinted Fully Tempered Float Glass, 1/4 inch thick, minimum.
 - a) Tint: Gray (SOLARBAN 60 (2) SOLARGRAY
 - b) Coating: Low-E
 - 3) Metal Edge Spacer
 - 4) Inboard Lite: Class Type G1A- Class Laminated Security
 - a) Tint: Clear
 - 5) Force Entry Resistance: Must comply with the following impact test:
 - a) ASTM F1233 Standard Method for Security Glazing Materials and Systems, Class 1.3 – 6 minutes.
 - 6) Total Thickness: 1-1/8 inch Maximum.
 - 7) Visible Light Transmittance: 35 percent minimum
 - 8) Solar Heat Gain Coefficient: 0.25 maximum

3 EXECUTION**3.1 EXAMINATION**

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
 - 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners
 - 2. Presence and functioning of weep systems
 - 3. Minimum required face and edge clearances
 - 4. Effective sealing between joints of glass-framing members
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
- B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.

3.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.
- C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
- D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- F. Provide spacers for glass lites where length plus width is larger than 50 inches.
 - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 - 2. Provide 1/8 inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

3.4 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until right before each glazing unit is installed.
- F. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

3.5 GASKET GLAZING (DRY)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

- D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- E. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between security glazing and glazing stops to maintain face clearances and to prevent sealant from extruding into glazing channel and blocking weep systems. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to security glazing and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial washaway from security glazing.

3.7 CLEANING AND PROTECTION

- A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.
- C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.
- D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.
- E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION 08 80 00

SECTION 08 91 00

LOUVERS

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, 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 SUMMARY

- A. Section includes extruded aluminum, wind driven rain resistant, stationary louver with horizontally mounted sight proof blades.
- B. Related Sections
 - 1. Section 04 20 00, Unit Masonry
 - 2. Section 05 40 00, Cold-Formed Metal Framing
 - 3. Section 07 21 13.13, Foam Board Insulation
 - 4. Section 07 42 13, Metal Wall Panels
 - 5. Section 07 92 00, Joint Sealants
 - 6. Section 09 29 00, Gypsum Board

1.3 REFERENCES

- A. Use current editions unless indicated otherwise.
- B. American Architectural Manufacturers Association (AAMA)
 - 1. AAMA 2605, Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels
- C. Air Movement and Control Association International, Inc. (AMCA)
 - 1. AMCA 500-L, Laboratory Methods of Testing Louvers for Rating
 - 2. AMCA 501, Application Manual for Air Louvers
- D. American Society for Testing and Materials (ASTM)
 - 1. ASTM B26 / B26M, Standard Specification for Aluminum-Alloy Sand Castings
 - 2. ASTM B209, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
 - 3. ASTM B221, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
 - 4. ASTM D1187 / D1187M, Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal
- E. National Association of Architectural Metal Manufacturers (NAAMM)
 - 1. Metal Finishes Manual for Architectural and Metal Products
- F. Texas Health and Safety Code, Chapter 161, Subchapter Q, Installation of Asbestos
- G. Texas Occupations Code, Chapter 1954, Asbestos Health Protection

1.4 DEFINITIONS

- A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.
- B. Horizontal Louver: Louver with horizontal blades; i.e., the axes of the blades are horizontal.
- C. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.
- D. Storm-Resistant Louver: Louver that provides specified wind-driven rain performance, as determined by testing according to AMCA 500-L.

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00, Project Management and Coordination.

1.6 ACTION SUBMITTALS

- A. Submit product data for each type of product indicated.
- B. Submit shop drawings for louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.
 - 1. Show weep paths, gaskets, flashing, sealant, and other means of preventing water intrusion.
 - 2. Show mullion profiles and locations.
- C. Submit samples for initial selection for units with factory-applied color finishes.

1.7 INFORMATIONAL SUBMITTALS

- A. Submit Material Safety and Data Sheet (MSDS) for all materials, products, and parts.

1.8 QUALITY ASSURANCE

- A. Source Limitations: Obtain louvers from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

1.9 FIELD CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.10 WARRANTY

- A. Provide written warranty against defects in material and workmanship for the work of this Section for a period of one year from the Date of Substantial Completion.
- B. Refer to Section 01 77 00, Closeout Procedures, for Warranty form.

2 PRODUCTS**2.1 MANUFACTURERS**

- A. Air Flow Company, Inc.
- B. Airolite Company, LLC (The)
- C. Greenheck Fan Corporation
- D. Industrial Louvers, Inc.
- E. Nystrom Building Products
- F. Ruskin Company; Tomkins PLC

2.2 PERFORMANCE REQUIREMENTS

- A. Structural Performance
 - 1. Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver blade rattle or flutter, or permanent damage to fasteners and anchors.
 - 2. Wind pressures shall be considered to act normal to the face of the building. Determine loads based on applicable codes and requirements of authorities having jurisdiction.
- B. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.

2.3 MATERIALS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Ruskin Company; Model EME520MD or comparable product by one of the listed manufacturers.
- B. Aluminum Extrusions: ASTM B221, Alloy 6063-T5, T-52, or T6

- C. Aluminum Sheet: ASTM B209, Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish
- D. Aluminum Castings: ASTM B26/B26M, Alloy 319
- E. Fasteners: Use types and sizes to suit unit installation conditions.
 - 1. Use Phillips flat-head screws for exposed fasteners unless otherwise indicated.
 - 2. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
 - 3. For color-finished louvers, use fasteners with heads that match color of louvers.
- F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187

2.4 FABRICATION, GENERAL

- A. Assemble louvers in factory to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- B. Maintain equal louver blade spacing to produce uniform appearance.
- C. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
 - 1. Frame Type: Channel unless otherwise indicated.
- D. Include supports, anchorages, and accessories required for complete assembly.
- E. Provide vertical mullions of type and at spacings indicated, but not more than recommended by manufacturer, or 72 inches o.c., whichever is less.
 - 1. Exposed Mullions: Where indicated, provide units with exposed mullions of same width and depth as louver frame. Where length of louver exceeds fabrication and handling limitations, provide interlocking split mullions designed to permit expansion and contraction.
- F. Provide subsills with end dams made of same material as louvers.
- G. Join frame members to each other and to fixed louver blades with fillet welds concealed from view unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.5 FIXED, EXTRUDED-ALUMINUM LOUVERS

- A. Horizontal Storm-Resistant Louver
 - 1. Louver Depth: 5 inches
 - 2. Frame and Blade Nominal Thickness: Not less than 0.080 inch
 - 3. Louver Performance Ratings
 - a. Free Area: Not less than 6.99 sq. ft. for 48 inch wide by 48 inch high louver (44%)
 - b. Air Performance: Not more than 0.20-inch wg static pressure drop at 1,361 fpm velocity
 - c. Wind-Driven Rain Performance
 - 1) Not less than 99% effectiveness when subjected to a rainfall rate of 3 inches per hour and a wind speed of 29 mph at a Free Area Velocity of 1361 fpm
 - 2) Not less than 99% effectiveness when subjected to a rainfall rate of 8 inches per hour and a wind speed of 50 mph at a Free Area Velocity of 778 fpm
 - 3) Comply with the following testing certifications:
 - a) AMCA540 Listed for Basic Protection
 - b) AMCA550 - High Velocity Wind Driven Rain with Damper
 - c) Texas Department of Insurance (TDI) Listed LVR-10

2.6 LOUVER SCREENS

- A. General: Provide insect screen at interior face of each exterior louver.
- B. Secure screen frames to louver frames with stainless-steel machine screws or machine screws with heads finished to match louver, spaced a maximum of 6 inches from each corner and at 12 inches o.c.
- C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.
 - 1. Metal: Same kind and form of metal as indicated for louver to which screens are attached.
 - 2. Finish: Mill finish unless otherwise indicated
 - 3. Type: Rewirable frames with a driven spline or insert

2.7 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

2.8 ALUMINUM FINISHES

- A. Finish louvers after assembly.
- B. High-Performance Organic Finish
 - 1. 2-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 2. Color and Gloss: Louvers to match veneer in color. Owner to make final approval prior to fabrication.

3 EXECUTION**3.1 EXAMINATION**

- A. Examine substrates and openings, with Installer present, 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 PREPARATION

- A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 INSTALLATION

- A. Locate and place louvers and vents level, plumb, and at indicated alignment with adjacent work.
- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
- C. Form closely fitted joints with exposed connections accurately located and secured.
- D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- E. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.
- F. Protect unpainted galvanized and nonferrous-metal surfaces that will be in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.
- G. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 07 92 00, Joint Sealants, for sealants applied during louver installation.

3.4 ADJUSTING AND CLEANING

- A. Clean exposed surfaces of louvers not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.
- B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.
- C. Restore louvers and vents damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.
 - 1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION 08 91 00

SECTION 09 22 16

NON-STRUCTURAL METAL FRAMING

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, 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 SUMMARY

- A. Section includes non-load-bearing steel framing systems for interior gypsum board assemblies and suspension systems for interior gypsum ceilings.
- B. Related Requirements:
 - 1. Section 05 40 00, Cold-Formed Metal Framing
 - 2. Section 07 81 00, Applied Fireproofing
 - 3. Section 08 11 13.16, Custom Hollow Metal Doors and Frames
 - 4. Section 08 41 13, Aluminum-Framed Entrances and Storefronts
 - 5. Section 08 44 13, Glazed Aluminum Curtain Walls
 - 6. Section 09 21 16.23, Gypsum Board Shaft Wall Assemblies
 - 7. Section 09 29 00, Gypsum Board
 - 8. Section 10 80 00, Other Specialties

1.3 REFERENCES

- A. Use current editions unless noted otherwise.
- B. ASTM International (ASTM)
 - 1. ASTM A641 / A641M, Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
 - 2. ASTM C645, Standard Specification for Nonstructural Steel Framing Members
 - 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 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 D226 / D226M, Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
 - 7. ASTM E488, Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements
 - 8. ASTM E1190, Standard Test Methods for Strength of Power-Actuated Fasteners Installed in Structural Members
- C. Texas Health and Safety Code, Chapter 161, Subchapter Q, Installation of Asbestos
- D. Texas Occupations Code, Chapter 1954, Asbestos Health Protection

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00, Project Management and Coordination.

1.5 ACTION SUBMITTALS

- A. Submit product data for each type of product.

1.6 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For dimpled steel studs and runners, from ICC-ES.

- B. Submit Material Safety and Data Sheet (MSDS) for all materials, products, and parts.

1.7 WARRANTY

- A. Provide written warranty against defects in material and workmanship for the work of this Section for a period of one year from the Date of Substantial Completion.
- B. Refer to Section 01 77 00, Closeout Procedures, for Warranty form.

2 PRODUCTS

2.1 MANUFACTURERS

- A. AllSteel & Gypsum Products, Inc.
- B. California Expanded Metal Products Company
- C. ClarkDietrich Building Systems
- D. Consolidated Fabricators Corp.; Building Products Division
- E. Craco Mfg., Inc.
- F. Custom Stud Inc.
- G. Design Shapes in Steel
- H. Formetal Co. Inc.
- I. MarinoWARE
- J. Nuconsteel; a Nucor Company
- K. Olmar Supply, Inc.
- L. Quail Run Building Materials, Inc.
- M. SCAFCO Corporation
- N. Southeastern Stud & Components, Inc.
- O. State Building Products, Inc.
- P. Steel Construction Systems
- Q. Steel Network, Inc.
- R. Steel Structural Systems
- S. Steeler, Inc.
- T. Super Stud Building Products, Inc.
- U. Telling Industries, LLC
- V. United Metal Products, Inc.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

2.3 FRAMING SYSTEMS

- A. Framing Members, General: Comply with ASTM C754 for conditions indicated.
 - 1. Steel Sheet Components: Comply with ASTM C645 requirements for metal unless otherwise indicated.
 - 2. Protective Coating: ASTM A653/A653M, G40, hot-dip galvanized unless otherwise indicated
 - 3. No equal to framing members shall be allowed. NO EXCEPTIONS.
- B. Studs and Runners: ASTM C645, Use either steel studs and runners or dimpled steel studs and runners.
 - 1. Steel Studs and Runners
 - a. Minimum Base-Metal Thickness: 0.033 inch (20 gauge) 33 mils min. thickness with 33ksi yield strength; refer to drawings for locations requiring heavier material
 - b. Depth: 1½ inch, 2½ inches, 3½ inches, and 6 inches as indicated on Drawings
 - 2. Dimpled Steel Studs and Runners

- a. Minimum Base-Metal Thickness: 0.033 inch (20 gauge) 33 mils min. thickness with 33ksi yield strength; refer to drawings for locations requiring heavier material
- b. Depth: 1 $\frac{5}{8}$ inch, 2 $\frac{1}{2}$ inches, 3 $\frac{5}{8}$ inches, and 6 inches as indicated on Drawings
- C. Flat Strap and Backing Plate: Steel sheets for blocking and bracing in lengths, widths, and thickness required to accommodate loads and fasteners
- D. Cold-Rolled Channel Bridging: Steel, 0.053-inch minimum base-metal thickness, with minimum $\frac{1}{2}$ inch wide flanges
 - 1. Depth: 1 $\frac{1}{2}$ inches
 - 2. Clip Angle: Not less than 1 $\frac{1}{2}$ inches by 1 $\frac{1}{2}$ inches, 0.068 inch thick, galvanized steel
- E. Hat-Shaped, Rigid Furring Channels: ASTM C645.
 - 1. Minimum Base-Metal Thickness: 0.018 inch
 - 2. Depth: $\frac{7}{8}$ inch and 1 $\frac{1}{2}$ inch as indicated on Drawings
- F. Resilient Furring Channels: $\frac{1}{2}$ inch deep, asymmetrical steel sheet members designed to reduce sound transmission
- G. Cold-Rolled Furring Channels: 0.053 inch uncoated-steel thickness, with minimum $\frac{1}{2}$ inch wide flanges
 - 1. Depth: $\frac{3}{4}$ inch
 - 2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum uncoated-steel thickness of 0.033 inch
 - 3. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062 inch diameter wire, or double strand of 0.048 inch diameter wire

2.4 SUSPENSION SYSTEMS

- A. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062 inch diameter wire, or double strand of 0.048 inch diameter wire
- B. Wire Hangers: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter
- C. Carrying Channels: 1 $\frac{1}{2}$ inch deep, cold-rolled, commercial-steel sheet with a base-metal thickness of 0.053 inch and minimum $\frac{1}{2}$ inch wide flanges
- D. Furring Channels (Furring Members):
 - 1. Cold-Rolled Channels: $\frac{3}{4}$ inch deep, 0.053 inch uncoated-steel thickness, with minimum $\frac{1}{2}$ inch wide flanges
 - 2. Hat-Shaped, Rigid Furring Channels: ASTM C645, $\frac{7}{8}$ inch deep with minimum base-metal thickness of 0.018 inch

2.5 AUXILIARY MATERIALS

- A. Provide auxiliary materials that comply with referenced installation standards.
- B. Fasteners for Metal Framing: Type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates
- C. Isolation Strip at Exterior Walls: Provide one of the following:
 - 1. Asphalt-Saturated Organic Felt: ASTM D226, Type I (No. 15 asphalt felt), nonperforated
 - 2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, $\frac{1}{8}$ inch thick, in width to suit steel stud size

3 EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that 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.
- B. Coordination with Sprayed Fire-Resistive Materials:
 - 1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.
 - 2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

3.3 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C754
- B. Gypsum Board Assemblies: Also comply with requirements in ASTM C840 that apply to framing installation.
- C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- D. Install bracing at terminations in assemblies.
- E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.
- F. Exterior wall sections shall have a bridge way of 1/2" leg cold formed steel 1-1/2" wide (54mils) Clips manufactured for securing the bridging to the stud will be used.
 - 1. The bridging shall run level through the pre punched studs as designed.

3.4 INSTALLING FRAMED ASSEMBLIES

- A. Install framing system components according to spacings indicated, but not greater than 16 inches o.c. and spacings required by referenced installation standards for assembly types.
- B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- C. Where stud walls to receive tile finish, framing gauge/ thickness shall be increased to next gauge/ thickness from that minimum specified or stud spacing may be installed at no greater than 8 inches o.c. in lieu of increased thickness.
- D. Install studs so flanges within framing system point in same direction.
- E. Securely fasten tracks (runners) at floors and overhead supports with concrete stub nails, power driven anchors, or other suitable fastener 2 inches from each end and at 24 inches o.c. Securely fasten tracks at ceilings with toggle or molly bolts 2 inches from each end and at 24 inches o.c.
- F. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.
 - 1. Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
 - 2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; Openings shall be framed with a boxed header and use a trimmer stud framed under the header and clipped to the doubled king studs.
 - a. Install two studs at each jamb with a minimum base-metal thickness of 0.033 inch. Double studs to be clipped together to make one assembly.
 - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2 inch clearance from jamb stud to allow for installation of control joint in finished assembly.
 - 3. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.

4. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
6. Curved Partitions
 - a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
 - b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs 6 inches o.c.
- G. Installation Tolerance: Install each framing member so fastening surfaces vary not more than $\frac{1}{8}$ inch from the plane formed by faces of adjacent framing.

3.5 INSTALLING SUSPENSION SYSTEMS

- A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
 1. Hangers: 48 inches o.c.
 2. Carrying Channels (Main Runners): 48 inches o.c.
 3. Furring Channels (Furring Members): 16 inches o.c.
- B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- C. Suspend hangers from building structure as follows:
 1. 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. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 2. 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. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
 3. 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.
 4. Do not attach hangers to steel roof deck or permanent metal forms.
 5. Do not connect or suspend steel framing from joist bridging, ducts, pipes, or conduit.
- D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.
- E. Installation Tolerances: Install suspension systems that are level to within $\frac{1}{8}$ inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 09 22 16

SECTION 09 29 00

GYPSUM BOARD

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, 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 SUMMARY

- A. Section includes all interior gypsum board, tile backing panels, trim accessories, joint treatment materials, texture finishes, and auxiliary materials, including screws, sound attenuation blankets, and acoustical joint sealant.
- B. Related Requirements
 - 1. Section 05 40 00, Cold-Formed Metal Framing
 - 2. Section 07 21 16, Blanket Insulation
 - 3. Section 08 11 13.16, Custom Hollow Metal Doors and Frames
 - 4. Section 08 41 13, Aluminum Framed Entrances and Storefronts
 - 5. Section 09 22 16, Non-Structural Metal Framing
 - 6. Section 09 21 16.23, Gypsum Board Shaft Wall Assemblies
 - 7. Section 09 30 00, Tiling
 - 8. Section 09 91 00, Painting

1.3 REFERENCES

- A. Use current editions unless noted otherwise.
- B. American National Standards Institute (ANSI)
 - 1. ANSI A108.11, Standard for Interior Installation of Cementitious Backer Units
 - 2. ANSI A118.9, Test Methods and Specification for Cementitious Backer Units
- C. ASTM International (ASTM)
 - 1. ASTM B221, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
 - 2. ASTM C475 / C475M, Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board
 - 3. ASTM C665, Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
 - 4. ASTM C834, Standard Specification for Latex Sealants
 - 5. ASTM C840, Standard Specification for Application and Finishing of Gypsum Board
 - 6. ASTM C919, Standard Practice for Use of Sealants in Acoustical Applications
 - 7. 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
 - 8. ASTM C1002, Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs
 - 9. ASTM C1047, Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base
 - 10. ASTM C1288, Standard Specification for Discrete Non-Asbestos Fiber-Cement Interior Substrate Sheets
 - 11. ASTM C1325, Standard Specification for Non-Asbestos Fiber-Mat Reinforced Cementitious Backer Units
 - 12. ASTM C1396 / C1396M, Standard Specification for Gypsum Board

13. ASTM D3273, Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber
14. ASTM D3274, Standard Test Method for Evaluating Degree of Surface Disfigurement of Paint Films by Fungal or Algal Growth, or Soil and Dirt Accumulation
15. ASTM E90, Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
16. ASTM E413, Classification for Rating Sound Insulation
17. ASTM E119, Standard Test Methods for Fire Tests of Building Construction and Materials
18. ASTM E413, Classification for Rating Sound Insulation
- D. Texas Health and Safety Code, Chapter 161, Subchapter Q, Installation of Asbestos
- E. Texas Occupations Code, Chapter 1954, Asbestos Health Protection

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00, Project Management and Coordination.

1.5 ACTION SUBMITTALS

- A. Submit product data for each type of product.
- B. Submit samples for the following products:
 1. Trim Accessories: Full-size Sample in 12 inch long length for each trim accessory indicated

1.6 INFORMATIONAL SUBMITTALS

- A. Submit Material Safety and Data Sheet (MSDS) for all materials, products, and parts.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.
- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.
 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

1.9 WARRANTY

- A. Provide written warranty against defects in material and workmanship for the work of this Section for a period of one year from the Date of Substantial Completion.
- B. Refer to Section 01 77 00, Closeout Procedures, for Warranty form.

2 PRODUCTS

2.1 MANUFACTURERS

- A. Gypsum Board
 1. American Gypsum
 2. CertainTeed Corp.
 3. Georgia-Pacific Gypsum LLC.
 4. Lafarge North America Inc.
 5. National Gypsum Company

6. PABCO Gypsum
7. Temple-Inland
8. USG Corporation
- B. Cementitious Backer Units
 1. C-Cure
 2. CertainTeed Corp.
 3. Custom Building Products
 4. FinPan, Inc.
 5. James Hardie Building Products, Inc.
 6. National Gypsum Company
 7. USG Corporation
- C. Aluminum Trim
 1. Fry Reglet Corp.
 2. Gordon, Inc.
 3. Pittcon Industries
- D. Acoustical Joint Sealant
 1. Accumetric LLC
 2. Grabber Construction Products
 3. Pecora Corporation
 4. Specified Technologies, Inc.
 5. USG Corporation

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

2.3 GYPSUM BOARD, GENERAL

- A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.4 INTERIOR GYPSUM BOARD

- A. Gypsum Board: Type X, ASTM C1396/C1396M, $\frac{5}{8}$ inch thick with long edges tapered
- B. Flexible Gypsum Board: ASTM C1396/C1396M, $\frac{1}{4}$ inch thick with long edges tapered and manufactured to bend to fit radii and to be more flexible than standard regular-type gypsum board of same thickness
- C. Humidity Resistant Gypsum Board: Type X, water-resistant wall and ceiling gypsum board, ASTM C1396/C1396M, $\frac{5}{8}$ inch thick with long edges tapered.
 1. Shall be used at all walls and ceilings in high humidity rooms such as restrooms, showers and non-airconditioned interior spaces.
 - a. Provide within 24 inches of all sinks or lavatories without tile finish.

2.5 TILE BACKING PANELS

- A. Cementitious Backer Units: ANSI A118.9 and ASTM C1288 or ASTM C1325, with manufacturer's standard edges
 1. Thickness: $\frac{5}{8}$ inch
 2. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274
 3. USG Corporation DUROCK Cement Board or an equivalent by a listed manufacturer
- B. Water-Resistant Gypsum Backing Board: Type X, ASTM C1396/C1396M, $\frac{5}{8}$ inch thick core, with manufacturer's standard edges

2.6 TRIM ACCESSORIES

- A. Trim: ASTM C1047.
 - 1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc
 - 2. Shapes
 - a. Cornerbead
 - b. Bullnose bead
 - c. LC-Bead: J-shaped; exposed long flange receives joint compound
 - d. L-Bead: L-shaped; exposed long flange receives joint compound
 - e. U-Bead: J-shaped; exposed short flange does not receive joint compound
 - f. Expansion (control) joint
 - g. Curved-Edge Cornerbead: With notched or flexible flanges
 - h. Reveal: DRM-50-100 by Fry Reglet or equal from one of the above manufacturers.

2.7 JOINT TREATMENT MATERIALS

- A. Comply with ASTM C475/C475M.
- B. Joint Tape
 - 1. Interior Gypsum Board: Paper
 - 2. Tile Backing Panels: As recommended by panel manufacturer
- C. Joint Compound for Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
 - 1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
 - 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
 - 3. Fill Coat: For second coat, use setting-type, sandable topping compound.
 - 4. Finish Coat: For third coat, use drying-type, all-purpose compound.
 - 5. Skim Coat: For final coat of Level 5 finish, use high-build interior coating product designed for application by airless sprayer and to be used instead of skim coat to produce Level 5 finish.
- D. Joint Compound for Tile Backing Panels:
 - 1. Cementitious Backer Units: As recommended by backer unit manufacturer
 - 2. Water-Resistant Gypsum Backing Board: Use setting-type taping compound and setting-type, sandable topping compound.
- E. Control Joints
 - 1. Basis of Design: Clarkdietrich 093 Zinc Control Joint (ZNCJ), or equivalent by a listed manufacturer
 - a. Size: 1/4 inch opening
 - b. Material: Corrosion resistant Zinc.

2.8 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate
- C. Steel Drill Screws
 - 1. Use screws complying with ASTM C1002 for fastening panels to steel members less than 0.033 inches thick.
 - 2. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 inch to 0.112 inch thick.
 - 3. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- D. Sound Attenuation Blankets: ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool
 - 1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
- E. Sound Attenuation Fire Batts (SAFB)

1. Basis of Design: Johns Manville Mineral Wool Sound Attenuation Fire Batts or Owens Corning Thermafiber SAFB
 - a. Standard Fiber
 - b. Size: 6"
 - c. Nominal Density, 2.5 pcf
 - d. ASTM C518 R-Value at 75°F, 3.7 per inch of thickness
 - e. Acoustical performance to meet ASTM C423 Test Method (Type A Mounting)
- F. Acoustical Joint Sealant
 1. Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C834
 2. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E90.
 3. USG Corporation SHEETROCK Acoustical Sealant or equivalent by a listed manufacturer
- G. Thermal Insulation: As specified in Section 07 21 16, Blanket Insulation

3 EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.
- B. Verify wood blocking and backing plates are in place and securely fastened and mechanical, electrical, and plumbing systems have been tested prior to concealment.
- C. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except where indicated otherwise.
 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
 2. Fit gypsum panels around ducts, pipes, and conduits.
 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4 inch to 3/8 inch wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4 inch to 1/2 inch wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

- I. Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant at all STC-rated assemblies and assemblies where sound attenuation blankets are indicated. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
- J. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.
 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
 3. Maintain 3 inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
 4. Where cavity heights exceed 96 inches, stud depth is greater than insulation thickness, or cover material is absent from one or both sides of steel studs, support unfaced blankets mechanically to flanges of metal studs.
 5. Hold insulation minimum 1 inch from slab.
 6. Where insulation is exposed at walls with gypsum board on one side, provide insulation hangers to hold insulation blanket in place. Refer to 07 21 16 for insulation pin requirements.

3.3 APPLYING INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
 1. Type X: At all locations unless otherwise indicated
 2. Type X water resistant: Shall be used at all walls and ceilings in high humidity rooms such as restrooms, showers and non-airconditioned interior spaces and provide within 24 inches of all sinks or lavatories without tile finish.
- B. Single-Layer Application:
 1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
 2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
 - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
 - b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
 3. Fastening Methods: Apply gypsum panels to supports with steel drill screws.
- C. Multilayer Application:
 1. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
 2. Fastening Methods: Fasten base layers and face layers separately to supports with screws.
- D. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.

3.4 APPLYING TILE BACKING PANELS

- A. Cementitious Backer Units: ANSI A108.11, install at all showers and restrooms indicated to receive tile, and other locations indicated.

- B. Water-Resistant Backing Board: Install at all locations except showers and restrooms indicated to receive tile and where indicated with ¼ inch gap where panels abut other construction or penetrations.
- C. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.5 INSTALLING TRIM ACCESSORIES

- A. For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Install trim in longest lengths available to minimize joints. Where length of trim does not exceed standard stock lengths, furnish and install a single length.
- C. Control Joints
 - 1. Install at locations indicated on Drawings and in walls and ceilings at spacing not exceeding 30 feet o.c. from floor to above ceiling whether indicated on the Drawings or not according to ASTM C840 and in specific locations approved by Architect for visual effect.
 - 2. Install at each sides of door and window frames, from top of jamb to above ceiling (at each side).
 - 3. Install at all sides of furdawns.
 - 4. Where locations not indicated on the Drawings are required, submit proposed locations to Architect for review and approval prior to installation.
- D. Interior Trim: Install in the following locations:
 - 1. Cornerbead: Use at all outside corners except where use of bullnose bead or curved-edge cornerbead is indicated below.
 - 2. Bullnose Bead: Use at all vertical outside corners except where tile is the finish surface.
 - 3. LC-Bead, L-Bead, U-Bead: Use at exposed panel edges, where panels abut dissimilar materials, and other locations where indicated.
 - 4. Curved-Edge Cornerbead: Use at curved openings.

3.6 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C840.
 - 1. Level 0
 - a. Locations: Temporary partitions to be removed prior to final occupancy
 - b. Taping, finishing, and cornerbeads are not required.
 - 2. Level 1
 - a. Locations: Ceiling plenum areas, concealed areas, and other locations where indicated
 - b. At joints and interior angles, embed the tape in the joint compound.
 - c. Panel surfaces must be free of excess joint compound, but tool marks and ridges are acceptable.
 - 3. Level 2
 - a. Locations: Panels that are substrate for tile and other locations where indicated
 - b. At joints and interior angles, embed the tape in the joint compound and immediately apply the joint compound over the tape.
 - c. Apply one coat of the joint compound on fastener heads and flanges of trim accessories.
 - d. Panel surfaces must be free of excess joint compound, but tool marks and ridges are acceptable.
 - 4. Level 3
 - a. Locations: Surfaces in mechanical, electrical, custodial, and storage rooms where lighting conditions are not critical and other locations where indicated

- b. At joints and interior angles, embed the tape in the joint compound and immediately apply the joint compound over the tape.
 - c. Apply one additional coat of the joint compound over the tape.
 - d. Apply two separate coats of the joint compound over fastener heads and flanges of trim accessories.
 - e. Panel surfaces and the joint compound must be smooth and free of tool marks and ridges.
5. Level 4
- a. Locations: Surfaces receiving light-textured finishes, wallcoverings, and flat paints and other locations where indicated
 - b. At joints and interior angles, embed the tape in the joint compound and immediately apply the joint compound over the tape.
 - c. Apply two additional separate coats of the joint compound over flat joints. Apply one additional coat of the joint compound over interior angles.
 - d. Apply three separate coats of the joint compound over fastener heads and flanges of trim accessories.
 - e. Panel surfaces and the joint compound must be smooth and free of tool marks and ridges.
 - f. "Drywall primer" must be applied to surfaces before applying final decoration. Primer and its application to surfaces are specified in Section 09 91 00, Painting.
6. Level 5
- a. Locations: Surfaces receiving gloss and semigloss enamels, other surfaces subject to severe lighting, and other locations where indicated
 - b. Finish must be equal to Level 4 (embedding coat and three finish coats) plus a skim coat over the entire gypsum board surface. Surfaces must be smooth and free of tool marks and ridges.
 - c. Primer and its application to surfaces are specified in Section 09 91 00, Painting.
- E. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.7 PROTECTION

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, or mold damaged.
 - 1. Indications that panels and/or insulation are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09 29 00

SECTION 09 30 00

TILING

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, 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 SUMMARY

- A. Section includes ceramic tile, quarry tile, stone thresholds (where indicated in the drawings and at all locations where tile floor transitions to adjacent floor finish), and finishing and edge-protection profiles.
- B. Related Sections
 - 1. Section 03 30 00, Cast-In-Place Concrete
 - 2. Section 04 20 00, Unit Masonry
 - 3. Section 09 29 00, Gypsum Board
 - 4. Section 09 65 19, Resilient Tile Flooring
 - 5. Section 09 67 26, Quartz Flooring
 - 6. Section 10 28 13, Toilet Accessories
 - 7. Section 11 40 00, Foodservice Equipment

1.3 REFERENCES

- A. Use current editions unless noted otherwise.
- B. American National Standards Institute (ANSI)
 - 1. ANSI A108.1A, Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar
 - 2. ANSI A108.1B, Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex Portland Cement Mortar
 - 3. ANSI A108.1C, Contractor's Option: Installation of Ceramic Tile Using A108.1A or A108.1B
 - 4. ANSI A108.5, Ceramic Tile Installed with Dry-Set Portland Cement Mortar or Latex Portland Cement Mortar
 - 5. ANSI A108.10, Installation of Grout in Tilework
 - 6. ANSI A108.13, Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone
 - 7. ANSI A118.1, Dry-Set Portland Cement Mortar
 - 8. ANSI A118.4, Latex Portland Cement Mortar
 - 9. ANSI A118.6, Ceramic Tile Grouts
 - 10. ANSI A118.10, Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone Installations
 - 11. ANSI A137.1, Ceramic Tile
 - 12. ANSI A10.20, Safety Requirements for Construction and Demolition – Ceramic Tile, Terrazzo, and Marble Work
- C. ASTM International (ASTM)
 - 1. ASTM A82, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement
 - 2. ASTM A185/A185M, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete
 - 3. ASTM A366, Standard Specification for Steel, Carbon, Cold-Rolled Sheet, Commercial Quality
 - 4. ASTM A1011, Standard Specification for Steel, Hot-Rolled Sheet and Strip, Commercial
 - 5. ASTM B117, Standard Method of Salt Spray (Fog) Testing

6. ASTM C144, Standard Specification for Aggregate for Masonry Mortar
7. ASTM C150 / C150M, Standard Specification for Portland Cement
8. ASTM C206, Standard Specification for Finishing Hydrated Lime
9. ASTM C207, Standard Specification for Hydrated Lime for Masonry Purposes
10. ASTM C241 / C241M, Standard Test Method for Abrasion Resistance of Stone Subjected to Foot Traffic
11. ASTM C373, Standard Test Methods for Determination of Water Absorption and Associated Properties by Vacuum Method for Pressed Ceramic Tiles and Glass Tiles and Boil Method for Extruded Ceramic Tiles and Non-tile Fired Ceramic Whiteware Products
12. ASTM C482, Standard Test Method for Bond Strength of Ceramic Tile to Portland Cement Paste
13. ASTM C503 / C503M, Standard Specification for Marble Dimension Stone
14. ASTM C648, Standard Test Method for Breaking Strength of Ceramic Tile
15. ASTM C650, Standard Test Method for Resistance of Ceramic Tile to Chemical Substances
16. ASTM C920, Standard Specification for Elastomeric Joint Sealants
17. ASTM C1028, Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method
18. ASTM C1353 / C1353M, Standard Test Method for Abrasion Resistance of Dimension Stone Subjected to Foot Traffic Using a Rotary Platform Abraser
19. ASTM D1735, Standard Practice for Testing Water Resistance of Coating Using Water Fog Apparatus
20. ASTM E90, Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss in Building Partitions
21. ASTM E336, Standard Test Method for Measurement of Airborne Sound Insulation in Buildings
22. ASTM E413, Classification for Determination of Sound Transmission Class
- D. Tile Council of North America, Inc. (TCNA)
 1. TCNA Handbook for Ceramic, Glass, and Stone Tile Installation
- E. 2010 ADA Standards for Accessible Design (SAD)
- F. 2012 Texas Accessibility Standards (TAS)
- G. Texas Health and Safety Code, Chapter 161, Subchapter Q, Installation of Asbestos
- H. Texas Occupations Code, Chapter 1954, Asbestos Health Protection

1.4 ACTION SUBMITTALS

- A. Submit product data and installation instructions for each type of product indicated.
- B. Samples for Initial Selection: Submit samples of each color of each type of ceramic tile specified herein available from manufacturer.

1.5 INFORMATIONAL SUBMITTALS

- A. Submit Material Safety and Data Sheet (MSDS) for all materials, products, and parts.

1.6 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00, Project Management and Coordination.

1.7 QUALITY ASSURANCE

- A. Subcontractor shall have not less than five years' experience in projects of similar size and scope.

1.8 WARRANTY

- A. Provide written warranty against defects in material and workmanship for the work of this Section for a period of one year from the Date of Substantial Completion of the Project.
- B. Refer to Section 01 77 00, Closeout Procedures, for Warranty form.

1.9 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
- B. Deliver to the Owner 25 square feet or unopened box (whichever is greater) with identification labels intact of each type and color of tile, cove base, bullnose, and accent tiles installed as attic stock.
- C. This material shall not be used for Contractor's warranty work.

2 PRODUCTS**2.1 MANUFACTURERS**

- A. Ceramic Tile – CT-1A, CT-2A, CT-3A, CT-4A, CT-5A, CT-5B, CT-6D, CT-7D, CT-8E, CT-9E & GT-1C
 - 1. Daltile; Division of Dal-Tile International Inc.
- B. Setting Materials
 - 1. Laticrete
 - 2. Mapei
 - 3. UZIN
 - 4. Other as recommended by tile manufacturer.
- C. Finishing and Edge-Protection Profiles
 - 1. Proline
 - 2. Schluter Systems
- D. Waterproof Membrane
 - 1. Boiard Products; a QEP company
 - 2. Bonsal American; an Oldcastle company
 - 3. Bostik, Inc.
 - 4. Custom Building Products
 - 5. Laticrete International, Inc.
 - 6. MAPEI Corporation
 - 7. Mer-Kote Products, Inc.
 - 8. Summitville Tiles, Inc.

2.2 MATERIALS

- A. Ceramic & Porcelain Tile
 - 1. Meet or exceed the Standard Grade requirements of ANSI A137.1.
 - a. Porcelain Ceramic Tile CT-1A, CT-2A, CT-3A, CT-4A, CT-5A, CT-5B, CT-6D, CT-7D, CT-8E, CT-9E & GT-1C
 - 2. Porcelain Ceramic Tile by Daltile
 - 2. Glass Mosaic Tile GT-1C - Cascading Glass
 - a. Glass Mosaic Tiles by Daltile
 - b. Water Absorption: Less than 0.5% when tested in accordance with ASTM C373
 - c. Breaking Strength: Greater than 100 lbs. when tested in accordance with ASTM C648
 - d. Dynamic Coefficient of Friction: N/A for walls/ backsplashes.
 - e. Scratch Hardness: 4.0 on MOHS scale
 - f. Chemical Resistance: Resistant when tested in accordance with ASTM C650
 - g. Size:
 - 1) GT-x (Color)C: Nominally 1 inch x 4 inch x $\frac{5}{16}$ inch
 - h. Grout Thickness: Minimum of 3 mm (1/8") recommended
 - i. Color: As selected by the Architect from the manufacturer's full range
 - j. Patterns: As indicated on the drawings
 - k. Provide edge protection profiles at base, top and outside corners.
 - 3. Ceramic Tile CT-1A, CT-2A,
 - a. Ceramic wall tile with MICROBAN Technology by Daltile.
 - b. Water Absorption: Less than 20% when tested in accordance with ASTM C373

- c. Breaking Strength: Between 120-230 lbs. when tested in accordance with ASTM C648
- d. Scratch Hardness: 4.0 - 6.0 on MOHS scale
- e. Chemical Resistance: Resistant when tested in accordance with ASTM C650
- f. Size:
 - 1) CT- X(color)A: Nominally 12 inch x 24 inch x $\frac{3}{8}$ inch
- g. Trim
 - 1) Furnish size, colors, and shades to match field tile.
 - 2) Provide bullnose cap at wainscot, outside corners, and jambs where tilework projects from wall surface.
 - 3) Provide bullnose at outside corners.
- h. Grout Thickness: Minimum of 1.6 mm ($\frac{1}{16}$ ") recommended
- i. Color: As selected by the Architect from the manufacturer's full range
- j. Finish: Matte
- k. Patterns: As indicated on the drawings
- 4. Ceramic Tile CT-3A, CT-4A, CT-5A, CT-6D, CT-7D, CT-8E & CT-9E
 - a. Color Body porcelain tile by Daltile.
 - b. Water Absorption: Less than 5% when tested in accordance with ASTM C373
 - c. Breaking Strength: Greater than 275 lbs. when tested in accordance with ASTM C648
 - d. Scratch Hardness: 8.0 on MOHS scale
 - e. Chemical Resistance: Resistant when tested in accordance with ASTM C650
 - f. Size:
 - 1) CT- X(color)A: Nominally 12 inch x 24 inch x $\frac{5}{16}$ inch
 - 2) CT- X(color)D: Nominally 6 inch x 24 inch x $\frac{5}{16}$ inch
 - 3) CT- X(color)E: Random Linear x $\frac{5}{16}$ inch
 - g. Trim
 - 1) Furnish size, colors, and shades to match field tile.
 - 2) Provide bullnose cap at wainscot, outside corners, and jambs where tilework projects from wall surface.
 - 3) Provide bullnose at outside corners.
 - 4) Provide 6 inch x 12 inch x $\frac{5}{16}$ inch cove base and 1 inch x 6 inch x $\frac{5}{16}$ inch cove base Outcorner at CT-3A & CT4A locations.
 - h. Grout Thickness:
 - 1) Minimum of 3 mm ($\frac{1}{8}$ ") recommended for CT-3A, CT-4A, CT-5A, CT-8E & CT-9E
 - 2) Minimum of 4.7 mm ($\frac{3}{16}$ ") recommended for CT-6D, CT-7D
 - i. Color: As selected by the Architect from the manufacturer's full range
 - j. Finish: Textured for CT-3A, CT-4A, CT-5A & Matte for CT-6D, CT-7D, CT-8E & CT-9E
 - k. Patterns: As indicated on the drawings
- 5. Porcelain Tile CT-5B
 - a. Glazed porcelain wall tile with by Daltile.
 - b. Water Absorption: Less than .5% when tested in accordance with ASTM C373
 - c. Breaking Strength: > 275 lbs. when tested in accordance with ASTM C648
 - d. Scratch Hardness: 7.0 on MOHS scale
 - e. Chemical Resistance: Resistant when tested in accordance with ASTM C650
 - f. Size:
 - 1) CT- X(color)B: Nominally 2 inch x 10 inch x $\frac{3}{8}$ inch
 - g. Grout Thickness: Minimum of 3 mm ($\frac{1}{8}$ ") recommended
 - h. Color: As selected by the Architect from the manufacturer's full range
 - i. Finish: Glossy
 - j. Patterns: As indicated on the drawings
- B. Setting Materials
 - 1. Mortar Bed
 - a. Portland Cement: Comply with the requirements of ASTM C150, Type 1, Gray or White.
 - b. Hydrated Lime: Comply with the requirements of ASTM C206 or C207, Type S.
 - c. Sand: Comply with the requirements of ASTM C144
 - d. Water: Clean and drinkable.

- e. Reinforcing: Comply with the requirements of ASTM A82 and A185, 2 x 2 16/16.
- 2. Dry Set Mortar: Comply with the requirements of ANSI A118.1.
- 3. Latex-Portland Cement Mortar: Comply with the requirements of ANSI A118.4.
- 4. Grout:
 - a. At interior locations, comply with the requirements of ANSI A118.6, Latex-Portland cement type.
 - b. At exterior locations provide one of the following to comply with the requirements of ANSI A118.7 standard for high performance cementitious grouts
 - 1) Mapei ULTRACOLOR PLUS FA
 - 2) Laticrete SPECTRALOCK® 2000 IG
 - 3) UZIN XTRAGUARD
 - c. Provide expansion joints per requirements of TCNA-EJ171. Refer to drawings for additional information.
- C. Finishing and Edge-Protection Profiles
 - 1. Material and Finish: Brushed stainless steel 304
 - 2. Outside Corner Edge Protection: Schluter®-QUADEC or equal by Proline
 - 3. Outside Corner at 135 ° corners - Schluter®-DECO-DE or equal by Proline
 - 4. Edge Protection between Resilient Base or Seamless Polymer Flooring Base and Tile: Schluter®-JOLLY or Equal by Proline.
 - 5. At Radius: Schluter®-SCHIENE-RADIUS.
 - 6. At Vertical and Horizontal transitions - Schluter®-JOLLY or Equal by Proline.
- D. Marble Thresholds
 - 1. ASTM C503, uniform, fine to medium grained white stone with gray veining with a minimum abrasion resistance of 10 per ASTM C1353 or ASTM C241 and with honed finish
 - 2. Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.
 - 3. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to ½ inch or less above adjacent floor surface.
- E. Expansion Joints
 - 1. Comply with the requirements of TCNA Method EJ171.
 - 2. Sealant: Polysulfide sealant complying with the requirements of ASTM C920.
 - 3. Back-up Strip: Rounded, flexible, compressible type as recommended by the sealant manufacturer.

3 EXECUTION

3.1 INSPECTION

- A. Tile Contractor shall examine preparatory work by others and notify Architect of any imperfections that would affect a satisfactory completion of this tile work. Absence of such notification shall constitute acceptance of responsibility by Tile Contractor.
 - 1. Verify that slab is free of cracks, waxy or oily films, and is well cured.
 - 2. Verify that variations in floor elevations not scheduled for mortar beds do not exceed ⅛ inch in 10 feet.
 - 3. Verify that variations in walls do not exceed ⅛ inch in 8 feet.
- B. Tile Contractor shall provide floor-stoning as required to correct any floor problems which may result in visually objectionable installation (such as meeting of wall and floor tile).

3.2 INSTALLATION

- A. Install all products in strict accordance with manufacturer's printed instructions and recommendations.
- B. Proportion all mixes in accordance with the latest ANSI Standard Specifications.
- C. Determine locations of all movement joints and accessories prior to starting of tile work.
- D. Setting Methods

1. Comply with tile manufacturer's recommendations.
2. Floors
 - a. Slab on grade: TCNA Method F113 (Dry-Set Mortar or Latex-Portland Cement Mortar)
 - b. Slab on grade (where waterproof floor is required): TCNA Method F122 (Thin-Set)
 - c. Slab on Grade (Quarry Tile): Cement Mortar Method, TCNA Spec. F112 (Bonded Mortar Bed)
3. Walls
 - a. Gypsum Board: TCNA Method W243 (Dry-Set Mortar or Latex-Portland Cement Mortar)
 - b. Gypsum Board (wet areas, including showers and laundries): TCNA Method W244 (Dry-Set Mortar or Latex-Portland Cement Mortar)
 - c. Masonry or Concrete: TCNA Method W202 (Dry-Set Mortar or Latex-Portland Cement Mortar)
- E. Ceramic Tile
 1. Lay out tile so as to eliminate tiles cut to less than one-half size.
 2. Locate tile cuts in floors, base and walls so as to be least conspicuous.
 3. Lay out tile wainscots and jambs to next full tile beyond dimension shown.
 4. Align all wall joints to give straight uniform grout lines plumb and level. Staggered joints are not permitted.
 5. Align all floor joints to give straight uniform grout lines. Staggered joints are not permitted.
 6. At installations where both wall and floor and base tile are modular, align wall and floor joints to give straight uniform grout lines.
 7. Make joints between tile sheets same width as joints within tile sheets so extent of each sheet is not apparent in finished work.
 8. Fit tile carefully against trim, accessories, pipes, electrical boxes and other built in fixtures so that escutcheons, plates and collars will completely overlap cut edges. Minimize tearing of tile sheets.
 9. Smooth all exposed cut edges.
 - a. Finishing and Edge-Protection Profiles: Install as indicated on the drawings and in accordance with manufacturer's recommendations at the bottom edge and at all outside corners of all CT-1, CT-2, CT-3, CT-4, CT-5, CT-6, CT-7, CT-8, CT-9, and CT-10 tiles.
- F. Grouting
 1. Follow grout manufacturer's printed instructions and recommendations as to grouting procedures and precautions.
 2. All floor tile grout to be sealed with a commercial penetrating sealer.
 3. Remove all grout haze, observing grout manufacturer's recommendations as to use of acid and chemical cleaners.
 4. Rinse tile work thoroughly with clean water before and after using chemical cleaners.
- G. Expansion Joints
 1. Comply with the requirements of TCNA Method EJ171 and sealant manufacturer.
 2. Space joints as shown in the drawings and at 20 feet to 25 feet in each direction.
 3. Provide where floor tile abuts restraining surfaces such as perimeter walls, dissimilar floors, curbs, columns, pipes, ceilings, and where changes occur in backing material.
 4. Provide at all expansion, control, construction and cold joints in backing material, including floor slab construction joints and masonry and gypsum board control joints. The width of such joints in the tilework shall not be less than the width of the joint in the backing material.

3.3 ADJUSTING AND CLEANING

- A. Leave finish tile work clean and free from smears, excess grout, and cracked, chipped, uneven, or broken tile.
- B. Polish glazed tile surfaces with soft cloth.

3.4 PROTECTION OF WORK

- A. Cover all tile floors with heavy-duty non-staining construction paper, masked in place.
- B. Prohibit all foot and wheel traffic from using newly tiled floors for at least 3 days, preferably 7 days. Place large flat boards over newly tiled floors for 7 days, where use is unavoidable.

END OF SECTION 09 30 00

SECTION 09 51 00

ACOUSTICAL CEILINGS

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, 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 SUMMARY

- A. Section includes all acoustical ceiling systems consisting of exposed suspension system (including wire hangers, fasteners, main runners, cross tees, and wall moldings) and acoustical ceiling tiles.
- B. Related Requirements
 - 1. Section 04 20 00, Unit Masonry
 - 2. Section 05 12 00, Structural Steel Framing
 - 3. Section 05 21 00, Steel Joist Framing
 - 4. Section 09 29 00, Gypsum Board

1.3 REFERENCES

- A. Use current editions unless noted otherwise.
- B. ASTM International (ASTM)
 - 1. ASTM A641/A641M, Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
 - 2. ASTM C423, Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
 - 3. ASTM C635, Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings
 - 4. ASTM C636, Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels
 - 5. ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials
 - 6. ASTM E1264, Standard Classification for Acoustical Ceiling Products
- C. Texas Health and Safety Code, Chapter 161, Subchapter Q, Installation of Asbestos
- D. Texas Occupations Code, Chapter 1954, Asbestos Health Protection

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00, Project Management and Coordination.

1.5 ACTION SUBMITTALS

- A. Submit product data for each type of product indicated.
- B. Samples: Submit samples not less than 6 inches square of each type of acoustical ceiling tile and samples not less than 12 inches long of each suspension system component.

1.6 INFORMATIONAL SUBMITTALS

- A. Submit Material Safety and Data Sheet (MSDS) for all materials, products, and parts.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
- B. Deliver to the Owner two unopened boxes with identification labels intact of each type of tile installed. This material shall not be used for Contractor's warranty work.

1.8 QUALITY ASSURANCE

- A. All system materials shall be obtained from a single specified manufacturer or from manufacturer approved by systems manufacturer.
- B. Installer shall have a minimum of three years' experience in the installation of specified systems for projects of similar size and scope as this project.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store all acoustical ceiling system components in manufacturer's original unopened packages or containers, with labels intact.
- B. Store all components to provide suitable protection against exposure to moisture, direct sunlight, surface contamination or other unacceptable conditions.
- C. Handle all components to prevent damage. Take special precaution to prevent damage to edges and corners of acoustical ceiling tiles.
- D. Comply with manufacturer's MSDS for delivery, storage, and handling of components.

1.10 WARRANTY

- A. Provide written Warranty against defects in material and workmanship for the work of this Section for a period of one year from the Date of Substantial Completion of the project. Warranty shall include sagging and warping of ceiling tiles and rusting of suspension system components.
- B. Refer to Section 01 77 00, Closeout Procedures, for Warranty form.

2 PRODUCTS**2.1 MANUFACTURERS**

- A. Acoustical Ceiling Tiles (ACP-1)
 - 1. Armstrong World Industries, Inc.
 - 2. CertainTeed
 - 3. USG Interiors, Inc.
- B. Exposed Suspension System (Type SS-1)
 - 1. Armstrong World Industries, Inc.
 - 2. USG Interiors, Inc.

2.2 MATERIALS

- A. Acoustical Ceiling Systems
 - 1. ACP-1
 - a. Acoustical Ceiling Tiles: Type ACP-1
 - b. Exposed Suspension System: Type SS-1
- B. Acoustical Ceiling Tiles
 - 1. Type ACP-1 - Basis-of-Design Product: Fine Fissured 1728, as manufactured by Armstrong World Industries, Inc.
 - a. Edge Detail: Square
 - b. Material: Mineral fiber
 - c. Surface Finish: Medium texture.
 - d. Light Reflectance: ASTM E 1477; 0.82
 - e. Sag/Humidity Resistance: HUMIGUARD Plus.
 - f. Flame Spread: ASTM E1264 Classification; Class A.
 - g. Mold/Mildew Resistance: BIOBLOCK.
 - h. Size: 24" x 24" x 5/8"
 - i. Color: White
 - j. Noise Reduction Coefficient (NRC) Range: 0.55 when tested in accordance with ASTM C423
 - k. CAC: 33.
 - l. Fire Class: Class A.
 - m. Light Reflectance: 0.82

- n. Recycled Content: Up to 43 percent.

C. Exposed Suspension System

1. Type SS-1

- a. Basis-of-Design Product: Prelude XL 15/16" Fire Guard, as manufactured by Armstrong World Industries, Inc.
- b. Structural Classification: Intermediate duty, in accordance with ASTM C635
- c. Main runners, cross tees and related components shall be manufactured of cold rolled galvanized steel.
- d. Main runners and cross tees shall be double web steel construction with 15/16" wide exposed flange with galvanized steel cap prefinished with white baked polyester paint.
- e. Wall Molding: Angle design manufactured of cold rolled galvanized steel with 15/16" wide hemmed exposed flange prefinished with white baked polyester paint.
- f. Hanger Wire: Galvanized carbon steel as per ASTM A641. Class 1 zinc coating, soft annealed, with a yield stress load of at least time three design load, but not less than 12 gauge.

3 EXECUTION

3.1 PREPARATION

- A. Determine acceptability of substrates and conditions under which acoustical ceiling systems are to be installed. Do not proceed until unacceptable conditions have been corrected. Commencement of installation constitutes Installer's acceptance of substrates and conditions.
- B. Install acoustical ceiling systems only when the building is enclosed, the air conditioning is operating with proper filters in place, and the temperature and humidity conditions are stabilized. Maintain between 60° F and 85° F and a maximum relative humidity of 70% prior to, during, and after installation.
- C. Do not proceed with installation until all wet work such as concrete, plastering, and painting has been completed and thoroughly dried out.
- D. Prior to installation of acoustical tiles, open packages and allow product to stabilize to current environment.
- E. Coordinate layout and installation with other work supported by or penetrating through ceiling, including light fixtures, HVAC equipment, fire detection and suppression system components, and partition systems.

3.2 INSTALLATION

- A. Layout ceiling systems in accordance with the reflected ceiling plans. Install minimum 1/2 tile at room and area perimeter unless patterns shown on the drawings or selected by the Architect indicate otherwise.
- B. Install ceiling systems with skilled workmen in accordance with manufacturer's printed instructions and in compliance with ASTM C636.
- C. Suspend ceiling systems from structural members (not bridging or metal deck) with hanger wire spaced at 4'-0" on center along the length of the main runners. Wrap hanger wire tightly with a minimum of 3 full turns. Provide additional support for light fixtures, diffusers and grilles at each corner.
- D. Install wall molding at intersection of ceiling systems and vertical surfaces. Securely fasten to vertical surface and neatly miter corners with hairline joints. Neatly scribe acoustical ceiling units at abutting surfaces and at all penetrations or projections where molding is not acceptable.
- E. Install acoustical ceiling units from a three carton mix to obtain uniform distribution of surface variations.
- F. Level ceiling systems to 1/8 inch in 12 feet with a maximum deflection of 1/360 of the span. Joints and exposed components shall be straight and in alignment.

3.3 ADJUSTING AND CLEANING

- A. Clean acoustical ceilings, including acoustical tiles and suspension system, as recommended by the manufacturer. Remove and replace acoustical tiles and exposed components of suspension system that cannot be cleaned.
- B. Remove and replace damaged and rusted components of suspension system.

END OF SECTION 09 51 00

SECTION 09 61 43

CONCRETE FLOOR SEALER

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, 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 SUMMARY

- A. Section includes low sheen sealer/finish to cured concrete floors.
- B. Related Requirements
 - 1. Section 03 30 00, Cast-In-Place Concrete
 - 2. Section 09 65 13, Resilient Base and Accessories

1.3 REFERENCES

- A. Texas Health and Safety Code, Chapter 161, Subchapter Q, Installation of Asbestos
- B. Texas Occupations Code, Chapter 1954, Asbestos Health Protection

1.4 ACTION SUBMITTALS

- A. Submit product data and installation instructions for each type of product indicated.

1.5 INFORMATIONAL SUBMITTALS

- A. Submit Material Safety and Data Sheet (MSDS) for all materials, products, and parts.

1.6 CLOSEOUT SUBMITTALS

- A. Submit manufacturer's maintenance instructions and data to include in maintenance manuals.

1.7 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00, Project Management and Coordination.

1.8 QUALITY ASSURANCE

- A. Installer shall be an experienced installer with a minimum of five years experience.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Materials shall be delivered to the site in manufacturer's original unopened containers.
- B. Store material in temperature controlled environment.

1.10 WARRANTY

- A. Provide written warranty against defects in material and workmanship for the work of this Section for a period of one year from the Date of Substantial Completion of the Project. Warranted defects shall include, but not necessarily be limited to loss of adhesion, excessive surface wear, color change or hazing, cackling or peeling or other deterioration.
- B. Refer to Section 01 77 00, Closeout Procedures, for Warranty form.

2 PRODUCTS**2.1 MANUFACTURERS**

- A. H&C Concrete. (No Substitutions).

2.2 MATERIALS

- A. At mechanical rooms, electrical rooms, technology rooms, housekeeping closets, and other interior exposed concrete locations, provide "H&C Clarishield Water-based Natural Look Clear Concrete Sealer" Matte Finish Only as manufactured by H&C Concrete.
- B. H&C SharkGrip Slip Resistant Additive, added per manufacturer recommendations.

3 EXECUTION**3.1 PREPARATION**

- A. Ensure that previously chemically cured floors are free of dust, dirt, stains and any other material which may adversely affect the finished floor.
- B. Ensure that selected sealer/finish is compatible with the chemical curing agent applied during concrete operations.
- C. Apply base sealer coat approved by the finish coat manufacturer where concrete has not been previously chemically cured or where extended exposure to weather has reduced the sealing capabilities of the previously applied curing agent.

3.2 INSTALLATION

- A. Apply three coats of sealer/finish over prepared previously chemically cured surface. Apply two coats over recommended base/sealer coat for concrete without previously applied chemical curing agent or where previously applied coating has weathered.
- B. Apply in strict accordance with manufacturer's instructions in temperature-controlled environment.
- C. All exposed slab control joints to be sealed and cured prior to sealing floors.
- D. Apply sealer/finish coats only on exposed concrete floors not scheduled to receive any other finish.

3.3 PROTECTION

- A. Barricade finished work to prevent traffic until finish is hardened and cured.
- B. Provide final cleaning just prior to Owner acceptance.

END OF SECTION 09 61 43

SECTION 09 65 13

RESILIENT BASE AND ACCESSORIES

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, 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 SUMMARY

- A. Section includes resilient base and resilient molding accessories.
- B. Related Sections
 - 1. Section 03 30 00, Cast-In-Place Concrete
 - 2. Section 04 20 00, Unit Masonry
 - 3. Section 09 29 00, Gypsum Board
 - 4. Section 09 65 19, Resilient Tile Flooring
 - 5. Section 09 65 66, Resilient Athletic Flooring
 - 6. Section 09 68 16, Sheet Carpeting
 - 7. Section 09 91 00, Painting
 - 8. Section 12 32 16, Manufactured Plastic-Laminate-Clad Casework

1.3 REFERENCES

- A. Use current editions unless indicated otherwise.
- B. Texas Health and Safety Code, Chapter 161, Subchapter Q, Installation of Asbestos
- C. Texas Occupations Code, Chapter 1954, Asbestos Health Protection

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00, Project Management and Coordination.

1.5 ACTION SUBMITTALS

- A. Product Data: Submit for each type of product indicated.
- B. Samples for Initial Selection: Submit for each type of product indicated.

1.6 INFORMATIONAL SUBMITTALS

- A. Submit Material Safety and Data Sheet (MSDS) for all materials, products, and parts.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.8 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
- B. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in good condition in manufacturer's unopened cartons.

- B. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50° F or more than 90° F. Store floor tiles on flat surfaces.

1.10 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70° F or more than 95° F, in spaces to receive resilient products 48 hours prior to installation, during installation, and 48 hours after installation.
- B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55° F or more than 95° F.
- C. Close spaces to traffic during floor tile installation.
- D. Close spaces to traffic for 48 hours after floor tile installation.
- E. Install resilient products after other finishing operations, including painting, have been completed.

1.11 WARRANTY

- A. Provide written warranty against defects in material and workmanship for the work of this Section for a period of one year from the Date of Substantial Completion.
- B. Refer to Section 01 77 00, Closeout Procedures, for Warranty form.

2 PRODUCTS

2.1 MANUFACTURERS

- A. Resilient Base
 - 1. Tarkett (formerly Johnsonite). No substitutions.
- B. Resilient Molding Accessory
 - 1. Tarkett (formerly Johnsonite)

2.2 RESILIENT BASE

- A. Resilient Base Standard: ASTM F1861.
 - 1. Material Requirement: Type TS (rubber, Vulcanized Thermoset)
 - 2. Manufacturing Method: Group I (solid, homogeneous)
 - 3. Style: Cove (base with toe)
- B. Minimum Thickness: 0.125 inch
- C. Height: 4 inches
- D. Lengths: 60 ft & 120 ft Coils in manufacturer's standard length; Cut lengths 48 inches long ARE NOT ACCEPTABLE.
- E. Accessories:
 - 1. Outside Corners: Pre-molded.
 - a. Field preformed outside corners ARE NOT ACCEPTABLE.
 - 2. Inside Corners: Pre-molded
 - a. Field preformed inside corners ARE NOT ACCEPTABLE.
- F. Finish: As selected by Architect from manufacturer's full range
- G. Colors and Patterns: As selected by Architect from full range of industry colors

2.3 RESILIENT MOLDING ACCESSORY

- A. Description: Cap for cove carpet, cap for cove resilient floor covering, carpet bar for tackless installations, carpet edge for glue-down applications, nosing for carpet, nosing for resilient floor covering, reducer strip for resilient floor covering, joiner for tile and carpet, and transition strips as required throughout the project
- B. Basis of Design: Tarkett (formerly Johnsonite) or equal from one of the above manufacturers.
 - 1. Carpet to MCT: SLT-XX-C and SLTC-XX-C
 - 2. MCT to Wood: Aluminum Threshold - Re: Section 08 80 00, Door Hardware
 - 3. MCT to Epoxy: SLT-XX-C

4. MCT to Sealed Concrete: SLT-XX-J
 5. MCT to Quarry Tile: CTA – XX-HT
 6. MCT to Resilient Athletic Flooring: CTA-XX-PL
- C. Material: Rubber
- D. Colors and Patterns: As selected by Architect from full range of industry colors

2.4 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, Portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated
- B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated

3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
- C. Do not install resilient products until they are same temperature as the space where they are to be installed. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
- D. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.
- E. Concrete Substrates for Resilient Stair Treads and Accessories: Prepare according to ASTM F710.
1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
 3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
 4. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.
 - a. Perform relative humidity test using in situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75% relative humidity level measurement.

3.3 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

- E. Do not stretch resilient base during installation.
- F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
- G. Job-Formed Corners: Not acceptable.

3.4 RESILIENT ACCESSORY INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient accessories.
- B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of carpet and resilient floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.
- B. Perform the following operations immediately after completing resilient product installation:
 - 1. Remove adhesive and other blemishes from exposed surfaces.
 - 2. Sweep and vacuum surfaces thoroughly.
 - 3. Damp-mop surfaces to remove marks and soil.
- C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Floor Polish: Remove soil, visible adhesive, and surface blemishes from resilient stair treads before applying liquid floor polish.
 - 1. Apply two coat(s)
- E. Cover resilient products until Substantial Completion.

END OF SECTION 09 65 13

SECTION 09 65 19

RESILIENT TILE FLOORING

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, 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 SUMMARY

- A. Section includes Marmoleum® Composition Tile (MCT) flooring and Luxury Vinyl Floor Tile (LVT),
- B. Related Sections
 - 1. Section 01 45 23, Testing and Inspecting Services
 - 2. Section 03 30 00, Cast-In-Place Concrete
 - 3. Section 09 65 13, Resilient Base and Accessories
 - 4. Section 09 68 16, Sheet Carpeting
 - 5. Section 09 91 00, Painting
 - 6. Section 12 32 16, Manufactured Plastic-Laminate-Clad Casework
 - 7. Section 14 24 00, Hydraulic Elevator

1.3 REFERENCES

- A. Use current editions unless indicated otherwise.
- B. American Society for Testing and Materials (ASTM)
 - 1. ASTM D2047, Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine
 - 2. ASTM E648, Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source
 - 3. ASTM E662, Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials
 - 4. ASTM F386, Standard Test Method for Thickness of Resilient Flooring Materials Having Flat Surfaces
 - 5. ASTM F710, Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring
 - 6. ASTM F925, Standard Test Method for Resistance to Chemicals of Resilient Flooring
 - 7. ASTM F1066, Standard Specification for Vinyl Composition Floor Tile
 - 8. ASTM F1869, Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
 - 9. ASTM F1914, Standard Test Methods for Short-Term Indentation and Residual Indentation of Resilient Floor Covering
 - 10. ASTM F2055, Standard Test Method for Size and Squareness of Resilient Floor Tile by Dial Gage Method
 - 11. ASTM F2170, Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes
 - 12. ASTM F2199, Standard Test Method for Determining Dimensional Stability of Resilient Floor Tile after Exposure to Heat
- C. 2010 ADA Standards for Accessible Design (SAD)
- D. 2012 Texas Accessibility Standards (TAS)
- E. Texas Health and Safety Code, Chapter 161, Subchapter Q, Installation of Asbestos
- F. Texas Occupations Code, Chapter 1954, Asbestos Health Protection

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00, Project Management and Coordination.

1.5 ACTION SUBMITTALS

- A. Product Data: Submit for each type of product indicated.
- B. Samples for Initial Selection: Submit for each type of floor tile indicated.

1.6 INFORMATIONAL SUBMITTALS

- A. Submit Material Safety and Data Sheet (MSDS) for all materials, products, and parts.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.8 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
- B. Floor Tile: Furnish 1 box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

1.9 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for floor tile installation indicated.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in good condition in manufacturer's unopened cartons.
- B. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50° F or more than 90° F. Store floor tiles on flat surfaces.

1.11 FIELD CONDITIONS

- A. Environmental Requirements/Conditions
 - 1. In accordance with manufacturer's recommendations, areas to receive flooring shall be clean, fully enclosed and weathertight.
 - 2. Permanent HVAC must be fully operational, controlled and set at a minimum of 68° F for a minimum of seven days prior to, during, and seven days after the installation. The flooring material shall be conditioned in the same manner for at least 48 hours prior to the installation.
 - 3. Areas to receive flooring shall be adequately lighted to allow for proper inspection of the substrate, installation and seaming of the flooring, and for final inspection.
- B. Field Measurements: Verify actual measurements by field measurements prior to installation. Coordinate field measurements and installation schedule with construction progress to avoid construction delays.
- C. Close spaces to traffic during floor tile installation.
- D. Close spaces to traffic for 48 hours after floor tile installation.
- E. Install floor tile after other finishing operations, including painting, have been completed.

1.12 WARRANTY

- A. Provide written warranty against defects in material and workmanship for the work of this Section for a period of **thirty** years from the Date of Substantial Completion. Refer to Section 01 77 00, Closeout Procedures, for Warranty form.
- B. Luxury Vinyl Floor Tile (LVT) manufacturer shall warrant that its floor products will be free of manufacturing defects and will not wear through the printed image for a period of not less than 10 years from the Date of Substantial Completion. Provide manufacturer's written standard limited warranty.

2 PRODUCTS

2.1 MANUFACTURERS

- A. Luxury Vinyl Floor Tile (LVT)
 - 1. Armstrong World Industries, Inc.
 - 2. Forbo Flooring, Inc.
 - 3. Tarkett
 - 4. ShawContract
 - 5. Six Degrees Flooring Surfaces

2.2 LUXURY VINYL FLOOR TILE (LVT)

- A. LVT-1: Basis-of-Design Product: Tarkett or equivalent from approved manufacturer.
 - 1. Event + Stone Series
 - a. Crafted Tile
 - b. Color: 11201 Boardwalk.
 - c. Location: Second Floor Main Corridors, Elevator Floors and as shown in drawings.
 - d. Tile Standard: ASTM F1700, Class III, Type B – Printed film with embossed surface.
 - e. Total Thickness: not less than 0.120 inch (3 mm)
 - f. Wear Layer Thickness: not less than 30 mils
 - g. Size: approximately 12" x 24"
 - h. Edge Treatment: Square Edge
 - i. Colors: One color, as selected by Architect from full range of manufacturer's wood grain colors
 - j. Floor Pattern: random, staggered
 - k. Performance
 - 1) Size and Tolerance: ASTM F2421 – Passes – ± 0.016 inch per linear foot
 - 2) Thickness: ASTM F386 – Passes – As specified ± 0.005 inch
 - 3) Squareness: ASTM F2055 – Passes – ± 0.010 inch maximum
 - 4) Flexibility: ASTM F137 – Passes
 - 5) Residual Indentation: ASTM F1914 – Passes – Average less than 8%
 - 6) Dimensional Stability: ASTM F2199 – Passes – not greater than 0.018 inch per linear foot
 - 7) Slip Resistance: ASTM D2047 – Passes – > 0.5 Wet, 0.5 Dry
 - 8) Resistance to Chemicals: ASTM F925 – Passes – No Change
 - 9) Resistance to Light: ASTM F1515 – Passes – $\Delta E \leq 8$
 - 10) Resistance to Heat: ASTM F1514 – Passes – $\Delta E \leq 8$
 - 11) Flame Spread: ASTM E648 – Passes – Class1, ≥ 0.45 watts/cm²
 - 12) Smoke Density: ASTM E662 – Passes – < 450 when tested in accordance with ASTM E662.
- B. LVT-2: Basis-of-Design Product: Tarkett or equivalent from approved manufacturer.
 - 1. Event + Wood Series
 - a. Crafted Plank
 - b. Color: 2122 Oak Grove.
 - c. Location: Wet Areas in offices and as shown in the drawings.
 - d. Tile Standard: ASTM F1700, Class III, Type B – Printed film with embossed surface.
 - e. Total Thickness: not less than 0.120 inch (3 mm)
 - f. Wear Layer Thickness: not less than 30 mils
 - g. Size: approximately 6" x 48"
 - h. Edge Treatment: Square Edge
 - i. Colors: One color, as selected by Architect from full range of manufacturer's wood grain colors
 - j. Floor Pattern: random, staggered
 - k. Performance
 - 1) Size and Tolerance: ASTM F2421 – Passes – ± 0.016 inch per linear foot

- 2) Thickness: ASTM F386 – Passes – As specified ± 0.005 inch
 - 3) Squareness: ASTM F2055 – Passes – ± 0.010 inch maximum
 - 4) Flexibility: ASTM F137 – Passes
 - 5) Residual Indentation: ASTM F1914 – Passes – Average less than 8%
 - 6) Dimensional Stability: ASTM F2199 – Passes – not greater than 0.018 inch per linear foot
 - 7) Slip Resistance: ASTM D2047 – Passes – >0.5 Wet, 0.5 Dry
 - 8) Resistance to Chemicals: ASTM F925 – Passes – No Change
 - 9) Resistance to Light: ASTM F1515 – Passes – $\Delta E \leq 8$
 - 10) Resistance to Heat: ASTM F1514 – Passes – $\Delta E \leq 8$
 - 11) Flame Spread: ASTM E648 – Passes – Class1, ≥ 0.45 watts/cm²
 - 12) Smoke Density: ASTM E662 – Passes – < 450 when tested in accordance with ASTM E662.
- C. LVT-3: Basis-of-Design Product: ShawContract or equivalent from approved manufacturer.
1. Soundscape Series
 - a. Crafted Plank
 - b. Color: 40663V Ink 63549
 - c. Location: Audio Production Studio
 - d. Tile Standard: ASTM F1700, Class III, Type B – Printed film with embossed surface.
 - e. Total Thickness: not less than 0.197 inch (5 mm)
 - f. Wear Layer Thickness: not less than 20 mils
 - g. Size: approximately 6" x 48"
 - h. Edge Treatment: Square Edge
 - i. Colors: One color, as selected by Architect from full range of manufacturer's colors
 - j. Floor Pattern: random, staggered
 - k. Performance
 - 1) Size and Tolerance: ASTM F2421 – Passes – ± 0.016 inch per linear foot
 - 2) Thickness: ASTM F386 – Passes – As specified ± 0.005 inch
 - 3) Squareness: ASTM F2055 – Passes – ± 0.010 inch maximum
 - 4) Flexibility: ASTM F137 – Passes
 - 5) Residual Indentation: ASTM F1914 – Passes – Average less than 8%
 - 6) Dimensional Stability: ASTM F2199 – Passes – not greater than 0.018 inch per linear foot
 - 7) Slip Resistance: ASTM D2047 – Passes – >0.5 Wet, 0.5 Dry
 - 8) Resistance to Chemicals: ASTM F925 – Passes – No Change
 - 9) Resistance to Light: ASTM F1515 – Passes – $\Delta E \leq 8$
 - 10) Resistance to Heat: ASTM F1514 – Passes – $\Delta E \leq 8$
 - 11) Flame Spread: ASTM E648 – Passes – Class1, ≥ 0.45 watts/cm²
 - 12) Smoke Density: ASTM E662 – Passes – < 450 when tested in accordance with ASTM E662.
- D. LVT-4: Basis of Desing Product: Six Degrees Flooring Surfaces
1. Impression Vinyl Stair Treads series
 - a. Finish: Embossed UV Cured Ceramic Reinforced Urethane
 - b. Color: PORTLAND CP-236
 - c. Location: At Enclosed Emergency Stairs and as shown in drawings.
 - d. Tile Standard: ASTM F1700, Class III, Type B – Solid Vinyl Tile
 - e. Total Thickness: 0.120 inch (3 mm)
 - f. Wear Layer Thickness: 28 mils

2.3 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.
- B. Adhesives
 1. Luxury Vinyl Floor Tile (LVT)

- a. Basis-of-Design Product: Subject to compliance with requirements, provide one or more of the following as recommended by the manufacturer to meet site conditions:
 - 1) Tarkett RollSmart™
 - 2) Tarkett 959 Adhesive
 - 3) Tarkett 975 Two-Part Urethane Adhesive,
 - 4) Comparable product recommended by LVT manufacturer.
- b. Water-based resin with superior moisture and alkali resistance, anti-fungal/mold protection, and strong early grab characteristics, suitable for floor tile indicated on concrete substrates with pH levels between 5 and 11, MVER (ASTM F1869) as high as 5 lbs of water/1,000 sq. ft. in 24 hours, and relative humidity (ASTM F2170) of up to 90%.

3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates: Prepare according to ASTM F710.
 1. Prepare Floor Substrate in accordance with manufacturer's instructions.
 2. Floors shall be sound, smooth, flat, permanently dry, clean, and free of all foreign materials including, but not limited to, dust, paint, grease, oils, solvents, curing and hardening compounds, sealers, asphalt and old adhesive residue.
 3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
 - a. Perform surface alkali testing using a quantitative method such as pH paper, distilled water, pH pencils or electronic devices. Proceed with installation only after substrates have been demonstrated to have a pH level of not more than 9.
 - b. Owner's Testing Agency shall perform surface alkali testing using a quantitative method such as pH paper, distilled water, pH pencils or electronic devices. Proceed with installation only after substrates have been demonstrated to have a pH level of not more than 11.
 4. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.
 - a. Luxury Vinyl Tile (LVT)
 - 1) Perform anhydrous calcium chloride test, ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 5 lbs of water/1000 sq. ft. in 24 hours.
 - 2) Perform relative humidity test using in situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 80% relative humidity level measurement.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install floor tiles until they are same temperature as space where they are to be installed. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
- E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.3 LUXURY FLOOR TILE INSTALLATION

- A. Comply with manufacturer's written instructions for installing floor tile.
- B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter. Lay tiles square with room axis.
- C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
- D. Lay LVT in one grain direction. Coordinate direction with Architect Prior to Install.
- E. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
- F. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.
- G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other non-permanent, non-staining marking device.
- H. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in finished floor areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.
- I. Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections. Use trowel recommended by flooring manufacturer for specific adhesive (1/16 inch x 1/16 inch x 1/16 inch square notch trowel). Do not spread the adhesive in an area larger than the tile can be installed while the adhesive is still wet.
- J. Immediately after installation, roll the tile with a 100 pound three-section roller in both directions and repeat as necessary to ensure adequate transfer of adhesive to the backing.

3.1 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protection of floor tile.
- B. Remove temporary coverings and protection of adjacent work areas.
- C. Repair or replace damaged installed products
- D. Clean installed products in accordance with manufacturer's instructions prior to acceptance.
- E. Remove construction debris from project site and legally dispose of debris.
- F. Perform the following operations immediately after completing floor tile installation:
 - 1. Remove adhesive and other blemishes from exposed surfaces.
 - 2. Sweep and vacuum surfaces thoroughly.
 - 3. Damp-mop surfaces to remove marks and soil.
- G. Protect floor tile products from marks, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- H. Cover floor tile until Substantial Completion.

END OF SECTION 09 65 19

SECTION 09 68 16

SHEET CARPETING

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, 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 SUMMARY

- A. Section includes all sheet carpeting and transition strips.
- B. Related Requirements
 - 1. Section 03 30 00, Cast-In-Place Concrete
 - 2. Section 09 65 13, Resilient Base and Accessories
 - 3. Section 09 65 19, Resilient Tile Flooring

1.3 REFERENCES

- A. American Society for Testing and Materials (ASTM)
 - 1. ASTM F710, Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring
- B. The Carpet and Rug Institute, Inc. (CRI)
 - 1. CRI 104, Standard for Installation Of Commercial Carpet
- C. 2010 ADA Standards for Accessible Design (SAD)
- D. 2012 Texas Accessibility Standards (TAS)
- E. Texas Health and Safety Code, Chapter 161, Subchapter Q, Installation of Asbestos
- F. Texas Occupations Code, Chapter 1954, Asbestos Health Protection

1.4 ACTION SUBMITTALS

- A. Submit product data and installation instructions for each type of product indicated.
- B. Submit seaming layout superimposed over Architect's floor plan.
- C. Samples for Initial Selection: Submit for each type of carpet indicated.
- D. Submit 12 inch long sample of each type of metal edge/transition strip.

1.5 INFORMATIONAL SUBMITTALS

- A. Submit Material Safety and Data Sheet (MSDS) for all materials, products, and parts.

1.6 CLOSEOUT SUBMITTALS

- A. Include maintenance data in maintenance manuals. Include methods for maintaining carpet, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule and precautions for cleaning materials and methods that could be detrimental to carpet.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. In addition to the carpet required for installation, provide an additional quantity of carpet from the same production run, suitably packaged for storage, and equal to one uncut 12'-0" x 20'-0" (240 square feet) roll of each carpet pattern and color installed.
- B. Deliver extra stock and all usable remnants and overage to an Alvin ISD storage facility designated by the Owner.

1.8 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00, Project Management and Coordination.
- B. Review methods and procedures related to carpet installation including, but not limited to delivery, storage, and handling procedures; ambient conditions and ventilation procedures; and subfloor preparation procedures.

1.9 QUALITY ASSURANCE

- A. Installation of carpet shall not begin until the work of all other trades, including painting, has been completed.
- B. Foreman shall have previous experience in supervising a project of this scope.
- C. Carpet Contractor shall have an experienced foreman at the jobsite during all carpet operations to ensure that all carpet work done in accordance with the specifications, manufacturer's requirements and approved submittals.
- D. Carpet installer shall arrange for manufacturer's inspections during the installation period to ensure that installation methods and workmanship are acceptable to the manufacturer.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Comply with CRI 104.
- B. Do not deliver carpet to the jobsite until spaces are ready for carpet installation.
- C. Building shall be enclosed with HVAC systems operating and temperatures maintained between 70° F and 80° F. prior to delivery to the jobsite.
- D. Store carpet for a minimum of 24 hours in an air conditioned portion of the building prior to installation.

1.11 FIELD CONDITIONS

- A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.
- B. Environmental Limitations: Do not deliver or install carpet until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at occupancy levels during the remainder of the construction period.
- C. Do not install carpet over concrete slabs until slabs have cured, are sufficiently dry to bond with adhesive, and have pH range recommended by carpet manufacturer.
- D. Where demountable partitions or other items are indicated for installation on top of carpet, install carpet before installing these items.

1.12 WARRANTY

- A. Submit written warranties from carpet contractor and carpet manufacturer.
- B. Carpet contractor and carpet manufacturer(s) shall jointly guarantee against defects in material for a period of one year after the Date of Substantial Completion. Refer to Section 01 77 00, Closeout Procedures, for Warranty form.
- C. Carpet contractor shall guarantee against defects in carpet installation for a period of three years after the Date of Substantial Completion.
- D. Special Warranty for Carpet: Carpet manufacturer agrees to repair or replace components of carpet installation that fail in materials or workmanship for a period of ten (10) years from date of Substantial Completion.
 - 1. Warranty does not include deterioration or failure of carpet due to unusual traffic, failure of substrate, vandalism, or abuse.
 - 2. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, excess static discharge, and delamination.

2 PRODUCTS

2.1 MANUFACTURERS

- A. Carpet and Resilient Transition Solution
 - 1. Tarkett – No substitutions allowed.

2.2 CARPET

- A. Carpet – Type 1 (CPT-1): Color Map #11130 , Color Landing Zone #42808 with Powerbond Cushion backing by Tarkett
- B. Carpet – Type 2 (CPT-2): Texturemap #11129, Color Space X #42810 with Powerbond Cushion backing by Tarkett
- C. Carpet – Type 3 (CPT-3): Abrasive Action II #02578, Color Charcoal #19100 with Powerbond Cushion backing by Tarkett.

2.3 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet manufacturer
- B. Adhesives: Water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet and is recommended or provided by carpet manufacturer.

3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet performance. Examine carpet for type, color, pattern, and potential defects.
- B. Verify that concrete slabs comply with ASTM F710 and the following:
 - 1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet manufacturer.
 - 2. Subfloor finishes comply with requirements specified in Section 03 30 00, Cast-in-Place Concrete, for slabs receiving carpet.
 - 3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.

3.2 PREPARATION

- A. Comply with CRI 104, Section 7.3, "Site Conditions; Floor Preparation," and with carpet manufacturer's written installation instructions for preparing substrates.
- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions $\frac{1}{8}$ inch wide or wider, and protrusions more than $\frac{1}{32}$ inch, unless more stringent requirements are required by manufacturer's written instructions.
- C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet manufacturer.
- D. Broom and vacuum clean substrates to be covered immediately before installing carpet.

3.3 INSTALLATION

- A. Carpet
 - 1. Comply with CRI 104 and carpet manufacturer's written installation instructions.
 - 2. Do not bridge building expansion joints with carpet.

3. Cut and fit carpet to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet manufacturer.
4. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
5. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.
6. Install pattern parallel to walls and borders to comply with CRI 104, Section 15, "Patterned Carpet Installations" and with carpet manufacturer's written recommendations.

3.4 CLEANING AND PROTECTING

- A. Perform the following operations immediately after installing carpet:
 1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet manufacturer.
 2. Remove yarns that protrude from carpet surface.
 3. Vacuum carpet using commercial machine with face-beater element.
- B. Protect installed carpet to comply with CRI 104, Section 16, "Protecting Indoor Installations."
- C. Protect carpet against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet manufacturer and carpet adhesive manufacturer.
- D. Replace damaged or soiled carpet that cannot be repaired or cleaned. Do not use maintenance material for replacements.

END OF SECTION 09 68 16

SECTION 09 77 16

LAMINATE WALL PANELS

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, Instructions to Bidders, for substitution of materials and products.

1.2 SUMMARY

- A. Section includes conventionally glazed aluminum curtain walls installed as stick assemblies.
- B. Related Requirements
 - 1. Section 04 20 00, Unit Masonry
 - 2. Section 05 40 00, Cold-Formed Metal Framing
 - 3. Section 06 10 53, Miscellaneous Rough Carpentry
 - 4. Section 09 22 16, Non-Structural Metal Framing
 - 5. Section 09 29 00, Gypsum Board

1.3 REFERENCES

- A. Use current editions unless noted otherwise.
- B. American Society for Testing and Materials (ASTM) E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
 - 1. Class 1/A - Flame Spread 0-25, Smoke Developed 450 or less.
 - 2. Class 2/B - Flame Spread 26-75, Smoke Developed 450 or less.
- C. Architectural Woodwork Institute (AWI) Quality Standards.
- D. National Electrical Manufacturer's Association (NEMA)

1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design glazed aluminum curtain walls framing members and internal reinforcing at exterior openings capable of resisting wind loads and loads imposed by Exterior Sun Control Devices and capable of accommodating Exterior Sun Control Devices fasteners, including comprehensive engineering analysis by a qualified professional engineer registered in the State of Texas, using performance requirements and design criteria indicated herein, and those included in applicable codes and ordinances.

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00, Project Management and Coordination.

1.6 ACTION SUBMITTALS

- A. Submit product data for each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Submit shop drawings for laminate wall panels in sufficient detail to show fabrication, installation, anchorage, and interface of the work of this Section with adjacent work. Include plans, elevations, sections, details, and attachments to other work.

1.7 INFORMATIONAL SUBMITTALS

- A. Submit Material Safety and Data Sheet (MSDS) for all materials, products, and parts.
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.

1.8 CLOSEOUT SUBMITTALS

- A. Submit maintenance data for laminate wall panels to include in maintenance manuals.

1.9 QUALITY ASSURANCE

- A. Panelwork Manufacturer Qualifications: Firm experienced in successfully producing panelwork similar to that indicated for this Project, with sufficient production capacity to produce required units without causing delay in the Work.
- B. Installer Qualifications: Arrange for installation of panelwork and related architectural woodwork by a firm that can demonstrate successful experience in installing architectural woodwork similar in type and quality to those required for this project.
- C. AWI Quality Standard: Comply with applicable requirements of "Architectural Woodwork Quality Standards" published by the Architectural Woodwork Institute (AWI) unless otherwise indicated.
- D. Field-Constructed Mock-Up: Before installing of panelwork, erect mock-ups for each form of panelwork and finish required to verify selections made under sample submittals and to demonstrate aesthetic effects (as well as qualities of materials and execution). Build mock-ups to comply with the following requirements, using materials indicated for final unit of Work.
 - 1. Locate mock-ups on site in location and size indicated or, if not indicated, directed by Architect.
 - 2. Erect mock-ups in presence of Architect.
 - 3. Demonstrate the proposed range of aesthetic effects and workmanship.
 - 4. Obtain Architect's acceptance of mock-ups before start of final unit of Work.
 - 5. Retain and maintain mock-ups during construction in undisturbed condition as a standard for judging completed unit of Work.
 - a. Accepted mock-ups in undisturbed condition at time of Substantial Completion may become part of completed unit of Work.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Protect woodwork during transit, delivery, storage, and handling to prevent damage, soilage, and deterioration.
- B. Do not deliver woodwork until painting, wet work, grinding, and similar operations that could damage, soil, or deteriorate woodwork have been completed in installation areas as specified by AWI 1700-G-3. If woodwork must be stored in other than installation areas, store only in areas meeting requirements specified in article "Project Conditions". Do not expose panels to continuous direct sunlight, nor to extremes in temperature and humidity. Store products in manufacturer's packaging until ready for installation.

1.11 FIELD CONDITIONS

- A. Field Measurements: Where panelwork is indicated to be fitted to other construction, check actual dimensions of other construction by accurate field measurements before manufacturing panelwork; show recorded measurements on final shop drawings. Coordinate manufacturing schedule with construction progress to avoid delay of Work.
 - 1. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with manufacture of panelwork without field measurements. Coordinate other construction to ensure that actual dimensions correspond to guaranteed dimensions.
- B. Environmental Conditions: Obtain and comply with Woodwork Manufacturer's and Installers coordinated advice. Do not deliver or install wall system 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 as specified by AWI 1700-G-3.
- C. Wall, ceilings, floors, and openings must be level, plumb, straight, in-line and square as specified by AWI 1700-G-3.

2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Subject to compliance with requirements, manufacturers offering premanufactured, fire retardant, laminate clad panel systems which may be incorporated in the work include but are not limited to the following:
 - 1. Panel Specialists, Inc.
- B. High Pressure Decorative Laminate
 - 1. Acceptable Manufacturer: Subject to compliance with requirements, provide high pressure decorative laminates of one of the following:
 - a. Formica Corp.
 - b. Nevamar Corp.
 - c. Pionite Decorative Surfaces
 - d. Wilsonart
 - e. Lab Designs
 - f. Lamitech
 - g. InteriorArts
- C. Requests for substitutions will be considered in accordance with provisions of Section 01 25 00

2.2 PANEL SYSTEMS

- A. General: Provide materials that comply with requirements of the AWI woodworking standard for each type of woodwork and quality grade indicated and, where the following products are part of woodwork, with requirements of the referenced product standards, that apply to product characteristics indicated:
- B. Laminate Cladding: High pressure decorative laminate complying with the following requirements:
 - 1. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces that comply with the following requirements:
 - a. Match color, pattern, and finish indicated by reference to laminate manufacturer's standard designations for (these) characteristic(s).
 - b. Colors to include standard color line including premium, wood grain, and metal laminates.
- C. Fire Performance Characteristics: Provide paneling composed of panels constructed with plastic laminate and fire- retardant particle board that are identical in construction to units tested for the following surface burning characteristics per ASTM E 84 by UL or other testing and inspecting organization acceptable to authorities having jurisdiction. Identify panels with appropriate markings of applicable testing and inspecting organization on surfaces that will be concealed from view after installation.
 - 1. Flame Spread: 75 or less.
 - 2. Smoke Developed: 450 or less.
- D. Panel System: #310 as manufactured by Panel Specialists inc. A progressive panel system with an exposed divider molding creating a 1/16 inch (1.5mm) horizontal and vertical reveal between edge banded panels.
 - 1. Panel Thickness: 7/16 inches (11.1 mm).
 - 2. Panel Edge Finish: Panel edges to be finished with .018-inch (.5mm) PVC edge banding.
 - 3. Panel Finish: Refer to Room Finish Schedule and drawings.
- E. Moldings: All moldings to be .062" thick 6063 alloy aluminum with T5 temper.
 - 1. Horizontal & Vertical:
 - a. #302a 1/16 in.(1.5mm) wide Divider Molding
 - 2. Horizontal Trim:
 - a. #604 3/8" Edge Trim molding (Above Base)
 - 3. Vertical Edge Trim:
 - a. #604 3/8" Edge Trim molding
 - 4. Outside Corner

- a. #603-90 3/8" Stepped 90 Degree
- F. Furring stripping: 3-1/2 inch wide 18 gauge material meeting the fire performance characteristics required for the paneling, as indicated above.
- G. Finishes:
 - 1. Panel Face: As specified in finish schedule.
- H. Panel Face Pattern Direction:
 - 1. Vertical
- I. Panel Edge Banding:
 - 1. .5mm PVC Black
- J. Finished wood veneer: As specified in finish schedule.
- K. Aluminum Molding Finish:
 - 1. Clear Anodized

2.3 MATERIALS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide High Pressure Decorative Laminates as manufacturer by Panel Specialists, Inc.
- B. High Pressure Laminate (VGS, VGF.) and non-decorative backers (BKV) used to surface wall panels systems shall be manufactured to meet or exceed the National Electrical Manufacturing Association (NEMA LD3-2005) for thickness, performance properties and appearance.
- C. Formaldehyde Emission Levels: Comply with formaldehyde emission requirements of each voluntary standard referenced below:
- D. Particleboard: NPA 8.
- E. Fire-Retardant Particleboard: Where indicated, provide panels complying with the following requirements that have fire-retardant chemicals bonded to softwood particles at time of panel manufacture to achieve products identical to those tested for flame spread of 20 or less and for smoke developed of 25 or less per ASTM E 84 by UL or other testing and inspecting organization acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing and inspecting organization.
- F. Quality Standard: Comply with AWI Section 500 and its Division 500B.
- G. Grade: Custom.

2.4 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- C. Fabricate components that, when assembled, have the following characteristics:
 - 1. Profiles that are sharp, straight, and free of defects or deformations
 - 2. Accurately fitted joints with ends coped or mitered
 - 3. Physical and thermal isolation of glazing from framing members
 - 4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances
 - 5. Provisions for field replacement of glazing from exterior
 - 6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible
- D. Fabricate components that, when assembled, have internal guttering system or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.
- E. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

3 EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared according to AWI 1700-G-3.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 FIELD DIMENSIONS

- A. Where wall system is indicated to be fitted to other constructions, check actual dimensions of other constructions by accurate field measurements before manufacturing wall system; show recorded measurements on final shop drawings. Coordinate manufacturing schedule with construction progress to avoid delay of work.
- B. Where field measurements cannot be made without delaying the work, guarantee dimensions and proceed with manufacture of wall system without field measurements coordinate other construction to ensure that actual dimensions correspond to guaranteed dimensions.

3.3 PREPARATION

- A. Panels must be acclimated to ambient temperature and humidity conditions in accordance with manufacturer's specifications prior to installation. Refer to PSI installation guide for proper, handling, storage, and acclimation procedures.
- B. Clean surfaces thoroughly prior to installation.
- C. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.4 INSTALLATION

- A. General:
 - 1. Quality Standard: Install woodwork to comply with AWI Section 1700 for same grade specified in Part 2 of this section for type of woodwork involved.
 - 2. Install Panelwork plumb, level, true, and straight with no distortions. Shim as required using concealed shims. Install to a tolerance of 1/8 inch in 8'-0" for plumb and level and with no variations in flushness of adjoining surfaces.
 - 3. Interior paneling on an exterior wall or in a wet area requires a barrier sheet of plastic film between the outside wall and the panels to prevent condensation from affecting the stability of the panel.
 - 4. Scribe and cut woodwork to fit adjoining work and replace damaged panels.
 - 5. Install Panelwork with manufacturer's standard trim pieces as specified above on all edges (tops, at door / window frames, bottoms and corners and as otherwise required by Architect).
 - 6. Anchor Panelwork to supporting substrate with manufacturers standard concealed panel-hanger clips, splined-connection strips, and similar trim and framing on metal backup strips located behind gypsum drywall. Do not face nail.
 - a. Wall systems shall be mechanically fastened to horizontal metal furring strapping spaced 24 inches (610 mm) O.C. Furring straps shall be no less than 18-ga 3-1/2 inches (89 mm) wide, continuously. Metal strapping to be installed to the drywall studs prior to the application of the gypsum board by the framing contractor.
 - b. Provide an "S" bead of panel mastic on the back of each panel during installation.

3.5 CLEANING

- A. Replace damaged and defective panelwork. Adjust joinery for uniform appearance.
- B. Clean panelwork on exposed and semiexposed surfaces. Touch up factory-applied finishes to restore damaged or soil areas.

3.6 PROTECTION

- A. Provide final Protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensures that panelwork is without damage or deterioration at time of Substantial Completion.

END OF SECTION 09 77 16

SECTION 09 84 13

FIXED SOUND-ABSORPTIVE PANELS

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, 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 SUMMARY

- A. Section includes acoustical wall panels and ceiling and wall diffuser panels.
- B. Related Sections
 - 1. Section 04 20 00, Unit Masonry
 - 2. Section 09 29 00, Gypsum Board

1.3 REFERENCES

- A. Use current editions unless noted otherwise.
- B. ASTM International (ASTM)
 - 1. ASTM C423 Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
 - 2. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials
- C. Texas Health and Safety Code, Chapter 161, Subchapter Q, Installation of Asbestos
- D. Texas Occupations Code, Chapter 1954, Asbestos Health Protection

1.4 ACTION SUBMITTALS

- A. Submit product data and installation instructions for each type of product indicated.
- B. Submit two samples of each type of acoustical panel.
- C. Submit two fabric selector cards from manufacturer's standard finishes.
- D. If requested, submit 12 inch x 12 inch samples requested by the Architect of each color and texture of each type of finish specified.

1.5 INFORMATIONAL SUBMITTALS

- A. Submit Material Safety and Data Sheet (MSDS) for all materials, products, and parts.

1.6 CLOSEOUT SUBMITTALS

- A. Submit manufacturer's maintenance instructions and data to include in maintenance manuals.

1.7 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00, Project Management and Coordination.
- B. Coordination of Work: Coordinate acoustical ceiling work with installers of related work including, but not limited to building insulation, gypsum board, light fixtures, mechanical systems, electrical systems, and sprinklers.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Delivered all materials in manufacturer's original packaging and stored flat in a covered, dry area providing protection from damage and exposure to the elements.
- B. Remove damaged or deteriorated materials from the premises.
- C. Handle acoustical ceiling units carefully to avoid chipping edges or damaged units in any way.

- D. Before installing acoustical ceiling units, permit them to reach room temperature and a stabilized moisture content.
- E.

1.9 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.
- B. Refer to Section 01 77 00, Closeout Procedures, for Warranty form.

2 PRODUCTS

2.1 MANUFACTURERS

- A. Acoustical Resources, Inc.
- B. Arktura
- C. AVL Systems, Inc.
- D. Capaul
- E. Conwed
- F. CSI Creative
- G. Decoustics, Div. Of Armstrong
- H. Lamvin, Inc.
- I. MDC Interior Solutions - Zintra
- J. Sonotrol
- K. Sound Concepts, Inc.
- L. Sound Solutions Systems, Inc.
- M. Tectum® by Armstrong World Industries, Inc.

2.2 MATERIALS

- A. Type A: AWP-1, AWP-2 & AWP-3
 - 1. Basis of Design Product: Subject to compliance with requirements, furnish and install Respond A as manufactured by Conwed or equivalent by a listed manufacturer.
 - 2. Acoustical Panels shall be constructed of a composite core construction of dimensionally stable rigid fiberglass of medium density laminated with a 1/8 inch thick, 18 PCF high density smooth sanded fiberglass face.
 - 3. Thickness: 1 inch
 - 4. Sizes: As shown on drawings.
 - 5. Edge profile and corner detail shall be square. Edge treatment shall be resin hardened.
 - 6. Panel Finish
 - a. Duvaltex (Formerly Guilford of Maine) - Guilford of Maine Series FR701
 - 1) AWP 1 - DESERT SAND 758
 - 2) AWP 2 - PEARL 481
 - 3) AWP 3 - CEMENT MIX 750
 - b. Finish shall be applied directly to the face and edges of the panel and return to the back of the panel to provide a full finished edge. All corners shall be fully tailored.
 - 7. Color: To be selected from manufacturer's full range of colors.
 - 8. Mounting: Concealed Z-clips fastened to masonry or gypsum board wall
 - 9. Acoustical Performance: Panels shall have a minimum NRC of 1.00 with ASTM C423 (Type "A" Mounting).
 - 10. Flammability: All panel components shall have a Class "A" flame spread rating of 25 or less in accordance with ASTM E84.
- B. Type B: AP-1
 - 1. Basis of design Product: Subject to compliance with requirements, furnish and install Tectum® Direct-Attached Ceiling Panels as manufactured by Tectum® by Armstrong World Industries, Inc. or equivalent by a listed manufacturer.

2. Surface Texture: Coarse
3. Composition: Aspen wood fibers bonded with inorganic hydraulic cement
4. Finish: Surface appearance shall be consistent from panel to panel
5. Color: Natural – Field spray painted with multiple coats of SW6993 Acrylic Dryfall paint – Black as Night.
 - a. Apply additional coats as necessary for color to reach throughout wood fibers.
6. Size: As shown in drawings.
7. Thickness: 2 inches.
8. Edge Profile: Long edge/short edge – Bevel.
9. Mounting Style: Direct attached mounting A with Hilti self drilling metal screws or approved equal.
10. UL Classified Noise Reduction Coefficient (NRC): ASTM C 423 ; Mounting; A(0.65); Classified with UL label.
11. UL Classified Flame Spread: ASTM E 1264; Class A. Product must be able to meet this criterion after being painted six times.
12. Light Reflectance (LR) White Panel: ASTM E 1477; Light Reflectance
13. Dimensional Stability/Mold Resistance: HumiGuard Plus and no significant mold growth when tested by ASTM D3273.
14. Sustainable: Third party verified EPD (Environmental Product Declaration) and HPD (Health Product Declaration) and Living Product Imperative Certification.
15. USDA Certified Biobased Product, 98%.

3 EXECUTION

3.1 INSTALLATION

A. General

1. Installation of acoustical panels shall not begin until all wet work (plastering, concrete, etc.) is completed and dry. Building shall be properly enclosed and under standard occupancy conditions (temperature of 60-85 degrees F and not more than 70% relative humidity) before installation begins. Walls shall be shielded from direct sunlight during and after installation. Exposure to intense sunlight and heat may result in distortion of panel surface.
2. Take care to install panels with joints symmetrically located with relationship to the exposed ceiling grid system, window mullions, and wall control joints. Where indicated on the drawings, panel joints shall align with exposed ceiling grid system, window mullions, and wall control joints.
3. Follow manufacturer's written instructions for concealed spline mounting.

B. Acoustical Panels

1. Furr walls.
2. Attach manufacturer's standard clip system to gypsum or furred block wall.
3. Mount clip to assure stable panel attachment.

C. Acoustical Fabric:

1. Preparation:
 - a. Carefully inspect all shipments. Check and examine material for imperfections and other defects prior to installation.
 - b. Walls are to be structurally sound and free of dirt, grease, and markings. All markings which cannot easily be removed should be sealed so that "bleeding" through the wallcovering shall not occur. Although it is not necessary for the installation of acoustical wall fabric, sealed walls, especially on newly installed drywall, could facilitate future removal of wallcovering and lessen damage to walls.
2. Installation:

- a. Apply a premixed, heavy-duty vinyl wallcovering adhesive directly to the wall, allowing it to dry overnight. Cut material to desired lengths, allowing for top and bottom trimming. This material is not factory trimmed. It is necessary for the paperhanger to cut a straight edge. All edges must be butt joined.
 - b. Material is designed to be dry hung. Do not use a pasting machine. Wallcarpet should be hung straight up...do not alternately reverse strips. Apply a second coat of undiluted adhesive to the wall, allowing it to dry to its maximum tackability without it being overly dry.
 - c. Install three strips and inspect all for color, uniformity, and correctness of application. If satisfactory, proceed with work.
 - d. As work proceeds, small areas (3 strips) should be inspected so that there are no more than 3 strips in question at any time. If anything goes wrong, stop work immediately and contact your nearest representative for inspection.
 - e. All seams shall be vertical and only full widths of material should be applied for the most satisfactory installation. Headers over doors may cause shading. All seams shall be at least 6 inches away from inside or outside corners.
 - f. For best results, it is recommended that a qualified textile installer be employed.
- D. Tectum Acoustical Panels
1. Preparation:
 - a. Measure ceiling and establish layout of units. Coordinate panel layout with mechanical ,electrical fixtures and structural components.
 - b. Coordination: Furnish layouts for preset inserts, clips, and other ceiling anchors whose installation is specified in other sections.
 - 1) Furnish concrete inserts and similar devices to other trades for installation well in advance of time needed for coordination of other work
 2. Installation:
 - a. In accordance with manufacturer's installation instructions.

3.2 ADJUSTING AND CLEANING

- A. At the completion of the project, leave the acoustical panels in clean, unmarred condition.

END OF SECTION 09 84 13

SECTION 09 84 13

FIXED SOUND-ABSORPTIVE PANELS

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, 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 SUMMARY

- A. Section includes acoustical wall panels and ceiling and wall diffuser panels.
- B. Related Sections
 - 1. Section 04 20 00, Unit Masonry
 - 2. Section 09 29 00, Gypsum Board

1.3 REFERENCES

- A. Use current editions unless noted otherwise.
- B. ASTM International (ASTM)
 - 1. ASTM C423 Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
 - 2. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials
- C. Texas Health and Safety Code, Chapter 161, Subchapter Q, Installation of Asbestos
- D. Texas Occupations Code, Chapter 1954, Asbestos Health Protection

1.4 ACTION SUBMITTALS

- A. Submit product data and installation instructions for each type of product indicated.
- B. Submit two samples of each type of acoustical panel.
- C. Submit two fabric selector cards from manufacturer's standard finishes.
- D. If requested, submit 12 inch x 12 inch samples requested by the Architect of each color and texture of each type of finish specified.

1.5 INFORMATIONAL SUBMITTALS

- A. Submit Material Safety and Data Sheet (MSDS) for all materials, products, and parts.

1.6 CLOSEOUT SUBMITTALS

- A. Submit manufacturer's maintenance instructions and data to include in maintenance manuals.

1.7 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00, Project Management and Coordination.
- B. Coordination of Work: Coordinate acoustical ceiling work with installers of related work including, but not limited to building insulation, gypsum board, light fixtures, mechanical systems, electrical systems, and sprinklers.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Delivered all materials in manufacturer's original packaging and stored flat in a covered, dry area providing protection from damage and exposure to the elements.
- B. Remove damaged or deteriorated materials from the premises.
- C. Handle acoustical ceiling units carefully to avoid chipping edges or damaged units in any way.

- D. Before installing acoustical ceiling units, permit them to reach room temperature and a stabilized moisture content.
- E.

1.9 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.
- B. Refer to Section 01 77 00, Closeout Procedures, for Warranty form.

2 PRODUCTS

2.1 MANUFACTURERS

- A. Acoustical Resources, Inc.
- B. Arktura
- C. AVL Systems, Inc.
- D. Capaul
- E. Conwed
- F. CSI Creative
- G. Decoustics, Div. Of Armstrong
- H. Lamvin, Inc.
- I. MDC Interior Solutions - Zintra
- J. Sonotrol
- K. Sound Concepts, Inc.
- L. Sound Solutions Systems, Inc.
- M. Tectum® by Armstrong World Industries, Inc.

2.2 MATERIALS

- A. Type A: AWP-1, AWP-2 & AWP-3
 - 1. Basis of Design Product: Subject to compliance with requirements, furnish and install Respond A as manufactured by Conwed or equivalent by a listed manufacturer.
 - 2. Acoustical Panels shall be constructed of a composite core construction of dimensionally stable rigid fiberglass of medium density laminated with a 1/8 inch thick, 18 PCF high density smooth sanded fiberglass face.
 - 3. Thickness: 1 inch
 - 4. Sizes: As shown on drawings.
 - 5. Edge profile and corner detail shall be square. Edge treatment shall be resin hardened.
 - 6. Panel Finish
 - a. Duvaltex (Formerly Guilford of Maine) - Guilford of Maine Series FR701
 - 1) AWP 1 - DESERT SAND 758
 - 2) AWP 2 - PEARL 481
 - 3) AWP 3 - CEMENT MIX 750
 - b. Finish shall be applied directly to the face and edges of the panel and return to the back of the panel to provide a full finished edge. All corners shall be fully tailored.
 - 7. Color: To be selected from manufacturer's full range of colors.
 - 8. Mounting: Concealed Z-clips fastened to masonry or gypsum board wall
 - 9. Acoustical Performance: Panels shall have a minimum NRC of 1.00 with ASTM C423 (Type "A" Mounting).
 - 10. Flammability: All panel components shall have a Class "A" flame spread rating of 25 or less in accordance with ASTM E84.
- B. Type B: AP-1
 - 1. Basis of design Product: Subject to compliance with requirements, furnish and install Tectum® Direct-Attached Ceiling Panels as manufactured by Tectum® by Armstrong World Industries, Inc. or equivalent by a listed manufacturer.

2. Surface Texture: Coarse
3. Composition: Aspen wood fibers bonded with inorganic hydraulic cement
4. Finish: Surface appearance shall be consistent from panel to panel
5. Color: Natural – Field spray painted with multiple coats of SW6993 Acrylic Dryfall paint – Black as Night.
 - a. Apply additional coats as necessary for color to reach throughout wood fibers.
6. Size: As shown in drawings.
7. Thickness: 2 inches.
8. Edge Profile: Long edge/short edge – Bevel.
9. Mounting Style: Direct attached mounting A with Hilti self drilling metal screws or approved equal.
10. UL Classified Noise Reduction Coefficient (NRC): ASTM C 423 ; Mounting; A(0.65); Classified with UL label.
11. UL Classified Flame Spread: ASTM E 1264; Class A. Product must be able to meet this criterion after being painted six times.
12. Light Reflectance (LR) White Panel: ASTM E 1477; Light Reflectance
13. Dimensional Stability/Mold Resistance: HumiGuard Plus and no significant mold growth when tested by ASTM D3273.
14. Sustainable: Third party verified EPD (Environmental Product Declaration) and HPD (Health Product Declaration) and Living Product Imperative Certification.
15. USDA Certified Biobased Product, 98%.

3 EXECUTION

3.1 INSTALLATION

A. General

1. Installation of acoustical panels shall not begin until all wet work (plastering, concrete, etc.) is completed and dry. Building shall be properly enclosed and under standard occupancy conditions (temperature of 60-85 degrees F and not more than 70% relative humidity) before installation begins. Walls shall be shielded from direct sunlight during and after installation. Exposure to intense sunlight and heat may result in distortion of panel surface.
2. Take care to install panels with joints symmetrically located with relationship to the exposed ceiling grid system, window mullions, and wall control joints. Where indicated on the drawings, panel joints shall align with exposed ceiling grid system, window mullions, and wall control joints.
3. Follow manufacturer's written instructions for concealed spline mounting.

B. Acoustical Panels

1. Furr walls.
2. Attach manufacturer's standard clip system to gypsum or furred block wall.
3. Mount clip to assure stable panel attachment.

C. Acoustical Fabric:

1. Preparation:
 - a. Carefully inspect all shipments. Check and examine material for imperfections and other defects prior to installation.
 - b. Walls are to be structurally sound and free of dirt, grease, and markings. All markings which cannot easily be removed should be sealed so that "bleeding" through the wallcovering shall not occur. Although it is not necessary for the installation of acoustical wall fabric, sealed walls, especially on newly installed drywall, could facilitate future removal of wallcovering and lessen damage to walls.
2. Installation:

- a. Apply a premixed, heavy-duty vinyl wallcovering adhesive directly to the wall, allowing it to dry overnight. Cut material to desired lengths, allowing for top and bottom trimming. This material is not factory trimmed. It is necessary for the paperhanger to cut a straight edge. All edges must be butt joined.
 - b. Material is designed to be dry hung. Do not use a pasting machine. Wallcarpet should be hung straight up...do not alternately reverse strips. Apply a second coat of undiluted adhesive to the wall, allowing it to dry to its maximum tackability without it being overly dry.
 - c. Install three strips and inspect all for color, uniformity, and correctness of application. If satisfactory, proceed with work.
 - d. As work proceeds, small areas (3 strips) should be inspected so that there are no more than 3 strips in question at any time. If anything goes wrong, stop work immediately and contact your nearest representative for inspection.
 - e. All seams shall be vertical and only full widths of material should be applied for the most satisfactory installation. Headers over doors may cause shading. All seams shall be at least 6 inches away from inside or outside corners.
 - f. For best results, it is recommended that a qualified textile installer be employed.
- D. Tectum Acoustical Panels
1. Preparation:
 - a. Measure ceiling and establish layout of units. Coordinate panel layout with mechanical ,electrical fixtures and structural components.
 - b. Coordination: Furnish layouts for preset inserts, clips, and other ceiling anchors whose installation is specified in other sections.
 - 1) Furnish concrete inserts and similar devices to other trades for installation well in advance of time needed for coordination of other work
 2. Installation:
 - a. In accordance with manufacturer's installation instructions.

3.2 ADJUSTING AND CLEANING

- A. At the completion of the project, leave the acoustical panels in clean, unmarred condition.

END OF SECTION 09 84 13

SECTION 09 91 00

PAINTING

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, 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 SUMMARY

- A. Section includes all painting and staining. Generally painting and staining shall be for, but not necessarily limited to, the following unless otherwise noted:
 - 1. All exposed exterior ferrous metals
 - 2. All exposed exterior galvanized metals
 - 3. All visible exterior wood
 - 4. All exposed exterior conduit, piping, etc., except for roof mounted piping not visible from the ground
 - 5. All exposed interior wood
 - 6. All exposed interior ferrous metals
 - 7. All exposed interior galvanized metals
 - 8. All prime coated hardware
 - 9. All removable mullions
 - 10. All exposed interior conduit, outlet boxes, electrical cabinets, etc. except those located in mechanical rooms
 - 11. All exposed pipe, plumbing and ductwork, except those located in mechanical rooms
 - 12. All metal grilles, except aluminum
 - 13. All exposed structural steel and joists
 - 14. All roof hatches
 - 15. All hollow metal doors and frames
 - 16. All prime coated metal items
 - 17. All exposed gypsum board surfaces, including walls, furr downs, ceilings
 - 18. Interior of elevator shaft.
 - 19. Elevator hoistways doors and jambs
 - 20. All exposed concrete masonry unit walls
 - 21. Stenciling signs above ceilings to identify fire and smoke barriers
 - 22. All items normally painted in accordance with good construction practice
 - 23. Traffic Marking Paint
- B. Related Sections
 - 1. Section 04 20 00, Unit Masonry
 - 2. Section 07 72 33, Roof Hatches
 - 3. Section 07 92 00, Joint Sealants
 - 4. Section 08 11 13.16, Custom Hollow Metal Doors and Frames
 - 5. Section 08 14 23.16, Plastic-Laminate-Faced Wood Doors
 - 6. Section 08 71 00, Door Hardware
 - 7. Section 09 29 00, Gypsum Board
 - 8. Section 09 72 16, Vinyl-Coated Fabric Wall Coverings
 - 9. Section 32 17 13, Pavement Markings

1.3 REFERENCES

- A. Texas Health and Safety Code, Chapter 161, Subchapter Q, Installation of Asbestos
- B. Texas Occupations Code, Chapter 1954, Asbestos Health Protection

1.4 ACTION SUBMITTALS

- A. Submit product data and installation instructions for each type of product indicated.
- B. Submit, in duplicate, color chips and a program showing the type of paint to be used on each different surface in the building.
- C. Prepare samples of finishes on the job to the satisfaction of the Architect. If required by the Architect, 4 foot x 8 foot portions of wall surface shall be finished for each different color selected.
- D. One room and/or area as selected by the Architect shall be painted, with materials specified or accepted, applied directly from the container, unthinned. After acceptance by Architect, room and/or area shall be standard of quality of entire project.

1.5 INFORMATIONAL SUBMITTALS

- A. Submit Material Safety and Data Sheet (MSDS) for all materials, products, and parts.

1.6 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00, Project Management and Coordination.

1.7 QUALITY ASSURANCE

- A. Subcontractor shall have at least three years experience in projects of similar size and scope.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver painting materials to the jobsite until spaces and surfaces are ready for painting.
- B. Deliver unadulterated products to building site in unbroken packages or containers, bearing manufacturer's labels.
- C. Materials shall be stored and locked in watertight shed well off the ground.

1.9 WARRANTY

- A. Provide written warranty against defects in material and workmanship for the work of this Section for a period of two years from the Date of Substantial Completion of the Project. Warranty shall cover peeling, discoloration, fading, crazing, cracking, blistering, mildewing, chalking or other failures due to preparation, workmanship or materials.
- B. Refer to Section 01 77 00, Closeout Procedures, for Warranty form.

2 PRODUCTS**2.1 MANUFACTURERS**

- A. Sherwin Williams. No substitutions.

2.2 MATERIALS

- A. General
 - 1. The following specifications for material and finishes are not intended to mention every particular item which will receive painter's finish, but are intended to establish type and quality of finish which will be required on various surfaces.
 - 2. The Paint Finish Numbers that follow are typically used in the architectural drawings, on the Room Finish Schedules, elevations and details, to denote types and locations of various finishes hereinafter specified.
 - 3. Colors to be selected by Architect. Different colors may be selected for each room and more than one color in each room.
- B. Painters Caulk
 - 1. Sherwin-Williams All-Weather Siliconized Acrylic Latex
 - 2. Use for interior locations between walls and hollow metal frames, minor cracks in masonry and miscellaneous other locations where the caulking is scheduled to be painted and a building sealant is not scheduled or noted on the drawings.

- C. Paint Colors:
 - 1. Refer to Schedule on Drawings
 - 2. Basis of Design: Sherwin Williams.
- D. Finishes – Interior Work – Designated by Alphanumeric type letter on schedule as indicated below, (**Ex. P-1A = Paint; Color; Type of Finish**):
 - 1. **Type A:** Interior gypsum board and CMU partitions where epoxy coating is not scheduled
 - a. Gypsum Board: Sherwin-Williams; ProMar 200 Zero VOC Interior Latex Paint B31
 - b. CMU Partition: Pro Industrial, Zero-VOC semi-gloss acrylic, B31 Series
 - c. Apply two finish coats over specified primer at a dry film thickness of 2.5 – 4.0 mils.
 - d. Apply semi-gloss finish.
 - e. Primer
 - 1) Gypsum Board
 - a) Sherwin-Williams; ProMar 200 Zero VOC Interior Latex Primer
 - b) Apply at a dry film thickness of not less than 1.5 mils.
 - 2) Concrete Masonry Units (CMU)
 - a) Sherwin-Williams; Heavy Duty Interior/Exterior Block Filler, B42W46
 - b) Apply at a dry film thickness of not less than 8.0 mils.
 - 2. **Type B:** Interior ferrous metals, including hollow metal doors and frames
 - a. Sherwin-Williams; DTM Acrylic Gloss Coating B66-200 Series
 - b. Apply two finish coats over specified primer at a dry film thickness of 2.5 – 4.0 mils.
 - c. Apply semi-gloss finish.
 - d. Primer
 - 1) Sherwin-Williams; DTM Bonding Primer (Raw Steel) B66A50 Primer
 - 2) Apply at a dry film thickness of 2.0 – 4.0 mils.
 - 3. **Type C:** Interior gypsum board ceilings and furrings
 - a. Sherwin-Williams; ProMar 200 Zero VOC Interior Latex Paint B31
 - b. Apply two finish coats over specified primer at a dry film thickness of 2.5 – 4.0 mils.
 - c. Apply semi-gloss finish.
 - d. Primer
 - 1) Sherwin-Williams; Hi-Build Primer – Latex Projects, Zero-VOC Promar 200 B28W2600
 - 2) Apply at a dry film thickness of not less than 1.5 mils.
 - 4. **Type D:** Interior gypsum board and CMU partitions scheduled for epoxy coating
 - a. Gypsum Board: Sherwin-Williams; Pro-Industrial Zero-VOC Waterborne Cat. Epoxy Gloss, B73-361 Series
 - b. CMU Partitions: Sherwin-Williams; Pro Industrial Catalized Water Based Epoxy 2-Part Paint B73 Series
 - c. Apply two finish coats over specified primer at a dry film thickness of 2.5 – 4.0 mils.
 - d. Apply semi-gloss finish.
 - e. Location: Wet Areas
 - f. Primer
 - 1) Gypsum Board
 - a) ProMar 200 Zero VOC Latex Primer, B28W2600
 - b) Apply at a dry film thickness of not less than 1.5 mils.
 - 2) Concrete Masonry Units (CMU)
 - a) Sherwin-Williams; Heavy Duty Interior/Exterior Block Filler, B42W46
 - b) Apply at a dry film thickness of not less than 8.0 mils.
 - 5. **Type E:** Exposed beams, decking, steel joists, bridging, pipes, conduit & tectum panels.
 - a. Location: Video Production Studio D262
 - b. Sherwin-Williams; Waterborne Acrylic Dryfall (B42 Series)
 - c. Apply necessary coats to achieve complete coverage.
 - d. Apply at a dry film thickness of not less than 2.9 mils.
 - 6. **Type F:** Not Used.
 - 7. **Type G:** Not Used.
 - 8. **Type H:** Not Used.

E. Finishes – Exterior Work

1. **Type J:** Steel doors and frames, steel railings, bollards, and steel masonry lintels
 - a. Sherwin-Williams; DTM Acrylic Gloss Coating
 - b. Apply two finish coats over specified primer at a dry film thickness of 2.0 – 4.0 mils.
 - c. Primers
 - 1) Concrete Masonry Units (CMU): Factory-formulated latex block fillers
 - a) Sherwin-Williams; Heavy Duty Interior/Exterior Block Filler, B42W46
 - b) Apply at a dry film thickness of not less than 8.0 mils.
 - 2) Concrete and Masonry (other than CMU): Factory-formulated masonry primer for exterior application
 - a) Sherwin-Williams; Loxon Masonry Primer, A24W300
 - b) Apply at a dry film thickness of not less than 3.0 mils.
 - 3) Metal: Factory-formulated for galvanized or bare metal for exterior application.
 - a) Sherwin-Williams; DTM Bonding Primer
 - b) Apply at a dry film thickness of 2.0 – 4.0 mils.
2. **Type K:** Galvanized Metal
 - a. Use for field weld touch-up on galvanized material to remain unpainted.
 - b. ZRC Worldwide ZRC Galviline Galvanizing Repair
 - c. Sherwin-Williams; DTM Acrylic Semi-Gloss Coating
 - d. Apply two finish coats over wire-brushed and cleaned metal.
 - e. Primers
 - 1) Galvanized Metal:
 - a) Sherwin-Williams; Galvite HS Primer
 - b) Apply at a dry film thickness of 2.0 – 4.0 mils.
3. **Type L: Traffic Marking Paint**
 - a. Use for painting parking striping, access aisles, symbols, fire lanes, and other markings on concrete.
 - b. Refer to Section 32 17 23, Pavement markings.

3 EXECUTION

3.1 INSTALLATION

- A. Apply materials directly from containers in which material is purchased except when Architect approves use of other containers.
- B. Subcontractor shall provide to the Owner and Architect a notarized certification that paint used is as specified in writing by the Architect.
- C. Number of coats of each of several finishes shall be in accordance with detailed specifications, which contemplate use of materials that will produce quality finish if properly applied. If number of coats specified fails to produce a finish acceptable to Architect, this Contractor shall apply additional coats at his own expense until an acceptable finish is achieved.
- D. Where necessary to thin any oil vehicle painting materials, use wither pure linseed oil or turpentine unless the manufacturer of the material calls for other types of thinners.
- E. Tint each coat of paint a different shade from preceding coat.
- F. Notify Contractor of any surface not in proper condition to be finished before proceeding with the work. Starting work will constitute the painter's acceptance of preceding work and conditions under which finish will be applied and his assumption of responsibility for results to be obtained.

3.2 PREPARATION

- A. General: Surfaces to be finished must be clean, dry and free of dirt, oils, loose paint or any other contamination that would adversely affect adhesion, protective properties or appearance of the coating.

- B. Finished woodwork: Remove all dirt, stains, and grade marks from surfaces to receive transparent finishes. Sand all surfaces to receive finishes smooth and dry brush clean. Wash knots and pitch pockets with mineral spirits, then seal with appropriate sealer. After first coat of primer or stain, neatly putty nail holes and cracks flush with adjoining surfaces. Apply paste wood filler in open grain woods. Wipe when set to obtain smooth, even appearance. Prime millwork and tops and bottoms of doors immediately upon arrival at job site.
- C. Zinc Alloy or Galvanized Metal Work: Clean with solvent or use commercial pre-treatment solution as directed by manufacturer's instructions.
- D. Shop-Coated Metal Work: Remove all foreign matter and clean thoroughly. Abraded areas shall be spot-primed with the proper primer.
- E. Ferrous Metal Work: Clean metal surfaces not provided with prime coat by others, of rust, millscale, grease and foreign matter.
- F. Drywall Surfaces: Ensure that surfaces are taped, cemented and sanded, ready to receive paint. Correct minor surface defects. Dust and clean surfaces before painting.
- G. Concrete Surfaces: Clean surfaces of all foreign matter. Repair all minor defects with suitable patching material. Test paint-receiving surfaces for presence of alkali; if present, neutralize with suitable neutralizing compounds.
- H. Back-Priming: Back-prime wood trim and other woodwork installed against steel, concrete and plaster with one coat of primer specified for that exposed surface.
- I. **Install sealant at all changes of material prior to application of paint.**

3.3 APPLICATION

- A. Allow exterior paints to dry 72 hours between coats and interior paints to dry 24 hours between coats. Allow all enamels and varnishes to dry 24 hours between coats. If enamel and varnishes are tacky after 24 hours, allow additional time until finish is dry.
- B. Perform all work under favorable weather conditions.
- C. Backpaint all interior wood finish, concealed surfaces.
- D. Refer to plans for locations of various finishes.
- E. Best workmanship will be required with all materials spread and smoothly flowed on without runs, streaks, sags, brush marks, unfinished patches or other blemishes.
- F. Employ only skilled mechanics.
- G. Painter option: Painter may remove all hardware other than butts and door closers prior to finishing doors and replacing same or mask them with heavy paper and tape. Tape shall not be stuck to hardware, but shall be used to hold paper in place. Failure to do either will require hardware to be replaced or require hardware to be removed and returned to manufacturer for reapplication of special infrared baked lacquer protective cover at paint contractor's expense. If left in place, plated butts shall be protected as mentioned above.
- H. Wall signs: Above ceilings on all corridor partitions, smoke partitions, horizontal exit partitions, exit enclosures and fire walls paint, in easily visible locations, wall signs located 1) not over 30 feet apart; and 2) also on walls closest to ceiling access panels; letters shall be painted in red using 4 inch standard letter stencils and the wording shall state "Fire and Smoke Barrier - Protect All Openings". Refer to drawings for locations of subject walls.
- I. Number of coats specified for paint, stain or block filler are minimum required under optimum conditions. Where additional coats are required for color coverage, filling of pinholes, smoothness or uniformity, painting contractor shall be responsible for applying additional coats of material.
- J. All drywall to have an "orange peel" texture finish.
- K. All work where a coat of material has been applied must be observed by Architect before application of succeeding specified coat; otherwise no credit for coat applied will be given. Notify Architect when a particular coat has been completed for inspection and approval.
- L. Apply coats of material in strict accordance with manufacturer's specifications except where requirements of these specifications are in excess of manufacturer's requirements.

END OF SECTION 09 91 00

SECTION 10 11 00

VISUAL DISPLAY SURFACES

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, 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 SUMMARY

- A. Section includes visual display board assemblies (markerboards) and related accessories.
- B. Related Sections
 - 1. Section 04 20 00, Unit Masonry
 - 2. Section 05 40 00, Cold-Formed Metal Framing
 - 3. Section 09 22 16, Non-Structural Metal Framing
 - 4. Section 09 29 00, Gypsum Board
 - 5. Section 09 91 00, Painting

1.3 REFERENCES

- A. Use current editions unless noted otherwise.
- B. Federal Specifications (FS)
 - 1. FS CCC-W-408D, Wall Covering, Vinyl-Coated
- C. National Association of Architectural Metal Manufacturers (NAAMM)
 - 1. Metal Finishes Manual for Architectural and Metal Products
- D. 2010 ADA Standards for Accessible Design (SAD)
- E. 2012 Texas Accessibility Standards (TAS)
- F. Texas Health and Safety Code, Chapter 161, Subchapter Q, Installation of Asbestos
- G. Texas Occupations Code, Chapter 1954, Asbestos Health Protection

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00, Project Management and Coordination.

1.5 ACTION SUBMITTALS

- A. Product Data: Submit for each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, finishes, accessories for marker boards.
- B. Shop Drawings: Submit for visual display assemblies. Include plans, elevations, sections, details, and attachments to other work. Show locations of panel joints, locations of special-purpose graphics for visual display surfaces, and sections of typical trim members.
- C. Samples for Initial Selection: Submit for each type of visual display unit indicated, for units with factory-applied color finishes. Include samples indicating actual factory-finish color samples applied to substrate, and samples of accessories to verify color selected. Printed color charts are not acceptable.
- D. Samples: Submit for each type of visual display unit indicated. Include visual display panel (not less than 8½ by 11 inches for each type, color, support system, and accessories (full size sample of each type).

1.6 INFORMATIONAL SUBMITTALS

- A. Submit Material Safety and Data Sheet (MSDS) for all materials, products, and parts.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: Submit to include in maintenance manuals.

1.8 QUALITY ASSURANCE

- A. Source Limitations: Obtain visual display assemblies from single source from single manufacturer.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver factory-fabricated assemblies completely assembled in one piece.
- B. Store marker board assemblies with packing materials between each unit.

1.10 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install marker boards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

WARRANTY

- B. Provide written warranty against defects in material and workmanship for porcelain-enamel face sheets in which manufacturer agrees to repair or replace porcelain-enamel face sheets that fail within **50** years from date of Substantial Completion. Failures include, but are not limited to, surfaces losing original writing and erasing qualities and surfaces exhibiting crazing, cracking, or flaking.
- C. Refer to Section 01 77 00, Closeout Procedures, for Warranty form.

2 PRODUCTS**2.1 MANUFACTURERS**

- A. Glass Wall-Mounted Markerboard
 - 1. Claridge Products and Equipment, Inc.
 - 2. Ghent (A GMi Company)

2.2 MATERIALS

- A. Magnetic Wall Mounted Dry-erase Glass Markerboard
 - 1. Basis of Design: Glass Magnetic Wall-Mounted Markerboard GB4x8MGMI by Claridge Products, or equivalent by one of the listed manufacturers.
 - a. Type: Magnetic Wall Mounted Dry-erase Glass Markerboard composed of low iron ultra clear glass, scratch and stain resistant.
 - 1) Thickness: 1/4"
 - 2) Mounting Style: Invisi-mount with Dual Lock
 - 3) Size: 4'-0" x 8'-0"
 - 4) Locations: As shown in plans and at every Conference Room & Collaboration Work Area whether shown or not.
 - 5) Accessories: To be provided for each markerboard
 - a) Magnets: Four (4) rare earth magnets with options from manufacturers available colors.
 - b) Marker Caddy: Medium Magnetic Holder.
 - c) Dry-Erase Markers & Cloth: Four (4) LCS assorted markers and one microfiber erase cloth.
 - d) Eraser: Magnetic with black felt.
 - e) Cleaner: 8 oz. Whiteboard Cleaner
 - b. Finish: Selection from manufacturers standard color selections.

2.3 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

3 EXECUTION**3.1 EXAMINATION**

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance of the Work.
- B. Examine walls and partitions for proper preparation and backing for magnetic marker boards.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions for surface preparation.
- B. Clean substrates of substances that could impair the performance of and affect the smooth, finished surfaces of magnetic marker boards, including dirt, mold, and mildew.

3.3 INSTALLATION, GENERAL

- A. General: Install magnetic marker boards per the manufacturer recommendations and at locations and at mounting heights indicated on Drawings. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

3.4 CLEANING AND PROTECTION

- A. Clean surfaces according to manufacturer's written instructions.
- B. Touch up factory-applied finishes to restore damaged or soiled areas.
- C. Cover and protect marker boards after installation and cleaning.

END OF SECTION 10 11 00

SECTION 10 14 00

SIGNAGE

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, 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 SUMMARY

- A. Section includes:
 - 1. Exterior pole mounted marquee capable of two-sided display of school name and logo with the capability of a two-sided electronic message display, Handicapped Parking and Traffic Control Signs, Fire Department Connection (FDC) signage, and illuminated fabricated channel characters shown on the drawings.
 - 2. The cost to furnish and install the Handicapped Parking and Traffic Control Signs, building marquee, illuminated entrance signage, courtyard inlays, and Fire Department Connection (FDC) signage shall be included in the base bid, but will not to be charged to the Graphics Allowance.
 - 3. The full amount of the Graphics Allowance shall be available for the post and panel signs, room identification and directional plaques, building dedication plaque, vinyl die cut letters, and other graphics, the extent of which may be indicated on the drawings, but will be more fully determined after award of the construction contract.
- B. Related Sections
 - 1. Section 01 21 00 Allowances
 - 2. Section 03 30 00, Cast-In-Place Concrete
 - 3. Section 04 20 00, Unit Masonry

1.3 REFERENCES

- A. Use current editions unless indicated otherwise.
- B. American Architectural Manufacturers Association (AAMA)
 - 1. AAMA 2603, Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels
- C. U. S. Department of Transportation, Federal Highway Administration (FHWA)
 - 1. Manual on Uniform Traffic Control Devices (MUTCD)
- D. 2010 ADA Standards for Accessible Design (SAD)
- E. 2012 Texas Accessibility Standards (TAS)
- F. Texas Health and Safety Code, Chapter 161, Subchapter Q, Installation of Asbestos
- G. Texas Occupations Code, Chapter 1954, Asbestos Health Protection

1.4 ACTION SUBMITTALS

- A. Submit product data and installation instructions for each type of product indicated.
- B. Submit complete shop drawings for marquee bearing the seal of a structural engineer registered to practice in the State of Texas. Shop drawings shall meet deferred submittal and/or sign permit requirements of City of Pearland for permitting.

1.5 INFORMATIONAL SUBMITTALS

- A. Submit Material Safety and Data Sheet (MSDS) for all materials, products, and parts.

1.6 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00, Project Management and Coordination.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver all materials to the jobsite in manufacturer's original packaging and store protected from damage and exposure to the elements. Remove damaged materials from the project.

1.8 WARRANTY

- A. Provide written warranty against defects in material and workmanship for the work of this Section for a period of Five year from the Date of Substantial Completion of the Project.
- B. Refer to Section 01 77 00, Closeout Procedures, for Warranty form.
- C. Provide web base software training for end-users.

2 PRODUCTS**2.1 MANUFACTURERS**

- A. Marquee Sign and Monument.
 - 1. Aria Signs & Design
 - 2. Baker Signs
 - 3. Chandler Signs
 - 4. National Signs
 - 5. Daktronics
 - 6. Watchfire

2.2 MATERIAL

- A. Marquee: Basis of Design is based on the 10mm Electronic Cabinet from Watchfire.
 - 1. Each electronic display viewing area shall be 4'-0" high x 8'-0" wide, Double face electronic sign 120 VOLT 40.0 amps (20.00 per face) Single Phase Service (Refer to the Installation manual for details on wiring) internally illuminated, weatherproof, with two colors plus District ID and logo mounted above the electronic message sign. Housing shall be prefinished Aluminum, Fluropon Kynar 500 matt black or mil finish as selected by Architect.
 - a. Communications: OPx-4G wireless with cellular data plan (Life-of-Sign data plan)
 - 3. Pole Cover shall be 3'-10" wide x 5'-8" high x 10" deep and constructed from prefinished aluminum, Fluropon Kynar 500 matt black or mil finish as selected by Architect. Total assembly of pole sign shall not exceed 12'-0" in height above grade.
 - 4. Provide a 11'-0" x 3'-0" x 6" thick concrete slab (reinforced with #3's at 18 inches each way) under pole cover.
 - 5. Pole sign assembly shall be designed to withstand a wind load as required by the building code, but not to be less than 110 mph.
 - 6. Sign components must bear the UL Label or equal.
- B. Handicapped Parking and Traffic Control Signs
 - 1. Signs shall consist of Engineer Grade Reflective sheeting and inks on rust-free, heavy gauge, durable aluminum.
 - 2. Comply with Federal standards (Manual on Uniform Traffic Control Devices) for R7 Series and R8 Series signs, 2010 ADA Standards for Accessible Design (SAD), and 2012 Texas Accessibility Standards (TAS).

3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of signage work.
- B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.
- C. Verify that sign surfaces are clean and free of materials or debris that would impair installation.
- D. Verify that electrical service is correctly sized and located to accommodate signs.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install handicapped parking signs in accordance with the requirements of the 2010 ADA Standards for Accessible Design (SAD) and 2012 Texas Accessibility Standards (TAS), whether or not detailed as such.
- B. Install signs using mounting methods indicated and according to manufacturer's written instructions.
- C. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
- D. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- E. Illuminated Fabricated Channel Characters
 - 1. Mount characters in the location indicated on the drawings.
 - 2. Place spacers on studs, place sign in position with spacers pinched between sign and substrate, and install gasketing, washers and nuts on stud ends projecting through opposite side of surface, and tighten.

3.3 ADJUSTING AND CLEANING

- A. Remove and replace damaged or deformed characters and signs that do not comply with specified requirements. Replace characters with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
- B. Remove temporary protective coverings and strippable films as signs are installed.
- C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 10 14 00

SECTION 10 14 23.16

ROOM IDENTIFICATION PANEL SIGNAGE

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.

1.2 WORK INCLUDED

- A. Provide and install all graphics items and related accessories in accordance with the drawings and as specified herein, including:
 - 1. Room Identification Plaques
 - 2. Directional Signage
 - 3. Fire Egress Map Signage
 - 4. Vinyl Die Cut Letters
 - 5. Door Security Identification Graphics

1.3 BIDDING

- A. Provide and install all graphics items and related accessories in accordance with the drawings and as specified herein.
- B. Submit proposals to the general contractor, itemized and priced separately as they may be awarded separately.
- C. Provide unit pricing for all plaque types, as the Owner may wish to purchase additional plaques as required for the school.

1.4 RELATED WORK SPECIFIED IN OTHER SECTIONS

- A. 08 80 00, Glazing
- B. 09 29 00, Gypsum Board
- C. 09 30 00, Tiling
- D. 09 77 26, Surfacing Films (Supergraphics)
- E. 09 91 00, Painting

1.5 SUBMITTALS

- A. Comply with the requirements of the General and Supplementary Conditions.
- B. Submit copy of this specification section, noting selected manufacturer and product. Indicate compliance with specification and note deviations where applicable.
- C. Submit layout drawings of each type of room identification plaque for approval prior to production.
- D. Submit manufacturer's product data describing materials and mounting methods for Room Identification Plaques and Directional Plaques.
- E. Submit material safety and data sheet for all materials or parts provided under this section of the Work.

1.6 REFERENCES

- A. 1990 Americans with Disabilities Act (ADA)
 - 1. ADA Accessibility Guidelines for Buildings and Facilities
- B. 2012 Texas Accessibility Standards, Texas Government Code, Chapter 469, Administered by the Texas Department of Licensing and Regulation, March 15, 2012.
- C. Texas Health and Safety Code, Chapter 161, Subchapter Q, as amended by House Bill No. 1927.
- D. Texas Asbestos Health Protection Act (Article 4477-3a, Vernon's Texas Civil Statutes), Section 13, as added by Senate Bill 509.

1.7 QUALITY ASSURANCE

- A. Installation conference shall be scheduled in accordance with the requirements of Section 01100, Notification and Meeting Requirements.

1.8 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. Re: Section 01700 for Warranty form.
- B. Warranted defects shall include but not necessarily be limited to color fading, delaminating, failure of anchoring or fastening, cracking, breaking or tarnishing.

1.9 DELIVERY AND STORAGE

- A. Do not deliver materials to the jobsite until surfaces are ready for installation of graphics.

2 PRODUCTS

2.1 MANUFACTURERS

- A. Architectural Graphic Products
 - 1. Address: 10616 Hempstead Rd., #E, Houston, Texas 77092
 - 2. Phone/E-mail: 713-683-8942, sales@agpmfg.com
- B. Aria Signs & Design
 - 1. Address: 14409 Reeveston Rd. Houston, TX 77039
 - 2. Phone/E-mail: 713-259-3737, sales@ariasigns.com
- C. NEC Signage+Architectural Products
 - 1. Address: 1122 Lauder Road, Houston, TX 77039
 - 2. Phone/Email: 281-987-1144, info@necsigns.net
- D. South Texas Graphic Specialties, Inc.
 - 1. Address: 10216 Georgibelle Dr., #800, Houston, Texas 77043-5291
 - 2. Phone/E-mail: 713-467-4499, stgs@sbcglobal.net

2.2 MATERIAL

- A. Room Identification Plaques and Informational Plaques (Plaque Types A, B, C, D, E, F, G & H)
 - 1. Plaques shall be of the design and sizes shown on the drawings.
 - 2. Plaques shall be made of 1/4" thick acrylic with one side laminated with 1/32" plastic laminate for engraving.
 - 3. Plaques shall include text as indicated on the drawings.
 - 4. Text (letters and/or numbers) shall be square corner Sans Serif style. The sizes of the plaques are to be as indicated on the attached drawings. The spacing of letter characters is to be as close as possible.
 - 5. Raised text shall be raised 1/32" and shall be made of 1/16" solid core laminate, chemically welded to the acrylic core through the plastic laminate face as shown on the drawings.
 - 6. Raised text shall be accompanied by the corresponding Unified English Braille Code 2 by means of Visi Touch Duradot Braille manufacturing system in the locations shown in the drawings.
 - 7. Engraved text shall be paint filled to match acrylic text. No rounded corners will be accepted on engraved letters and numbers
 - 8. Engraved Graphic shall be paint filled to match acrylic text. No rounded corners will be accepted on engraved graphic. District Logo Artwork to be provided by architect. (plaque types A, B, C, D, E, F, G & H)
 - 9. Plaque corners to have radius as noted and edges shall be painted to match the plastic laminate face color.
 - 10. The plastic laminate face colors are as indicated on the drawings. Colors will not be selected from premium price range laminates.
 - 11. The 1/16" solid core acrylic text and symbols shall be as indicated on the drawings.
 - 12. The back of all plaques scheduled to be mounted on glass shall be painted to match the plastic laminate face color. A blank backer plaque shall also be provided at all such locations.

B. Directional Signs (Plaque type B, B1, C & C1)

1. Plaques shall be of the design and sizes shown on the drawings.
2. Plaques shall be made of 1/4" thick acrylic with one side laminated with 1/32" plastic laminate for engraving.
3. Plaques shall include text as indicated on the drawings.
4. Text (letters and/or numbers) shall be square corner Sans Serif style. The sizes of the plaques are to be as indicated on the attached drawings. The spacing of letter characters is to be as close as possible.
5. Raised text shall be raised 1/32" and shall be made of 1/16" solid core laminate, chemically welded to the acrylic core through the plastic laminate face as shown on the drawings.
6. Raised text shall be accompanied by the corresponding Grade 2 Braille by means of Visi Touch Duradot Braille manufacturing system in the locations shown in the drawings.
7. Engraved text shall be paint filled to match acrylic text. No rounded corners will be accepted on engraved letters and numbers.
8. Plaque corners to have radius as noted and edges shall be painted to match the plastic laminate face color.
9. The plastic laminate face colors are as indicated on the drawings. Colors will not be selected from premium price range laminates.
10. The 1/16" solid core acrylic text and symbols shall be as indicated on the drawings.
11. The back of all plaques scheduled to be mounted on glass shall be painted to match the plastic laminate face color. A blank backer plaque shall also be provided at all such locations.
12. Plaque shall consist of digitally printed text on Adhesive Label.

C. Fire Egress Map Signage (Plaque Type L)

1. Plaques shall be of the design and sizes shown on the drawings.
2. Qty: 5. Coordinate locations with Owner and Architect Prior to installation.
3. Plaques shall be made of 1/8" thick clear acrylic face and 1/4" thick acrylic backplate.
4. Provide thumb slot for easy removal of insert.
5. Painted border on reverse side of clear acrylic. Paint to match SW 2936 "Black Emerald"

D. Dedication Plaque: (Plaque type I)

1. Plaque shall be of the design and size as shown on the drawings.
2. Manufacturer: A.R.K. Ramos or Approved Equal.
3. Material: 1/2" cast aluminum.
4. Borders: No borders.
5. Background Texture: Smooth
6. Finish: Baked Enamel Finish with protective matte finish clear coat, color to be determined.

3 EXECUTION**3.1 INSTALLATION****A. Room Identification Plaques and Directional Plaques**

1. Mount Room identification plaques such that the center of the plaque is centered at 58" above the finished floor or where the baseline of the highest tactile character is no more than 60 inches maximum above the finish floor or ground surface. All mounting locations shall be coordinated with the Architect prior to installation.
2. At room identification plaques where a tactile sign is provided at a door, the sign shall be installed alongside the door at the latch side. Where a tactile sign is provided at double doors with one active leaf, the sign shall be installed on the inactive leaf. Where a tactile sign is provided at double doors with two active leaves, the sign shall be installed to the right of the right-hand door. Where there is no wall space at the latch side of a single door or at the right side of double doors, signs shall be installed on the nearest adjacent wall. Signs containing tactile characters shall be installed so that a clear floor space of 18 inches (455 mm) minimum by 18 inches (455 mm) minimum, centered on the

tactile characters, is provided beyond the arc of any door swing between the closed position and 45-degree open position.

3. Mount the room identification plaques and directional plaques with two ¾" wide x 6" long strips of foam adhesive tape and in-filled with a full bed of clear silicone adhesive on the back of the plaque.
 4. Provide backer plate at areas where signs are installed on glazing. Align with plaque on opposite side of glass.
- B. Dedication Plaque
1. Flush mount to wall using threaded studs set in clear silicone adhesive.
 2. Coordinate final location with Architect prior to installation.
- C. Vinyl letters
1. Install at locations indicated on the drawings and schedules.
 2. Glass surface to be cleaned before letters are applied.
 3. Letters should be free of all surface defects, including bubbles and wrinkles.
- D. Interior Building Corridor Signage
1. Install as indicated on the drawings.
 2. Glass surface to be cleaned before letters are applied.
 3. Letters and graphics should be free of all surface defects, including bubbles and wrinkles.

END OF SECTION 10 14 23.16

SECTION 10 21 13.17

PHENOLIC TOILET COMPARTMENTS

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, 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 SUMMARY

- A. Section includes solid-polymer toilet compartments configured as toilet enclosures and urinal screens.
- B. Related Sections
 - 1. Section 04 20 00, Unit Masonry
 - 2. Section 06 10 53, Miscellaneous Rough Carpentry
 - 3. Section 09 30 00, Tiling
 - 4. Section 10 28 13, Toilet Accessories

1.3 REFERENCES

- A. Use current editions unless noted otherwise.
- B. ASTM International (ASTM)
 - 1. ASTM B26 / B26M, Standard Specification for Aluminum-Alloy Sand Castings
 - 2. ASTM B86, Standard Specification for Zinc and Zinc-Aluminum (ZA) Alloy Foundry and Die Castings
 - 3. ASTM B221, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
 - 4. ASTM B584, Standard Specification for Copper Alloy Sand Castings for General Applications
 - 5. ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials
- C. 2010 ADA Standards for Accessible Design (SAD)
- D. 2012 Texas Accessibility Standards (TAS)
- E. Texas Health and Safety Code, Chapter 161, Subchapter Q, Installation of Asbestos
- F. Texas Occupations Code, Chapter 1954, Asbestos Health Protection

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00, Project Management and Coordination.

1.5 ACTION SUBMITTALS

- A. Submit product data for each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Submit shop Drawings for toilet compartments. Include plans, elevations, sections, details, and attachments to other work. Show locations of centerlines of toilet fixtures and overhead support or bracing locations.
- C. Samples for Initial Selection: For each type of unit indicated. Include Samples of hardware and accessories requiring material and color selection.

1.6 INFORMATIONAL SUBMITTALS

- A. Submit Material Safety and Data Sheet (MSDS) for all materials, products, and parts.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For toilet compartments to include in maintenance manuals

1.8 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E84, or another standard acceptable to authorities having jurisdiction, by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: 75 or less
 - 2. Smoke-Developed Index: 450 or less
- B. Regulatory Requirements: Comply with applicable provisions in the 2010 ADA Standards for Accessible Design (SAD) and the 2012 Texas Accessibility Standards (TAS) for toilet compartments designated as accessible.

1.9 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.
- B. Ambient Conditions: Maintain environmental conditions such as temperature, humidity, and ventilation within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.10 WARRANTY

- A. Provide written warranty against defects in material and workmanship for the work of this Section for a period of one year from the Date of Substantial Completion.
- B. Refer to Section 01 77 00, Closeout Procedures, for Warranty form.

2 PRODUCTS**2.1 MANUFACTURERS**

- A. Accurate Partitions Corporation
- B. General Partitions Mfg. Corp.
- C. Global Steel Products Corp.
- D. Hadrian Manufacturing Inc.
- E. Knickerbocker Partition Corporation
- F. Metpar Corp.
- G. Partition Systems Incorporated of South Carolina
- H. Rockville Partitions Incorporated
- I. Santana Products, Inc.
- J. Sanymetal; a Crane Plumbing company
- K. Weis-Robart Partitions, Inc.

2.2 MATERIALS

- A. Aluminum Castings: ASTM B26/B26M
- B. Aluminum Extrusions: ASTM B221

2.3 PHENOLIC UNITS

- A. Basis of Design: Alpaco Toilet Compartments Black Core phenolic, Alpaco Elegance by ASI Accurate Partitions.
- B. Toilet-Enclosure Style: Floor anchored, Overhead braced
- C. Urinal-Screen Style: Wall hung with floor-mounted pilaster.
- D. Door, Panel, and Pilaster Construction: Phenolic-resin impregnated, wood-based product core with melamine-impregnated decorative surface papers and transparent, protective topcoat; NEMA LD 3 Compact Laminate. Not less than 1 inch thick, seamless, with eased edges.
 - 1. Heat-Sink Strip: Manufacturer's standard continuous, extruded-aluminum or stainless-steel strip fastened to exposed bottom edges of solid-polymer components to prevent burning.

2. Finish and Color: Black Core Phenolic with Weathered Ash 9842 Laminate or from manufacturers full line of laminate colors.
- E. Pilaster and Sleeves (Caps): Manufacturer's standard design; stainless steel
- F. Urinal-Screen Post: Manufacturer's standard post design of 1¾ inch square, aluminum tube with satin finish; with shoe and sleeve (cap) matching that on the pilaster
- G. Brackets (Fittings):
 1. Full-Height (Continuous) Type: Manufacturer's standard design; extruded aluminum or stainless steel
- H. Panel or Pilaster Pedestal Legs: Brushed stainless steel, adjustable in height plus or minus to 1 inch (25 mm) to support panel 12 inches above finished floor.
- I. Head Rails: Brushed stainless Steel 1-1/4-inch (32 mm) diameter tube attached with clips to top of pilaster.

2.4 ACCESSORIES

- A. Brackets:
 1. Continuous Type: Brushed stainless steel, extended depth.
- B. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories
 1. Material: Clear-anodized aluminum or Stainless steel
 2. Hinges: Brushed stainless steel barrel hinges.
 3. Latch and Keeper: Brushed stainless steel latch with occupancy indicator.
 4. Coat Hook: Brushed stainless steel. Manufacturer's coat hook with rubber bumper; one per compartment, mounted on door.
 5. Door Bumper: Brushed stainless steel. Provide rubber-tipped door bumpers at out-swinging doors.
 6. Door Pull: Brushed stainless steel. Provide door pull for outswinging doors. Provide on both sides of doors designated as accessible.
- C. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish
- D. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel or chrome-plated steel or brass, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized steel, or other rust-resistant, protective-coated steel.

2.5 FABRICATION

- A. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.
- B. Urinal and Entrance Screen Posts: Provide anchoring assemblies with leveling adjustment at bottoms of posts.
- C. Door Size and Swings: Unless otherwise indicated, provide 24 inch wide, in-swinging doors for standard toilet compartments and 36 inch wide, out-swinging doors with a minimum 32 inch wide, clear opening for compartments designated as accessible.
- D. Coordinate requirements and provide cutouts for through-partition toilet accessories and solid blocking within panel where required for attachment of toilet accessories.

3 EXECUTION

3.1 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.
 1. Maximum Clearances: ½ inch at pilasters and panels and 1 inch at panels and walls

- B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1³/₄ inches into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels, and adjust so tops of doors are parallel with overhead brace when doors are in closed position.
- C. Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb, rigid, and secured to resist lateral impact.

3.2 ADJUSTING

- A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION 10 21 13.17

SECTION 10 22 39

FOLDING PANEL PARTITIONS

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, Instruction to Bidders, for substitution of materials and products.
- C. Addenda issued during the bidding period that affect this section of specifications.

1.2 SUMMARY

- A. Section Includes:
 - 1. Furnish and install operable panel walls as indicated in the drawings and specified herein.
- B. Related Requirements
 - 1. Section 04 20 00, Unit Masonry
 - 2. Section 06 10 53, Miscellaneous Rough Carpentry (above ceiling track support)
 - 3. Section 06 20 00, Millwork (plastic laminate sweep strip and jamb trim)
 - 4. Section 08 71 00, Door Hardware (Key operation switch cylinders)
 - 5. Section 09 22 16, Non Structural Metal Framing
 - 6. Section 09 29 00, Gypsum Board
 - 7. Section 09 51 00, Acoustical Ceilings
 - 8. Section 09 65 19, Resilient Tile Flooring
 - 9. Section 09 68 16, Carpet
 - 10. Section 09 91 00, Painting
 - 11. Division 26: Electrical

1.3 REFERENCES

- A. Use current editions unless noted otherwise.
- B. ASTM International (ASTM)
 - 1. ASTM E 90: Laboratory Measurement of Airborne-Sound Transmission Loss of Building Partitions.
 - 2. ASTM E 413: Determination of Sound Transmission Class (STC).
 - 3. ASTM E 557: Architectural Application and Installation of Operable Partitions.
 - 4. ASTM E 84: Surface Burning Characteristics of Building Materials.
 - 5. ASTM A 653: Specification for General Requirements for Steel Sheet, Alloy-Coated (Galvannealed) by the Hot Dip Process.
 - 6. ASTM C 423: Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
 - 7. CCC-W-408A: Federal Specification which applies to Vinyl Coated Wall Coverings.
 - 8. CFFA-W-101-D: Chemical Fabrics and Film Association Quality Standard for Vinyl Coated Fabric Wall Coverings.
 - 9. NFPA 70: Standard for the safe installation of electrical wiring and equipment.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00, Project Management and Coordination.

1.5 ACTION SUBMITTALS

- A. Comply with the requirements of the General and Supplementary Conditions.
- B. Submit product data and installation instructions for each type of product indicated.
- C. Shop Drawings: For operable panel partitions.

1. Include detailed engineering drawings featuring track plan, panel elevation, horizontal and vertical details, wiring diagram and beam punching template as required.
2. Indicate stacking and operating clearances. Indicate location and installation requirements for hardware and track, blocking, and direction of travel.
3. Include written test report of the independent acoustical testing laboratory certifying the attainment of the specified STC rating.
4. Include written instructions specifying the proper operation and maintenance of the operable wall system.
5. Include diagrams for power, signal, and control wiring.
- D. Samples for Initial Selection: For each type of exposed material, finish, covering, or facing.
 1. Include Samples of accessories involving color selection.
 2. Samples for Verification: For each type of exposed material, finish, covering, or facing, prepared on Samples of size indicated below:
 3. Panel Facing Material: Manufacturer's standard-size unit, not less than 3 inches (75 mm) square.
 4. Panel Edge Material: Not less than 3 inches (75 mm) long.
 5. Hardware: One of each exposed door-operating device.

1.6 INFORMATIONAL SUBMITTALS

- A. Submit Material Safety and Data Sheet (MSDS) for all materials, products, and parts.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who is certified in writing by the operable partition manufacturer, as qualified to install the manufacturer's partition systems for work similar in material, design, and extent to that indicated for this Project.
- B. Acoustical Performance: Test operable partitions in an independent acoustical laboratory in accordance with ASTM E90 and ASTM E 413 test procedure to attain no less than the STC rating specified. Provide a complete and unedited written test report by the testing laboratory upon request.
- C. Panel Construction: The operable wall panel construction and finish materials shall consist of Class A rated materials in accordance with ASTM E 84.
- D. Preparation of the opening shall conform to the criteria set forth per ASTM E557 Standard Practice for Architectural Application and Installation of Operable Partitions.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Do not deliver materials to the jobsite until spaces are ready for installation of panels.
- B. Panels shall be individually wrapped in a protective plastic covering to keep panels clean during delivery, storage and handling.
- C. Panels shall be stored on edge and above the floor on cushioned blocking in a dry and ventilated area, protected from humidity and temperature extremes.
- D. Clearly mark packages and panels with numbering systems used on Shop Drawings. Do not use permanent markings on panels.
- E. Protect panels during delivery, storage, and handling to comply with manufacturer's direction and as required to prevent damage.

1.9 SEQUENCING / SCHEDULING

- A. Beam Punching: Manufacturer shall provide beam punching template drawing detailing the anchor locations for the suspended track system (as required for Drop Rod Mounting), as required for the fabrication and installation of structural overhead support by others.
- B. Track Installation: Scheduling of operable wall track installation shall occur after structural overhead support has been properly and completely fabricated and installed by others.
- C. Panel Installation: Operable wall panel installation shall occur after fixed wall substrate construction is properly and completely installed by others, as required to protect panels from ongoing adjacent construction.

1.10 WARRANTY

- A. Manufacturer shall warrant each partition and its component parts to be free from defects in material and workmanship for a period of **five (5) years** from the date of delivery to the original purchaser. Refer to Section 01 77 00, Close Out Procedures, for Warranty form.

2 PRODUCTS**2.1 MANUFACTURERS**

- A. Kwik-Wall
- B. Modernfold, Inc.
- C. Advanced Equipment Corporation
- D. Moderco
- E. Operable Walls shall be Series 3000, Model 3050 Continuously Hinged / Electric as manufactured by KWIK-WALL Company. Locally distributed by Griesenbeck Architectural Products Inc., sales@griesenbeck.com, (832) 841-2074.

2.2 MATERIALS

- A. Operable Wall Panels
 - 1. Basis of Design:
 - a. Series 300, Model 3050 - Operable Walls: Continuously Hinged / Electrically Operated as manufactured by Kwik-Wall Company distributed by Griesenbeck Architectural Products Inc., or equivalent by one of the listed manufacturers at that make up the configuration of the Main Training Rooms G101, G102, G103, G104, G105, G106, G108 & G109 as shown in floor plans.
 - 1) Sound Transmission Classification: STC 56, to comply with ASTM E 90 and ASTM E 413 test procedures.
 - 2) Operation: Electric.
 - a) Motor: 1 Horsepower (.746 kw), 208/230-volt, 3-Phase, 60 Hz capacitance wound motor.
 - b) Activation of the operator shall be controlled by a two (2) position (low voltage) key switch to arm the system. Control of the operator shall consist of two (2) stations with extend and retract constant-pressure push button switches. Switches shall be low voltage, wired in series, and located on opposite sides and ends of the partition. Electric operator shall include safety devices (limit switches) to automatically shut off the operator at the fully extended and fully retracted position. Operator shall be located at the opposite end of stack area off center to the side of the partition. All electric operator components shall be modularized for easy replacement in the field without removing the surrounding components and NFPA 70 approved. Access panels to the operator unit and return sprockets are required for adjustment and maintenance purposes, as provided by others. Electric operator shall consist of:
 - (1) Standard Speed Reducer Drive: consisting of a 50 to 1 ratio worm gear, adjustable clutch and 1 H.P. (.746 kw) electric motor. Speed reducer drive system shall be capable of moving a wall system up to 600 ft.² (56 m²).
 - Operation shall be Continuously Hinged / Electric, consisting of panels hinged together forming a continuous panel train. Panels shall be top-supported by one (1) carrier in each panel, consisting of four (4) permanently lubricated, precision ground ball bearing polished steel wheels riding on a steel tread surface. Panels shall be operated between stacking location and installed position by an electric operator, which connects to lead panel by #50 roller chain. A manual override shall be included in the event of a power failure to allow the operable wall system to be manually operated.
 - 3) Configuration:
 - a) Continuously hinged and center stacked.

- b) Open in one direction.
- c) Stack Quantity: Panels shall be stored at:
 - (1) *Standard One End*: on one end of the wall run
- 4) Panel Construction:
 - a) Thickness: Nominal 4"
 - b) Panel Size Width: 48" maximum.
 - c) Partition Lengths: Varies – Refer to Plan.
 - d) Partition Heights: 24'-0"
 - e) Panel Frame: Steel frame shall be 16-gauge galvanized steel, which meets or exceeds ASTM A 653 requirements. Frame shall be all-welded construction with steel corner supports and cross-bracing reinforcement. Top horizontal cross member shall be a minimum 7-gauge structural rectangular steel tube designed to accept a spring-loaded floating carrier. Panel frame shall be Class A rated, fire retardant, non-combustible and non-corrosive in accordance with ASTM E 84.
 - f) Skin: Standard Steel of minimum 22-gauge tension-levleed galvanized steel, pressure laminated to a structural acoustical backer and mechanically-joined to the steel frame to form a rigid, unitized and structural panel.
 - g) Hinges: Full leaf butt hinges.
 - (1) Hinges shall be attached to steel frame utilizing a steel mounting bracket welded to frame. Bottom hinge shall be located 7'-0" (2.13 m) A.F.F. for partition heights over 16'-0" (4.88 m).
- 5) Finish: Panel finish material shall be Class rated in accordance with ASTM E 84:
 - a) Operable Partitions:
 - (1) Vinyl: Consisting of Type II, reinforced vinyl weighing 21 oz. / lin. yr. (4651 g / lin. m). Vinyl shall meet or exceed CCC-W-408A and CFFA-W-101-D quality standards.
 - (a) Selection: Include vinyl options per manufacturer's full color selection.
 - (2) Pocket Doors:
 - (a) Include options for Vinyl & High Pressure Laminate (HPL) from manufacturer's full color selection.
- 6) Perimeter Trim and Seals:
 - a) Vertical Trim and Seals: Panels shall have Trimless vertical astragals containing flexible vinyl seals and incorporate reversible tongue-and-groove-type configuration for positive interlocking with adjacent panels. Vertical trim shall not be permitted on the panel faces, resulting in a minimal groove appearance between adjacent panels.
 - b) Horizontal Top Trim and Seals: Top seals shall consist of flexible vinyl sweep seals installed on both sides of the panel. The seals shall consist of a compressed bulb between two (2) fingers of vinyl. Top seal type shall be Fixed consisting of continuous-contact flexible vinyl, sealing against the bottom flange of the overhead track.
 - c) Horizontal Bottom Trim and Seals: Bottom seals shall consist of multiple fingers of flexible vinyl for positive contact and sealing with various floor surfaces. Bottom seal type shall be:
 - (1) Standard Adjustable Bottom Seals: consisting of field-adjustable, continuous-contact vinyl sweep seals with 2" [50.8] nominal height with 3/4" [19] of nominal adjustment.
 - d) Horizontal and Vertical Panel Trim: All exposed panel trim and hinges shall be of one (1) similar color:
 - (1) Dark Bronze or Grey; final selection by the architect.

2.3 CLOSURE SYSTEMS

- A. Initial Closure System: The lead panel (the first panel exiting the stack) shall form a seal vertically against a rigid wall surface. The initial closure shall be accomplished by an Adjustable-Compensating Closure containing two (2) continuous-contact, flexible vinyl bulb seals installed along the vertical edge of the lead panel for positive compression against a rigid wall surface. Initial closure panel shall contain a flush pull handle on each side.
- B. Final Closure System: The final closure panel (the last panel exiting the stack) shall form a seal vertically against a rigid wall surface. Final closure shall be accomplished by a Half Panel that does not require any attachment to the permanent wall. The Half Panel and its two (2) immediately adjacent panels will incorporate adjustable bottom seals, and the first panel adjacent to the half panel shall contain a flush pull handle. The type of final closure panel shall be:
 - 1. *Automatic Half Panel Pivot Closure*: consisting of a Half Panel attached to a mechanical closure device with a 50 to 1 ratio worm gear and 1 Horsepower (.746 kw) electric motor allowing the operable wall to extend and retract automatically
- C. Pocket Door Types: Each pocket door configuration shall be hinged to an adjustable jamb consisting of an aluminum extrusion which is permanently mounted to a structural wall surface and is field-adjustable to compensate for out-of-plumb conditions of the fixed wall. The adjustable jamb shall incorporate a tongue-and-groove-type vertical astragal for positive interlocking with a pocket door panel. To stabilize the pocket door(s) a surface mounted footbolt shall be furnished by the operable wall manufacturer and installed by others in the field. The pocket door configuration shall be:
 - 1. *Double Doors w/Expander and Interlock Switches*: consisting of two (2) individual panels with each panel being hinged to an adjustable jamb. The lead edge of one (1) panel shall contain an expander mechanism with a nominal 5" [127] of travel, activated from the face of the panel using a removable wrench as supplied by manufacturer. The lead edge of the adjacent panel shall contain flexible vinyl bulb seals installed along the vertical edge for positive compression against the face of the operable wall panel. Each pocket door shall contain an electric Interlock Switch to prevent the operator from running until the pocket doors have been opened up 180°.

2.4 PANEL ACCESSORIES

- A. Accessories including Single Pass Doors, Keyed Cylinder Locks, Concealed Door Closures, Room Viewers, Exit Signs, Dry Marker Writing Surfaces, Recessed Eraser Trays, Vision Lites, Tack Surfaces, and Pocket Doors shall be compatible with other accessories and options, furnished and installed by the operable wall manufacturer as noted on submitted shop drawings.

2.5 TRACK SYSTEM

- A. Type H.D. Continuously Hinged / Electric Steel Track: The Continuously Hinged / Electric Steel track running surface shall be made of cold-rolled, high carbon steel tread surfaces to facilitate ease of panel movement and operation. Track system shall not require a panel guide to straighten out the wall system.
- B. The steel tread surface shall be contained within a continuous structural track housing extruded from aluminum, which prohibits deterioration caused by rust or corrosion. The track housing shall have a durable anodized clear satin finish, which resists color fading and flaking. The track housing shall utilize grooves and interlocking steel pins for positive alignment of adjacent track sections, and shall be reinforced overhead by a heavy-duty steel bracket made of hot-rolled, 3/8" [10] thick plate steel. Aluminum track housing shall include an integral nut slot to accept a hardened steel square nut to facilitate attachment of each steel all-rod and splice brackets to the overhead structural support.

2.6 CARRIER SYSTEM

- A. The operable wall system shall consist of Continuously Hinged panels that are electrically operated, featuring panels hinged together in a continuous panel train.

- B. Type H.D. Continuously Hinged / Electric Steel Wheel Carrier: Each Continuously Hinged / Electric panel shall be top supported by one (1) carrier, utilizing a 5/8" [16] diameter pendant bolt. Each top carrier shall consist of four (4) permanently-lubricated, precision ball bearing polished steel wheels, as required for smooth and quiet operation. Floating bottom carrier shall consist of two (2) offset, permanently-lubricated, precision ground ball bearing steel wheels riding in a structural rectangular steel tube with 3/8" [10] diameter steel guide rails. Carrier shall utilize a constant-force spring allowing it to travel back and forth within the steel tube.

2.7 SUSPENSION SYSTEM

- A. Mounting System: The track shall be suspended by steel Drop Rods, consisting of adjustable rods of grade 2, 3/8" [10] diameter threaded steel all-rod provided with 3/8" [10] serrated steel nuts.

3 EXECUTION

3.1 EXAMINATION

- A. Examine flooring, structural support, and opening, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of operable partitions.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Openings prepared by the General Contractor.
- B. Installation shall be by an authorized representative of the manufacturer, complying with the manufacturer's written instructions and the drawings.
- C. Install operable partitions and accessories after other finishing operations, including painting have been completed.
- D. Match operable partitions by installing panels from marked packages in numbered sequence indicated on Shop Drawings.
- E. Broken, cracked, chipped, deformed or unmatched panels are not acceptable.

3.3 ADJUSTING AND CLEANING

- A. The operable wall panels and track system shall be adjusted and cleaned in accordance with manufacturer's written instructions.
- B. Clean partition surfaces upon completing installation of operable partitions to remove dust, dirt, adhesives, and other foreign materials according to manufacturer's written instructions.
- C. Provide final protection and maintain conditions in a manner acceptable to the manufacturer and Installer that insure operable partitions are without damage or deterioration at time of Substantial Completion.

3.4 PROTECTION

- A. The operable wall panels shall be stored in the stacked (retracted) position prior to acceptance by the owner's representative.

3.5 DEMONSTRATION

- A. The operable wall manufacturer's authorized distributor shall demonstrate proper operation and explain proper and necessary maintenance requirements of the operable wall system to the owner's representative.
- B. Provide Operation and Maintenance Manual to Owner's representative.

END OF SECTION 10 22 39

SECTION 10 23 26

PROTECTIVE WALL COVERING

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, 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 SUMMARY

- A. Section includes protective wall covering.
- B. Related Requirements
 - 1. Section 09 21 16, Gypsum Board Assemblies
 - 2. Section 09 65 13, Resilient Base and Accessories
 - 3. Section 09 91 00, Painting

1.3 REFERENCES

- A. Use current editions unless noted otherwise.
- B. ASTM International (ASTM)
 - 1. ASTM D1308, Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes
 - 2. ASTM D4060, Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser
 - 3. ASTM D5420, Standard Test Method for Impact Resistance of Flat, Rigid Plastic Specimen by Means of a Striker Impacted by a Falling Weight (Gardner Impact)
 - 4. ASTM E1428, Standard Test Method for Evaluating the Performance of Antimicrobials in or on Polymeric Solids Against Staining by Streptovorticillium Reticulum
 - 5. ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials
 - 6. ASTM F793, Standard Classification of Wall Coverings by Use Characteristics
 - 7. ASTM G21, Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi
 - 8. ASTM G22, Standard Practice for Determining Resistance of Plastics to Bacteria
- C. California Specification 01350, Standard Method for The Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers
- D. California Department of Public Health CDPH/EHLB/Standard Method Version 1.2
- E. NSF International (NSF) / American National Standards Institute (ANSI)
 - 1. NSF/ANSI 342, Sustainability Assessment for Wallcovering Brochure
- F. Texas Health and Safety Code, Chapter 161, Subchapter Q, Installation of Asbestos
- G. Texas Occupations Code, Chapter 1954, Asbestos Health Protection

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00, Project Management and Coordination.

1.5 ACTION SUBMITTALS

- A. Submit product data for each type of product.
- B. Samples for Initial Selection: Submit manufacturer's samples of each pattern and color of wall coverings specified. Samples shall be not less than 3 inches x 4½ inches.
- C. Warranty documentation: Submit manufacturer's standard warranty.

1.6 INFORMATIONAL SUBMITTALS

- A. Submit Material Safety and Data Sheet (MSDS) for all materials, products, and parts.

1.7 CLOSEOUT SUBMITTALS

- A. Cleaning instructions: Submit manufacturer's instructions for Maintenance and Surface Cleaning.

1.8 QUALITY ASSURANCE

- A. Manufacturer shall have been regularly engaged in manufacture of commercial wallcoverings for the past 5 years.
- B. Installer shall have been regularly engaged in installation of commercial wallcoverings for the past 3 years, and shall employ persons trained for installation of commercial wallcoverings.

1.9 DELIVERY, STORAGE AND HANDLING

- A. Delivery and acceptance requirements: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
- B. Storage and Handling Requirements
 - 1. Store and handle materials in accordance with manufacturer's instructions.
 - 2. Keep materials in manufacturer's original, closed box packaging until installation.
 - 3. Store materials in clean, dry area indoors, out of direct sunlight.
 - 4. Keep materials clean and dry.
 - 5. Store materials at normal occupied building temperature and humidity for a minimum of 3 days before installation.

1.10 FIELD CONDITIONS

- A. Rooms to receive material shall be weather tight with HVAC settings, including pressure, temperature, and relative humidity (65° F to 80° F, 35% to 55% humidity), the same as those of occupied building for three days prior to installation, throughout installation, and for three days after installation.

1.11 WARRANTY

- A. Provide written warranty against defects in material and workmanship for the work of this Section for a period of one year from the Date of Substantial Completion.
- B. Refer to Section 01 77 00, Closeout Procedures, for Warranty form.
- C. Provide manufacturer's warranty against defects in material for the work of this Section for a period of five years from the Date of Substantial Completion

2 PRODUCTS

2.1 MANUFACTURERS

- A. J. Josephson, Inc.

2.2 WALL PROTECTION

- A. P3TEC Advanced Wall Protection
 - 1. Finished width: Trims to 48 inches.
 - 2. Low VOC emitting
 - a. Meets California 01350 Specification for low VOC emissions.
 - b. California Department of Public Health CDPH/EHLB/Standard Method Version 1.2
 - 3. Packaging: 15-yard rolls, shipped in box.
- B. Physical Properties
 - 1. Material Thickness: .032 inch to .038 inch (varies by emboss and finish)
 - 2. PVF protective cap film
 - 3. Backing Type: Heavy Polyester/Cotton knit.
- C. Surface Properties

1. Impact Resistance, ASTM D5420, Gardner Drop Dart: 24 to 100+ inch-lbs
2. Abrasion Resistance, ASTM D4060, Taber CS-10f wheel (500 gram load): 200 cycles, 0.02% weight loss
3. Chemical Resistance, ASTM D1308 (10 cleaning agents, 10 staining agents): after 7 days, no change
4. Cleaning and Stain Resistance, ASTM F793 (10 cleaning agents, 10 staining agents): after 7 days, no change
5. Streptovorticillium Reticulum Stain Resistance, ASTM E1428: No visible stain
- D. Fire Ratings
 1. Surface burning characteristics, ASTM E 84: Class A
 - a. Flame Spread Index: 10
 - b. Smoke Developed Index: 120
- E. Environment and Health
 1. Meets California 01350 Specification for low VOC emissions
 2. Fungal Resistance, ASTM G-21: No growth
 3. Bacterial Resistance, ASTM G-22: No growth
 4. EPD: 3rd Party Certified
 5. HPD: 3rd Party Certified
 6. NSF/ANSI 342 Certified to Wallcovering Association Sustainability Standard
 7. State of California, Proposition 65: No labeling required
- F. Design: Select from P3TEC full pattern and color options

2.3 ACCESSORIES

- A. Corner guard: Apply to outside corners
 1. CG161
 - a. Size: 3/4 inch wing x length as shown in drawings.
 - b. Color: From Manufacturers full range of colors.
- B. Top Cap: Apply as chair rail at top of wall protection.
 1. TC161
 - a. Size: As shown in drawings.
 - b. Color: From Manufacturers full range of colors.

3 EXECUTION

3.1 EXAMINATION

- A. Examine surfaces to receive material.
- B. Notify architect of conditions that would adversely affect installation or subsequent use.
- C. Do not begin surface preparation or installation until unacceptable conditions are corrected.
- D. Review surface preparation, testing for and eliminating sources of moisture accumulation into walls, installation, cleaning, protection, and coordination with other work.

3.2 SURFACE PREPARATION

- A. Prepare surfaces in accordance with manufacturer's instructions.
- B. Ensure walls are structurally sound, smooth, clean, and dry.
- C. Remove mold, mildew, dirt, oil, grease, stains, and marks.
- D. Repair wall irregularities.
- E. Test for and eliminate sources of moisture accumulation into wall or wall cavity.
- F. Apply primer to wall surfaces to receive wall protection, prior to installation, in accordance with manufacturer's instructions.
- G. Do not apply primer over oil-based paint/primer.

3.3 INSTALLATION

- A. Install wall protection in accordance with manufacturer's instructions.
- B. Install a minimum of 3 strips of material for test.

1. Inspect material and evaluate appearance for color uniformity and pattern match.
2. Notify Architect and manufacturer if appearance is unacceptable.
3. Do not begin main installation until unacceptable appearance is corrected.
- C. Install material under adequate lighting conditions.
- D. Install cuts of wall protection in roll sequence order.
- E. Install wall protection strips plumb.
- F. Apply adhesive to back of material in accordance with manufacturer's instructions.
- G. Ensure materials have made good contact to wall, with no bubbles.
- H. Seams
 1. Install wall protection seams vertical, with tight fit, using overlap/double-cut technique.
 2. Install wall protection seams free from air and paste bubbles.
 3. Do not locate seams closer than 6 inches to corners.
 4. Obtain commercial color match associated with patterns across seams.
 5. Do not wrap outside corners.
- I. Remove paste residue from wall protection, ceilings, and baseboards.
- J. Do not install wall protection over existing wallcoverings or other installed materials.

3.4 CLEANING

- A. Clean wall protection after installation, if necessary, in accordance with manufacturer's instructions.
- B. Do not use harsh abrasive cleaning materials, steel wool abrasive cleaners, metal bristled brushes, or methods that could damage material. SOLVENTS and STRONG DISINFECTANTS CAN BE USED in accordance with manufacturer's instructions.

3.5 PROTECTION

- A. A. Protect BOTH installed and UNINSTALLED wall protection from damage during construction.

END OF SECTION 10 23 26

SECTION 10 28 13

TOILET ACCESSORIES

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, 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 SUMMARY

- A. Section includes washroom accessories, shower room accessories and custodial accessories.
- B. Related Sections
 - 1. Section 04 20 00, Unit Masonry
 - 2. Section 06 10 53, Miscellaneous Rough Carpentry
 - 3. Section 09 22 16, Non-Structural Metal Framing
 - 4. Section 09 29 00, Gypsum Board
 - 5. Section 09 30 00, Tiling
 - 6. Section 09 91 00, Painting
 - 7. Section 10 21 13.19, Plastic Toilet Compartments

1.3 REFERENCES

- A. 2010 ADA Standards for Accessible Design (SAD)
- B. 2012 Texas Accessibility Standards (TAS)
- C. Texas Health and Safety Code, Chapter 161, Subchapter Q, Installation of Asbestos
- D. Texas Occupations Code, Chapter 1954, Asbestos Health Protection

1.4 ACTION SUBMITTALS

- A. Submit product data and installation instructions for each type of product indicated.

1.5 INFORMATIONAL SUBMITTALS

- A. Submit Material Safety and Data Sheet (MSDS) for all materials, products, and parts.

1.6 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00, Project Management and Coordination.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver all materials to the jobsite in manufacturer's original packaging and store protected from damage and exposure to the elements. Remove damaged materials from the project.

1.8 WARRANTY

- A. Provide written warranty against defects in material and workmanship for the work of this Section for a period of one year from the Date of Substantial Completion of the Project.
- B. Refer to Section 01 77 00, Closeout Procedures, for Warranty form.

2 PRODUCTS

2.1 MANUFACTURERS

- A. Toilet Accessories:
 - 1. AJW
 - 2. American Specialties Co., Inc.
 - 3. Bobrick Washroom Equipment, Inc.
 - 4. Bradley Washroom Accessories Div., Bradley Corporation
 - 5. General Accessory Manufacturing Co. (GAMCO)
 - 6. McKinney Company
- B. Baby Changing Stations:
 - 1. Koala Kare Products, a Division of Bobrick.

2.2 MATERIAL

- A. Toilet Accessories
 - 1. Basis-of-Design Product: Provide products indicated on the Toilet Accessory Schedule in the Drawings or comparable product by one of the above listed manufacturers.
 - 2. Grab Bars: The structural strength of grab bars, shower seats, fasteners and mounting devices shall meet the requirements of the 2010 ADA Standards for Accessible Design (SAD) and 2012 Texas Accessibility Standards (TAS).
- B. Baby Changing Stations:
 - 1. Basis-of-Design Product: Koala Kare Products, a Division of Bobrick.
 - a. Model KB300
 - b. Color: As selected by Architect from manufacturer's full range of colors.
 - 2. Substitutions: The Architect will consider products of comparable manufacturers as a substitution, pending the contractor's submission of adequate documentation of the substitution in accordance with procedures in Division 1 of the Project Manual.

3 EXECUTION

3.1 INSTALLATION

- A. Install all items in strict accordance with the manufacturer's printed instructions and in accordance with the requirements of the 2010 ADA Standards for Accessible Design (SAD) and 2012 Texas Accessibility Standards (TAS), whether or not detailed as such.
- B. Verify wall blocking has been installed properly.
- C. Install units level, plumb and in proper relationship with adjacent construction.
- D. Install anchors where necessary as the work progresses or install by use of screws and expansion shields or toggle bolts. Screw heads, if exposed, shall be vandal proof head bright stainless steel, without sharp edges.

3.2 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 10 28 13

SECTION 10 44 00

FIRE PROTECTION SPECIALTIES

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, 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 SUMMARY

- A. Section includes fire extinguishers, fire extinguisher and automated external defibrillators (AED) cabinets, and fire extinguisher brackets. Furnish and install one fire extinguisher at each fire extinguisher cabinet, and each fire extinguisher bracket.
- B. Related Sections
 - 1. Section 04 20 00, Unit Masonry
 - 2. Section 09 22 16, Non-Structural Metal Framing
 - 3. Section 09 29 00, Gypsum Board
 - 4. Section 09 91 00, Painting
 - 5. Section 09 30 00, Tiling

1.3 REFERENCES

- A. Use current editions unless indicated otherwise.
- B. ASTM International (ASTM)
 - 1. ASTM E814, Standard Test Method for Fire Tests of Penetration Firestop Systems
- C. National Fire Protection Association (NFPA)
 - 1. NFPA 10, Standard for Portable Fire Extinguishers
- D. 2010 ADA Standards for Accessible Design (SAD)
- E. 2012 Texas Accessibility Standards (TAS)
- F. Texas Health and Safety Code, Chapter 161, Subchapter Q, Installation of Asbestos
- G. Texas Occupations Code, Chapter 1954, Asbestos Health Protection

1.4 ACTION SUBMITTALS

- A. Submit product data and installation instructions for each type of product indicated.

1.5 INFORMATIONAL SUBMITTALS

- A. Submit Material Safety and Data Sheet (MSDS) for all materials, products, and parts.

1.6 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00, Project Management and Coordination.

1.7 QUALITY ASSURANCE

- A. Each employee engaged in the installation of fire extinguishers must be licensed by the State Board of Insurance.
- B. All equipment specified herein, and the installation thereof, shall comply with the requirements of the State Board of Insurance.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the site in manufacturer's original unopened containers.

1.9 WARRANTY

- A. Provide written warranty against defects in material and workmanship for the work of this Section for a period of one year from the Date of Substantial Completion.
- B. Refer to Section 01 77 00, Closeout Procedures, for Warranty form.

2 PRODUCTS**2.1 MANUFACTURERS**

- A. Modern Metal Products
- B. J.L. Industries, Inc.
- C. Larsen's Manufacturing Company
- D. Potter-Roemer

2.2 MATERIALS

- A. Fire Extinguisher Cabinets
 - 1. Basis of Design Product: Subject to compliance with requirements, furnish and install Model Cosmopolitan Stainless Steel Number 1037-FX2 by JL Industries or equivalent by one of the listed manufacturers.
 - 2. Comply with the requirements of UBC Standard 43-6 and ASTM E814.
 - 3. Fire -Rating: Fire Rated for 1hr combustible and noncombustible wall systems.
 - 4. Type: Semi-Recessed
 - 5. Tub: Stainless steel; #4 directional satin finish.
 - 6. Trim and Door
 - a. Stainless steel; flush doors with 5/8 inch (15.88 mm) doorstop attached by continuous hinge and equipped with zinc-plated handle.
 - b. Door shall have vertical duo clear acrylic vision panel, pull handle and roller latches, lock, and continuous hinge.
 - c. Provide vertical Red FE Silkscreen lettering reading "FIRE EXTINGUISHER" on the door.
 - d. Finish: Factory-applied ground and polished finish.
 - 1) Standard Finish: #4 directional satin finish.
 - 7. Trim Style and Depth:
 - a. Semi-Recessed Cabinet:
 - 1) Rolled Edge: 3 inch.
- B. Fire Extinguisher Brackets: Model Number B-2 as manufactured by Larsen's Manufacturing Company or equivalent by one of the listed manufacturers.
- C. Fire Extinguishers:
 - 1. Model Number MP-10 (multi-purpose dry chemical type) as manufactured by Larsen or equivalent by a listed manufacturer.
 - 2. Model Number WC 2 ½ (Wet Chemical Fire Extinguisher) as manufactured by Larsen or equivalent by a listed manufacturer at Kitchen.
- D. Automated External Defibrillators (AED) Cabinets
 - 1. Basis of Design Product: Subject to compliance with requirements, furnish and install Model Number SR-L by J.L. SafetyMed or equivalent by one of the listed manufacturers.
 - 2. Type: Semi-Recessed with textured white powder-coated 0.8mm cold rolled steel fabrication
 - 3. Door: Magnetic door with recessed hinges. Clear acrylic vision panel and standard AED graphics
 - 4. Alarm: Battery operated audible (85 db) alarm with on/off key switch on exterior of cabinet. Provide set of two keys.
 - 5. Accessories: AED 2-sided wall sign for emergency awareness. One at each location shown on plan.
 - 6. Locations: As shown on plan.

3 EXECUTION**3.1 INSTALLATION**

- A. Install items included in this section in locations and at mounting heights shown on the drawings.
 - 1. Prepare recesses in walls for fire extinguisher cabinets as required by type and size of cabinet and style of trim and to comply with manufacturer's instructions.
 - 2. Securely fasten mounting brackets and fire extinguisher cabinets to structure, square and plumb, to comply with manufacturer's instructions.
- B. Installation shall comply with requirements of governing code and State Board of Insurance.

3.2 INSPECTION

- A. Verify servicing, charging, and tagging of all fire extinguishers.

END OF SECTION 10 44 00

SECTION 10 71 13

EXTERIOR SUN CONTROL DEVICES

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, 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 SUMMARY

- A. Section includes design, fabrication, and installation of vertical type and outrigger type welded extruded aluminum sun control assemblies.
- B. Related Requirements
 - 1. Section 05 12 00, Structural Steel Framing
 - 2. Section 05 50 00, Metal Fabrications
 - 3. Section 07 62 00, Sheet Metal Flashing and Trim
 - 4. Section 07 92 00, Joint Sealants

1.3 REFERENCES

- A. Use current editions unless indicated otherwise.
- B. American Architectural Manufacturers Association (AAMA)
 - 1. AAMA 609 & 610, Cleaning and Maintenance Guide for Architecturally Finished Aluminum
 - 2. AAMA 611, Voluntary Specification for Anodized Architectural Aluminum
- C. American Welding Society (AWS)
 - 1. AWS D1.2, Structural Welding Code – Aluminum
 - 2. AWS D1.3, Structural Welding Code – Sheet Steel
- D. ASTM International (ASTM)
 - 1. ASTM B26 / B26M, Standard Specification for Aluminum-Alloy Sand Castings
 - 2. ASTM B209, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
 - 3. ASTM B221, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
 - 4. ASTM D1187 / D1187M, Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal
- E. The Society for Protective Coatings (SSPC)
 - 1. SSPC Paint 12, Cold-Applied Asphalt Mastic (Extra Thick Film)
- F. Texas Health and Safety Code, Chapter 161, Subchapter Q, Installation of Asbestos
- G. Texas Occupations Code, Chapter 1954, Asbestos Health Protection

1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design sun control devices and their attachments suitable for connection to structural steel columns. Include comprehensive engineering analysis by a qualified professional engineer registered in the State of Texas, using performance requirements and design criteria indicated herein and those included in applicable codes and ordinances.

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00, Project Management and Coordination.

1.6 ACTION SUBMITTALS

- A. Submit manufacturer's product data, specifications and installation instructions for building components and accessories.

- B. Delegated-Design Submittal
 - 1. Submit shop drawings indicating plan dimensions, elevations, and details. Include details showing profiles, sizes and spacing of trellis tubes, frames and supports. Include unit dimensions related to supporting and adjoining structure. Include anchorage details and locations.
 - 2. Submit design calculations bearing the seal of a Registered Professional Engineer, licensed in the state where the project is located. Include a comprehensive analysis of design loads, including dead loads, live loads, snow loads, snow drift loads, wind loads, collateral loads, and thermal movement.

1.7 INFORMATIONAL SUBMITTALS

- A. Submit Material Safety and Data Sheet (MSDS) for all materials, products, and parts.

1.8 QUALITY ASSURANCE

- A. Sun control devices shall be produced and installed by a listed manufacturer with at least five years experience in the design, fabrication, and installation of extruded aluminum sun control assemblies.
- B. Components shall be assembled in shop to greatest extent possible to minimize field assembly.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the Project site in manufacturer's original packaging, labeled with manufacturer's name, material or product brand name, and lot number, if any.
- B. Store materials in their original, undamaged packages and containers, inside a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1.10 WARRANTY

- A. Provide written warranty against defects in material and workmanship for the work of this Section for a period of one year from the Date of Substantial Completion.
- B. Refer to Section 01 77 00, Closeout Procedures, for Warranty form.

2 PRODUCTS

2.1 MANUFACTURERS

- A. The Airolite Company, LLC
- B. Aluminum Techniques, Inc.
- C. Arcadia, Inc.
- D. Architectural Grilles & Sunshades, Inc.
- E. ASCA, Inc.
- F. AVAdek Walkway Cover Systems & Canopies
- G. Canopy Solutions, LLC
- H. Columbia Commercial Building Products
- I. Construction Specialties, Inc.
- J. Dittmer Architectural Aluminum
- K. Doralco Architectural Metals
- L. East Texas Canopy, Inc.
- M. H&H Enterprises, Inc.
- N. McGill Architectural Products
- O. Peachtree Protective Covers, Inc.
- P. Perfection Architectural Systems, Inc.
- Q. Sharchs Corporation

2.2 MATERIALS

- A. Aluminum Extrusions: ASTM B221, 6063 alloy, T5 or T52 temper

- B. Aluminum Sheet: ASTM B209, 3003 or 5005 alloy, temper as required for forming or as recommended by metal producer for specified finish
- C. Aluminum Castings: ASTM B26, alloy 319
- D. Fasteners: Same basic metal and alloy as fastened metal or 300 series stainless steel, unless otherwise indicated. Do not use metals that are incompatible with joined materials.
- E. Anchors and Inserts: Type, size, and material required for loading and installation indicated. Use ferrous metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere, as needed, for corrosion resistance.

2.3 FABRICATION

- A. Assemble sun control devices in shop to minimize field splicing and assembly.
- B. Assemble sun control devices using mechanical fasteners or welding only. Comply with AWS D1.2 and D1.3.
- C. Maintain equal tube spacing centers, including separation between tubes and frames, to produce uniform appearance.
- D. Provide supports, anchorages, and accessories required for complete assembly.
- E. Join frame members to one another and to fixed sun control blades with mechanical fasteners, concealed when possible. Bolt connections between frame members only as necessary.
- F. Thermal Movements
 - 1. Fabricate assemblies to allow for thermal movements resulting from maximum temperature changes (range) of 120° F ambient and 180° F material surface to prevent buckling, opening of joints, overstressing of components, and other detrimental effects.
 - 2. Allow for not less than $\pm 1/8$ inch thermal expansion room at each shade to compensate for dissimilar movement between building structure and aluminum sunshade structure.
- G. Trellis Tubular Sun Screen System
 - 1. Components
 - a. Tube Configuration: 2 inch x 6 inch tube
 - 1) Factory Finish: Class II, **Clear** Anodic Finish, AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.4 mils to 0.7 mils thick), complying with AAMA 611
 - b. Mounting Arms and Brackets
 - 1) Factory Finish: Class II, **Clear** Anodic Finish, AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.4 mils to 0.7 mils thick), complying with AAMA 611
 - 2. Size
 - a. Height: As indicated on the drawings

3 EXECUTION

3.1 EXAMINATION

- A. Verify that all concrete, masonry, and roofing work in the vicinity is complete and cleaned prior to erection of sun control devices.

3.2 ERECTION

- A. Install sun control devices level, plumb, and in indicated alignment with adjacent work.
- B. Conceal anchorages where possible. Provide stainless steel/neoprene washers fitted to screws where required to protect metal surfaces and to make connections weathertight.
- C. Form closely fitted joints with exposed connections accurately located and secured.
- D. Repair damaged finishes so that no evidence remains of corrective work. Return items that cannot be refinished in the field to the shop. Make required alterations and refinish entire unit or replace unit.

- E. Protect galvanized and nonferrous metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint to surfaces that will be in contact with concrete, masonry, or dissimilar materials.

3.3 CLEANING

- A. Clean all sun control devices components promptly after installation.
- B. Clean sun control devices surfaces to prevent buildup of dust and debris. Clean sunshades as outlined in AAMA 609 & 610.
- C. Clean and touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

3.4 PROTECTION

- A. Protect materials during and after installation to prevent damage. Use temporary protective coverings approved by the sun control manufacturer where needed.
- B. Ensure no equipment or personnel stands on top of sun control devices and that sun control devices are not used to hang any type of tarp or similar barricade or signage.

END OF SECTION 10 71 13

SECTION 10 73 26

PROTECTIVE COVERS AND CANOPIES

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, 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 SUMMARY

- A. Section includes design, fabrication and installation of complete welded, overhead covered aluminum protective cover system.
- B. Related Requirements
 - 1. Section 03 30 00, Cast-In-Place Concrete
 - 2. Section 04 20 00, Unit Masonry
 - 3. Section 05 50 00, Metal Fabrications
 - 4. Section 07 62 00, Sheet Metal Flashing and Trim
 - 5. Section 07 92 00, Joint Sealants
 - 6. Section 26 51 13, Lighting Fixtures

1.3 REFERENCES

- A. Use current editions unless indicated otherwise.
- B. The Aluminum Association
 - 1. Aluminum Design Manual 2010
- C. American Welding Society- AWS D1.2/D1.2M: 2008
- D. American Architectural Manufacturers Association (AAMA)
 - 1. AAMA 607.1, Voluntary Guide Specifications and Inspection Methods for Clear Anodic Finishes for Architectural Aluminum
- E. ASTM B 209 Aluminum & Aluminum Alloy Sheet and Plate
- F. ASTM B 221 Aluminum & Aluminum Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
- G. American Society of Civil Engineers (ASCE) / Structural Engineering Institute (SEI)
 - 1. ASCE/SEI 7, Minimum Design Loads for Buildings and Other Structures
- H. Texas Health and Safety Code, Chapter 161, Subchapter Q, Installation of Asbestos
- I. Texas Occupations Code, Chapter 1954, Asbestos Health Protection

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00, Project Management and Coordination.

1.5 ACTION SUBMITTALS

- A. Submit manufacturer's product data, specifications and installation instructions for building components and accessories.
- B. Shop Drawings (Delegated-Design Submittal)
 - 1. Submit shop drawings indicating all necessary plan dimensions, elevations and details.
 - 2. Include engineering calculations to supplement the general design stating that the protective cover system design complies with the wind requirements of ASCE 7, the stability criteria of applicable building code, and all other governing criteria.
 - 3. Engineering calculations and shop drawings shall bear the seal of a professional engineer licensed in the State of Texas.

1.6 INFORMATIONAL SUBMITTALS

- A. Submit Material Safety and Data Sheet (MSDS) for all materials, products, and parts.
- B. Finishes: samples of canopy finishes.

1.7 QUALITY ASSURANCE

- A. Canopy shall be produced and installed by a listed manufacturer with at least five years experience in the design and fabrication of extruded aluminum canopy cover systems.
- B. Canopy shall be designed to comply with state and local building codes.
- C. Components shall be assembled in shop to greatest extent possible to minimize field assembly, and installation of the canopy shall be performed by the manufacturer to assure single source responsibility.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Protect materials from exposure to moisture. Do not deliver until after wet work is complete and dry.
- C. Store materials in a dry, warm, ventilated weathertight location.

1.9 WARRANTY

- A. Provide written warranty against defects in material and workmanship for the work of this Section for a period of one year from the Date of Substantial Completion.
- B. Refer to Section 01 77 00, Closeout Procedures, for Warranty form.

2 PRODUCTS

2.1 MANUFACTURERS

- A. Aluminum Techniques, Inc.
- B. AVAdek Walkway Cover Systems & Canopies
- C. Canopy Solutions, LLC
- D. East Texas Canopy, Inc.
- E. E. L. Burns Company
- F. Dittmer Architectural Aluminum
- G. Mason Corporation
- H. Mapes Canopies, LLC
- I. Peachtree Protective Covers, Inc.
- J. Perfection Architectural Systems, Inc.
- K. Texas Aluminum Industries, Inc.

2.2 MATERIALS

- A. Canopy cover shall be all welded extruded aluminum system complete with internal drainage connected to storm drainage system.
- B. Provide expansion joints as necessary to accommodate temperature changes of 120° F.
- C. Aluminum Members
 - 1. All sections shall be extruded aluminum 6063 alloy, heat treated to T-6 temper.
 - 2. All sections shall be sized by a professional engineer licensed in the State of Texas to comply with live load and wind load requirements of the project, but shall not be less than the dimensions indicated on the drawings.
 - 3. Beams
 - a. Open-top tubular extrusions with top edges thickened for strength and designed to receive deck members in self-flashing manner.
 - b. Install structural ties in tops of all beams.
 - c. Finish: Clear Anodized, AA-M-10C-22A-31, Architectural Class II, complying with AAMA 607.1

4. Deck
 - a. Extruded aluminum, self-mating deck with welded endplate water dams where sections terminate at other than drainage channels
 - b. Finish: clear anodized finish, complying with AAMA 2604
5. Fascia
 - a. Manufacturer's standard extruded aluminum fascia sections as shown on drawings and as required to complete the installation resulting in a neat finished appearance.
 - b. Finish: Fluoropolymer Coating: Two coat application, 70 percent PVDF resin based fluoropolymer, AA-C-12C-42R-1, complying with AAMA 605, color as selected by architect from manufacturer's standard selections
- D. Overhead Support System: Manufacturer's standard system with pipe supports, wall plates and brackets, and all associated fittings.
 1. Provide matching steel plate and steel tube stub out to attach to structure. Steel to be primed to match structure. Coordinate with General Contractor and Steel Erector.
- E. Flashing: Aluminum sheet, thickness as recommended by manufacturer for specific condition, but not less than .040 inch
- F. Fasteners: Fasteners shall be aluminum, 18-8 stainless steel or, 300 series stainless steel.
- G. Grout: Grout shall be 2000 psi compressive strength, 1 part Portland cement and 3 parts masonry sand. Add water to produce pouring consistency.
- H. Finish: Satin etched Clear Anodized.

2.3 FABRICATION

- A. Bent Construction
 1. Beams and columns shall be factory welded with neatly mitered corners into one-piece rigid bents. Field welding is not permitted.
 2. All welds shall be smooth and uniform using an inert gas shielded arc. Suitable edge preparation shall be performed to assure 100% penetration.
 3. Grind welds only where interfering with adjoining structure to allow for flush connection.
 4. Rigid mechanical joints shall be used only when shipping limitations prohibit the shipment of fully welded bents.
- B. Deck Construction
 1. Deck shall be manufactured of extruded modules that interlock in a self-flashing manner.
 2. Interlocking joints shall be positively fastened at 8 inch centers creating a monolithic structural unit capable of developing the full strength of the sections.
 3. Fastenings must have minimum shear strength of 350 pounds each.
 4. Deck shall be assembled with sufficient camber to offset dead load deflection.

3 EXECUTION

3.1 EXAMINATION

- A. Erection shall be performed after all concrete, masonry, and roofing work in the vicinity is complete and cleaned.
- B. Examine building surfaces to which canopy will connect.
- C. Coordinate with responsible trade to perform corrective work on unsatisfactory surfaces.

3.2 ERECTION

- A. Erect protective covers in accordance with manufacturer's installation instructions.
- B. Erect all components true to line, level and plumb.

3.3 CLEANING

- A. Clean surfaces soiled by work promptly after installation as recommended by manufacturer.
- B. Remove surplus materials and debris from the site.

3.4 PROTECTION

- A. Protect finished aluminum surfaces from damage due to subsequent construction operations.

END OF SECTION 10 73 26

SECTION 10 75 00

FLAGPOLES

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, 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 SUMMARY

- A. Section includes aluminum flagpoles including fittings and accessories.
- B. Related Sections
 - 1. Section 03 30 00, Cast-In-Place Concrete

1.3 REFERENCES

- A. Use current editions unless indicated otherwise.
- B. ASTM International (ASTM)
 - 1. ASTM B241 / B241M, Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube
 - 2. ASTM C150 / C150M, Standard Specification for Portland Cement
- C. Texas Health and Safety Code, Chapter 161, Subchapter Q, Installation of Asbestos
- D. Texas Occupations Code, Chapter 1954, Asbestos Health Protection

1.4 ACTION SUBMITTALS

- A. Submit product data and installation instructions for each type of product indicated.
- B. Submit shop drawings of flagpoles and bases, indicating layout, jointing, and complete anchoring and supporting systems.

1.5 INFORMATIONAL SUBMITTALS

- A. Submit Material Safety and Data Sheet (MSDS) for all materials, products, and parts.

1.6 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00, Project Management and Coordination.

1.7 QUALITY ASSURANCE

- A. Provide each flagpole as a complete unit produced by a single manufacturer, including fittings, accessories, bases and anchorage devices.
- B. Construct pole and ship to site in one piece if possible. If more than one piece is necessary, provide snug-fitting precision joints with self-aligning, internal splicing sleeve arrangement for weather-tight, hairline field joints.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Spiral wrap flagpole with heavy Kraft paper or other protective wrapping and prepare for shipment in hard fiber tubes or other protective container.
- B. Deliver flagpole and accessories completely identified for installation procedure. Handle carefully to avoid soiling or damage. Store flagpoles unwrapped to avoid staining from wrappings.

1.9 WARRANTY

- A. Provide written warranty against defects in material and workmanship for the work of this Section for a period of one year from the Date of Substantial Completion.
- B. Refer to Section 01 77 00, Closeout Procedures, for Warranty form.

2 PRODUCTS

2.1 MANUFACTURERS

- A. American Flagpole, Inc.
- B. Concord Industries, Inc.
- C. EMC, a Division of Eder Mfg. Corp.
- D. Eder Flag Manufacturing, Inc.
- E. Morgan-Francis Company, AABEC Pole Division
- F. Pole-Tech Co., Inc.

2.2 MATERIALS

- A. Tapered aluminum flagpoles fabricated from seamless extruded tubing, complying with ASTM B241, alloy 6063-T6, tensile strength of not less than 35,000 psi and a yield point of 30,000 psi. Heat-treat and age-harden flagpoles after fabrication. Flagpoles shall have a uniform conical taper of 1 inch in every 5'-6" throughout the tapered portion. The tapered portion shall be 20'-6" long.
- B. Description
 - 1. Exposed height: 35'-0"
 - 2. Overall height: 38'-6"
 - 3. Butt diameter: 6 inches
 - 4. Top diameter: 3¼ inches
 - 5. Wall thickness: 0.188 inch
- C. Mounting
 - 1. Ground Mounted Removable Base (Embedded): Provide a foundation tube fabricated from 16 gauge galvanized corrugated steel with a base plate with a square dimension at least the inside diameter of the sleeve plus 4 inches. Securely weld a 6 inch square setting plate to the ground spike at least 6 inches below the base plate. The ground spike shall be ¾ inch diameter and not less than 24 inches long welded to center of support plate.
 - 2. Provide spun aluminum collar, finished to match flagpole shaft.
 - 3. Caulking, concrete, shims, sand, and other miscellaneous items as required by manufacturer for a complete installation for removable pole.
 - 4. Concrete: 3,000 psi comprehensive strength in 28 days. Comply with requirements of Section 03 00 00.
- D. Fittings:
 - 1. Pole Finish & Color:
 - a. Very fine, non-directional, satin brushed, mechanical polished
 - b. Clear anodized (AA M32-C22-A41); The unexposed portion of the flagpole and all parts below ground including the foundation tube assembly to receive shop coat of black asphaltum paint.
 - 2. Finial ball:
 - a. Manufacturer's standard, sized as standard with manufacturer for flagpole size indicated.
 - b. Cast aluminum, finished with gold anodic finish.
 - 3. Cleat:
 - a. One 9" cast aluminum cleat with stainless steel fastenings.
 - b. Tamperproof stainless-steel socket head bolts.
 - 4. Halyard:
 - a. Complete External Halyard Assembly.
 - 1) Provide one continuous polypropylene, white, braided, 3/8" (No. 12).
 - 5. Halyard Flag Snaps:

- a. Provide 4 (To accommodate two flags) stainless steel swivel snaps per halyard.

3 EXECUTION

3.1 INSTALLATION

- A. Excavate for foundation concrete to neat clean lines in undisturbed soil. Depth and diameter of excavation shall be as recommended by the manufacturer for the flagpole length and mounting type specified.
- B. Provide forms where required due to unstable soil conditions.
- C. Remove wood, loose soil, rubbish and other foreign matter from excavation, and moisten earth before placing concrete.
- D. Concrete
 - 1. Provide concrete composed of Portland cement, coarse aggregate, fine aggregate and water, mixed in proportions to attain 28 day compressive strength of not less than 3000 psi.
 - 2. Use not less than 5 sacks of Portland cement, complying with ASTM C150, per cubic yard of wet concrete. Perform chuting to avoid segregation of mix.
 - 3. Compact concrete in place by use of vibrators to consolidate.
 - 4. Moisten-cure exposed concrete for not less than 7 days.
 - 5. Finish trowel exposed concrete surfaces to smooth, dense surface. Provide positive slope for water runoff to base perimeter.
- E. Install flagpole as indicated and in compliance with final shop drawings and manufacturer's instructions.
- F. Provide positive lightning ground for each flagpole.
- G. Paint portions of ground-set flagpole below grade with a heavy coat of bituminous paint.

END OF SECTION 10 75 00

SECTION 10 80 00

OTHER SPECIALTIES

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, 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 SUMMARY

- A. Section includes sound retardant swinging door assemblies, including steel frames; plastic laminate faced doors with factory cut openings, glazing, and glazing stops; factory machining for mortised hardware items; and certain items of door hardware.
- B. Related Sections
 - 1. Section 09 22 16, Non-Structural Metal Framing
 - 2. Section 09 29 00, Gypsum Board
 - 3. Section 09 51 00, Acoustical Ceilings
 - 4. Section 11 31 00 Residential Appliances

1.3 REFERENCES

- A. 2010 ADA Standards for Accessible Design (SAD)
- B. 2012 Texas Accessibility Standards (TAS)
- C. Texas Health and Safety Code, Chapter 161, Subchapter Q, Installation of Asbestos
- D. Texas Occupations Code, Chapter 1954, Asbestos Health Protection

1.4 ACTION SUBMITTALS

- A. Submit product data and installation instructions for each type of product indicated.

1.5 INFORMATIONAL SUBMITTALS

- A. Submit Material Safety and Data Sheet (MSDS) for all materials, products, and parts.

1.6 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00, Project Management and Coordination.

1.7 WARRANTY

- A. Provide written warranty against defects in material and workmanship for the work of this Section for a period of one year from the Date of Substantial Completion of the Project.
- B. Refer to Section 01 77 00, Closeout Procedures, for Warranty form.

2 PRODUCTS

2.1 MATERIALS

- A. Knox Box
 - 1. Size, type, quantities, per AHJ, locations to be determined by Montgomery County Fire Marshalls Office and shown in drawings.
- B. Storage Cabinet
 - 1. Field Storage Cabinet for O&M's and As-built Drawings
 - a. Basis of Design:

- 1) Uline H-1106GR
- 2) Size: 36" x 18" x 42"
- b. Thickness:
 - 1) Bottom & Shelves: 20 gauge
 - 2) Top, Header & Sill: 22 gauge
 - 3) Doors, Sides, & Back: 24 gauge
- c. Shelves:
 - 1) 2 adjustable shelves.
 - 2) Adjust in 2" increments.
- d. Finish: Powder Coated Gray.
- e. Not fireproof.
- f. Provide 3 point locking system with 2 keys.
- g. Assemble and place in BOILER/PUMP D126

2.2 INSTALLATION

- A. Install all items in accordance with the project drawings and specifications, the approved shop drawings, and the manufacturer's printed instructions.

END OF SECTION 10 80 00

SECTION 11 31 00

RESIDENTIAL APPLIANCES

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, 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 SUMMARY

- A. Section includes residential appliances.
- B. Related Sections
 - 1. Section 12 32 16, Manufactured Plastic-Laminate-Clad Casework

1.3 REFERENCES

- A. 2010 ADA Standards for Accessible Design (SAD)
- B. 2012 Texas Accessibility Standards (TAS)
- C. Texas Health and Safety Code, Chapter 161, Subchapter Q, Installation of Asbestos
- D. Texas Occupations Code, Chapter 1954, Asbestos Health Protection

1.4 ACTION SUBMITTALS

- A. Submit product data and installation instructions for each type of product indicated.

1.5 INFORMATIONAL SUBMITTALS

- A. Submit Material Safety and Data Sheet (MSDS) for all materials, products, and parts.

1.6 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00, Project Management and Coordination.

1.7 DELIVERY AND STORAGE

- A. Do not deliver materials to the jobsite until spaces are ready for installation of appliances.
- B. Store materials in covered, dry, temperature and humidity controlled space.

1.8 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.
- B. Refer to Section 01 77 00, Closeout Procedures, for Warranty form.

2 PRODUCTS

2.1 MANUFACTURERS

- A. Top-Freezer Refrigerators, Dishwasher, Microwaves.
 - 1. Fridgidare
 - 2. General Electric Company
 - 3. Kenmore Sears Contract Sales
 - 4. Whirlpool Corp.
 - 5. Monogram

- B. Under-counter Beverage Coolers.
 - 1. Zephyr
 - 2. Summit Appliance
- C. Ice makers
 - 1. Hoshizaki America, Inc.
- D. Storage Shelving
 - 1. Cambro
- E. Mobile Worktable

2.2 MATERIALS

- A. Top-Freezer Refrigerator, Fros-free (both compartments), with Automatic Ice Maker
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide General Electric Company Model GIE17GSN or comparable product by one of the above listed manufacturers.
 - 2. Top Freezer Type: Freestanding, two-door unit with upfront temperature controls, internal digital temperature display and automatic ice maker.
 - 3. Finish: Stainless Steel
 - 4. Capacity: 16.6 cubic feet (4.04 cubic feet freezer, 12.6 cubic feet refrigerator)
 - 5. Furnish and install one in each Coffee Bar near corridor (B102B, B115B, D101C, D130B, F100A, B211A, D201A, D233E & F200D) Break Room E108, Processing Lab F109 & Break Room B206. Install two at each Break Room E100 & E200 and also where noted in equipment plans and elevations.
- B. Dishwasher, ADA compliant with hidden controls.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide General Electric Company Model GDT225SSLSS or comparable product by one of the above listed manufacturers.
 - 2. Finish: Stainless steel
 - 3. Power Usage: 120V/60/1, 15AMP
 - 4. Wash System Features: Automatic temperature control with HotStart, Sanitize option (NSF Certifies) with Piranha Hard Food Disposer, flood control system and dual pump & standard 3-level.
 - 5. Furnish and install in Break Room E108.
- C. Counter top Microwave
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide General Electric Company Model PES7227SLSS or comparable product by one of the above listed manufacturers.
 - 2. Finish: Stainless steel
 - 3. Capacity: 2.20 cubic feet – 1100 watts.
 - 4. Power Usage: 120V/60
 - 5. Furnish and install one in each Coffee Bar near corridor (B102B, B115B, D101C, D130B, F100A, B211A, D201A, D233E & F200D) Break Room E108 & Processing Lab F109. Install two at each Break Room E100, B206 & E200 and also where noted in equipment plans and elevations.
- D. Under Counter Ice Maker
 - 1. Hoshizaki AM-50BAJ-AD (No Substitutions)
 - a. Ice Shape/Production: Top hat/55 lbs produced per 24 hrs.
 - b. Power usage: Single Phase 115V/60/1, 6FT. cord with NEMA 5-156 plug. 3.8 AMP
 - c. Water Pressure: 7 – 113 PSIG
 - d. Accessories: HS-5061 Drain pump assembly & Additional water filter H9320-51 for each Under-counter ice maker.
 - 2. Furnish and Install in one in each Coffee Bar near corridor (B102B, B115B, D101C, D130B, F100A, B211A, D201A, D233E & F200D) Break Room B206, Break Room E100 & E200 and also where noted in equipment plans and elevations.
- E. Ice Maker
 - 1. Hoshizaki F-450MAJ-C on B-500SF Storage Bin (No Substitutions)
 - a. Ice Shape/Production: Small cubelet nugget-style ice/412 lbs.

- b. Power usage: Single Phase 115V/60/1, 3wire. 15AMP
 - c. Potable water usage: 12.0 Gal/100 lbs
 - d. Filter System: Artic Pure AR-10000. Provide two (2) additional cartridges K-00493 for a total of three (3). Mount on wall adjacent to equipment, Insulate drain lines with 1" thick insulation.
- 2. Furnish and Install in Break Room E108
- F. Under-counter Beverage Cooler
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Summit Appliance Model ALBV2466CSS or comparable product by one of the above listed manufacturers.
 - 2. Finish:
 - a. Cabinet: Stainless steel
 - b. Door: Reversible Stainless Steel Seamless Door Frame with Double Pane Tempered Glass.
 - 3. Shelves: Four (4) Adjustable shelves.
 - 4. Lock: Factory Installed lock with Two (2) Keys Each.
 - 5. Capacity: 4.2 cubic feet – 295 watts.
 - 6. Power Usage: 115V/60
 - 7. Furnish and install one at Processing Lab F109, Training Room E208 and also where noted in equipment plans and elevations.
- G. Storage Shelving
 - 1. Cambro Shelving (No substitutions)
 - 2. Furnish and install One (1) CPU243672V5480 Camshelving® Starter Unit 5 Shelves 24X36X72 & Five (5) CPU244872V5480 Camshelving® Starter Unit 5 Shelves 24X48X72 in Storage E109 as shown in floor plan.
- H. Mobile Worktable - Custom Fabrication
 - 1. Turn free sides down two inch square.
 - 2. Open Base construction.
 - 3. Full Length undershelf.
 - 4. Two (2) drawer assemblies.
 - 5. Mount on casters with brakes.
 - 6. Furnish and install Four (4) in Breakroom E108 as shown in floor plan.

2.3 CUSTOM FABRICATED/ ASSEMBLED UNITS

- A. All fixtures within this Section are to be constructed by one manufacturer, of uniform design and finish.
 - 1. Mobile Worktables:
 - a. 14-gauge stainless steel; all free edges turned down 180° on 1 5/8" radius. Free corners: rounded on 3/4" radius.
 - b. Marine edges: turned up 1/2" on 45° angle and turned down 2" with 3/4" tight hem at bottom.
 - c. Tops abutting high fixtures or walls: cove up 6" and slope back 1-1/2" at top on 45° angle; 2-1/2" where piping occurs. Turndown 1" at rear of splash and close ends to bottom of top turndown. Secure splash turndown to wall with 4" long 14 gauge Stainless Steel "zee" clip anchored to wall, 36" o.c.
 - d. Freestanding tables and all serving counter splash risers: turned back on 90° angles with 1" turndown at rear.
 - e. Brace tops with rigid-welded 1-1/2" x 1-1/2" x 1/8" galvanized steel angle frame at perimeter with cross bracing 2'-0" o.c. maximum. Provide 4" x 4" x 12 gauge steel triangular pads where leg socket welds to gusset. Paint entire frame with Rustoleum Primer. Angle frames: secured to underside of top surfaces with 1/4" studs welded 9" o.c. maximum with chrome-plated washer, lock washer, and cap nut. Studs: such length that cap nuts can be made-up tight, bringing top down snugly on an angle frame eliminating all vibrations or "oil-cannings."
 - f. All tops: 1-1/2" overhang at free sides of underframe or Closed Base Body.

- g. All openings in tops shall have raised die formed edges, 3/16" high.
- h. Reinforce all "built-in" counter equipment with framing members at perimeter of opening.
 - 1) Undershelves:
 - a) Open Base Structures: 16-gauge stainless steel turned down 1-1/2" tight hem at bottom. Notch all corners to fit tubular legs and weld from underside to completely fill gap; grind and polish. Cove up 2" at rear and/or ends adjacent to wall, columns, refrigerators, etc. The turnup is to be hemmed tight to bottom of turndown when turnup is specified for freestanding fixtures. Brace undershelf with 1" x 4" x 14 gauge stainless steel channel at longitudinal centerline and each intermediate pair of legs.
 - b) Closed Base Fixtures: 16 gauge stainless steel turned down 1-1/2" at front. Front edge of bottom shelf: turned back and sealed to masonry platform or boxed for leg application. Center shelf has 3/4" tight hem.
 - (1) Shelves: turn up square at ends (coved up at rear only) to the shelf above or counter top flanged out for attachment with no open spaces at interior.
 - (2) All shelf partitions at exposed ends of cabinet bodies or interiors: free of exposed framing members.
 - (3) Reinforce shelves with full-length 1" x 4" x 14 gauge stainless steel closed hat channel.
 - (4) Unless otherwise noted, all undershelves are to be 22" deep, clear.
 - (5) Weld the vertical seam of shelf turndown/turnup with face of body partition.
 - c) Shop/Field Joints:
 - (1) Stainless steel tops: welded, ground and polished to No. 4 finish.

3 EXECUTION

3.1 INSTALLATION

- A. Install according to manufacturer's printed instructions, project drawings, and shop drawings.
- B. Provide all necessary mechanical, electrical and plumbing connections.
- C. Coordinate installation of appliances with casework. Refer to Section 12 32 16, Manufactured Plastic-Laminate-Clad Casework.
- D. Range Hoods: Coordinate installation with work included under Division 23.

3.2 ADJUSTING AND CLEANING

- A. At the completion of the project, leave all appliances in clean and in unmarred condition.
- B. Adjust and level for proper operation.

END OF SECTION 11 31 00

SECTION 12 32 16

MANUFACTURED PLASTIC-LAMINATE-CLAD CASEWORK

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, 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 SUMMARY

- A. Section includes all base cabinets, upper cabinets, tall cabinets, special use cabinets, countertops, backsplashes, fillers and grounds as required, and other related accessories.
- B. Related Sections
 - 1. Section 04 20 00, Unit Masonry
 - 2. Section 06 10 53, Miscellaneous Rough Carpentry
 - 3. Section 09 22 16, Non-Structural Metal Framing
 - 4. Section 09 29 00, Gypsum Board
 - 5. Section 09 65 13, Resilient Base and Accessories
 - 6. Section 09 65 19, Resilient Tile Flooring
 - 7. Section 09 68 00, Carpeting
 - 8. Section 09 91 00, Painting

1.3 REFERENCES

- A. Use current Editions unless indicated otherwise.
- B. American National Standards Institute (ANSI)
 - 1. ANSI A208.1, Particleboard
 - 2. ANSI A208.2, MDF for Interior Applications
- C. Engineered Wood Association (APA, *formerly American Plywood Association*)
 - 1. APA PS 1, Voluntary Product Standard, Structural Plywood
- D. National Electrical Manufacturers Association (NEMA)
 - 1. NEMA LD 3, High-Pressure Decorative Laminates (HPDL)
- E. 2010 ADA Standards for Accessible Design (SAD)
- F. 2012 Texas Accessibility Standards (TAS)
- G. Texas Health and Safety Code, Chapter 161, Subchapter Q, Installation of Asbestos
- H. Texas Occupations Code, Chapter 1954, Asbestos Health Protection

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00, Project Management and Coordination.

1.5 ACTION SUBMITTALS

- A. Submit manufacturer's product data describing fabrication, materials, and hardware.
- B. Submit detailed shop drawings including plan locations, top dimension and related walls. Locate all sink and appliance openings. Provide large scale elevations indicating doors, drawers, shelves, hardware and manufacturer's catalog numbers.
- C. Samples for Initial Selection: Submit complete chain of laminate manufacturer's samples. The Architect will attempt to select colors from the plastic laminate selections preferred by the Subcontractor; however, if the standard colors do not prove entirely satisfactory, the Architect reserves the right to make selections from any of the manufacturers listed herein.

1.6 INFORMATIONAL SUBMITTALS

- A. Submit Material Safety and Data Sheet (MSDS) for all materials, products, and parts.

1.7 QUALITY ASSURANCE

- A. Casework installation company shall have a minimum of three years experience in the installation of similar systems for projects of similar size and scope and shall be authorized by the casework manufacturer for this installation.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver materials to the site until spaces are ready for installation of casework.
- B. Store materials in covered, dry, temperature and humidity controlled space. Humidity level changes shall not exceed 20% and temperature changes shall not exceed more than 15° F in any 24 hour period.
- C. Protect from other trades.

1.9 WARRANTY

- A. Provide written warranty against defects in material and workmanship for the work of this Section for a period of one year from the Date of Substantial Completion. Warranted defects shall include, but not be limited to, delamination of plastic surfacing, warping, deflection of shelves or tops, swelling of core material, loosening of fastenings or hinges, and misalignment of doors or drawers.
- B. Refer to Section 01 77 00, Closeout Procedures, for Warranty form.

2 PRODUCTS**2.1 MANUFACTURERS**

- A. Casework
 - 1. Alpha Omega Casework LLC
 - 2. Ameritek Design Incorporated
 - 3. Casework Services, Inc.
 - 4. Global Casework Manufacturing, Inc.
 - 5. Jericho Woodworks (Basis of Design)
 - 6. Jim R. Reynolds & Associates, Inc.
 - 7. LSI Corporation of America, Inc.
 - 8. Stevens Industries, Inc.
 - 9. Taylor Division of American Desk Mfg. Co.
 - 10. Terrill Manufacturing Co.
 - 11. Timber Casework Manufacturing Company, Inc.
 - 12. TMI, Dickinson
- B. Plastic Laminate
 - 1. Formica
 - 2. Nevamar
 - 3. Wilson-Art
- C. Particle Board
 - 1. Kirby Forest Products
 - 2. Louisiana-Pacific
 - 3. Temple-Inland, Inc.
 - 4. Weyerhaeuser

2.2 MATERIAL

- A. General
 - 1. Casework indicated on the drawings is identified by Stevens Industries, Inc.. catalog model numbers. All casework manufacturers shall provide cabinets of size and features equivalent to the Catalog numbers, with any modifications indicated on the drawings or specified herein.

2. Model numbers may be modified to reflect certain requirements for this project. Where these modifications are different from the standard products furnished, deviation from these modifications will not be allowed.
 3. Particle Board shall have a minimum density of 45 lb. per cubic foot with a moisture content not to exceed 8%. Particle board shall conform to ANSI A208.1, type M-3.
 4. Plywood: Plywood shall be 5 ply veneer core for 1/2 inch material, 7 ply veneer core for 3/4 inch material, and 9 ply for 1 1/8 inch material. Species shall be Douglas Fir. Grade shall be B faces with interior veneers grade C or better. Voids in interior cores exceeding five square inches will be subject to rejection. All plywood shall be manufactured in accordance with APA PS 1, marked for exterior use and shall be adhered with waterproof glue. Where drawings or specifications indicate the use of plywood, particleboard will not be accepted.
- B. Countertops
1. Typical counter tops, unless otherwise noted, shall be 1 1/4 inch thick (47 lb. density) particle board core with General Purpose (HGS) type 107, .050 inch NEMA plastic on working surface and backing sheet on bottom. Provide nominal 1 1/4 inch exterior grade plywood core at sink cabinets.
 2. Back and end splashes shall be nominally 3/4 inches thick consisting of Grade HGS high-pressure decorative laminate on 3/4 inch thick plywood core substrate. Splashes shall be securely screwed to countertops.
 3. Exposed edges of countertops and splashes shall be 3mm PVC edge banded.
 4. Counter tops 96" or less in length to be one piece.
 5. Countertop corners to have radius corners.
 6. Joints shall be held to a minimum and all joints shall be caulked with clear silicone sealant. Sealant shall be installed neat without excess and to the satisfaction of the Architect.
- C. Panels, Backs and Bottoms
1. Typical panel stock shall consist of Grade VGS high-pressure decorative laminate on 3/4 inch thick plywood core substrate. Provide marine grade plywood at cabinets with sinks or other plumbing fixtures.
 2. Interiors behind doors shall be melamine. Concealed bottoms and backs shall be laminated with fabricator's standard backing sheet. Open cabinets, open shelving and bottoms of upper cabinets shall be considered as exposed surface.
 3. Cabinet backs shall be a 3/8 inch thick particleboard. Provide 1 inch x 4 inch continuous hardwood or 3/4 inch x 4 inch plywood anchor cleat at top and bottom of wall hung cabinets. Fasten through cleats to masonry walls or to each stud in drywall.
 4. Sides and bottoms of all sink cabinets shall have exterior grade plywood core.
- D. Drawers
1. Drawers shall have a drawer box of 1/2 inch thick hardwood fronts, backs and sides, tongue and grooved - glued and mechanically fastened together with 13/16 inch thick drawer front screwed to drawer box.
 2. Bottoms shall be 1/4 inch thick hardboard set into routed drawer box. Finish interior with cabinet liner.
 3. Provide 3/4 inch thick core drawer front faced with plastic laminate (total thickness 13/16 inch) and edges with 3mm PVC edge banding. Edge banding colors to match plastic laminate.
 4. Size each drawer to provide 3/16 inch uniform gap between drawers and between drawers and adjacent door.
- E. Base:
1. All cabinet bases shall be constructed of preservative treated solid lumber. No particleboard is permitted within 4 inches of floor level. No through to floor panels or backs will be permitted.
 2. All casework shall be mounted on sub-base completely separate cabinet body.
 3. Sub-base assemblies shall be minimum 1 1/2 inch thick, treated dimensional lumber.
 4. Sub-base shall be ladder type.
- F. Shelves
1. All shelves shall be 1 inch thick core.

2. Shelves behind doors shall have particleboard core, laminated two sides with specified cabinet liner and notched at end to receive shelf standards.
 3. Exposed shelves shall be same construction as above with .050 inch plastic laminate top and bottom surfaces.
 4. All four edges of shelves and face frames of open shelving units, shall have 3mm thick beveled PVC edge banding, color as selected by the Architect.
 5. All shelving shall be adjustable on 1/2 inch centers using KV #255 standards with KV 256 supports or drilled holes 1 1/4 inch o.c. with KV 348 clips (white).
- G. Doors
1. Base and wall cabinet doors shall be 3/4 inch thick particle board surfaces both sides with .030 inch selected plastic laminate. Provide continuous 3mm thick PVC edge banding on all edges. Edge banding colors to match plastic laminate. Provide two hinges at doors less than 42 inches high.
 2. Tall doors shall be 1 inch thick particle board core surfaced both sides with .030 inches selected plastic laminate. Provide continuous 3mm thick beveled PVC edge banding, color as selected by the Architect. Provide three hinges at doors over 42 inches high and four hinges at doors over 72 inches high
 3. Size each door to provide 3/16 inch uniform gap between doors and between each door and adjacent drawer.
- H. Hardware
1. All drawers shall be mounted on KV #8400 full extension slides, three section, rated for 100 lb, load per pair.
 2. Door and drawer pulls shall be 4 inch chrome wire pulls as manufactured by Trimco, Inc. or Semi-flush ABS #144 as manufactured by Outwater Plastics, Inc.
 3. **All locks shall be furnished by casework supplier. Key all locks in a room alike, unless noted otherwise. Key each room different. Cores to be provided to match district standard Best keying system. Coordinate with Div 8 and keying supplier.**
 4. Hinges shall be Rockford Process Control, Inc. (RPC) hospital tips five knuckle 2 3/4 inches with tight pin, dull chrome plated. Hinges shall be wrap-around type allowing for 270 degree door swing.
 5. All doors shall be equipped with magnetic catches with 10 lb. pull. Provide elbow catches at double doors less than 33 inches high. Provide Heavy Duty Elbow Catch, Model Number E1018N from Engineered Products Company (EPCO) or approved equal at the center of the inactive leaf of double doors. Provide 4" dia. chain pulls on doors greater than 32" high. Model Number CP200 from Case Systems or approved equal.
 6. Grommets shall be provided at all knee spaces.
 - a. Basis of Design: Mockett EDP Flip-Top Series, 2 1/2 inch round.
 - b. Color as selected by the Architect from Manufacturers standard 11 colors.
 7. **Keyboard Trays:**
 - a. **Basis of Design: Fellowes #8029801 Professional Series Sit / Stand Keyboard Tray with Mouse Pad.**
 - b. **Provide at locations indicated on the drawings.**
- I. Colors
1. Colors shall be selected by the Architect from laminate manufacturer's full range of standard colors. The Architect will attempt to select colors from the plastic laminate selections preferred by the manufacturer; however, if the standard colors do not prove entirely satisfactory, the Architect reserves the right to make selections from any of the manufacturers listed herein.
 2. Cushioned PVC edge band color(s) to be selected by the Architect.
 3. All interior surfaces behind doors shall be laminated with .020 inch thick high pressure cabinet liner, Wilsonart #1573-CL, "Solid Frosty White" or equivalent.
 4. Interiors of open shelving and open cabinets shall have 1/32 inch high pressure laminated plastic, colors to be selected by the Architect.

2.3 UNITS

- A. Items of casework by room shall be as indicated on the Drawings.

3 EXECUTION**3.1 INSPECTION**

- A. Ensure that walls are finish painted prior to beginning installation of casework.
- B. Ensure that all utility stub-outs are complete and operable prior to beginning installation of casework.

3.2 INSTALLATION

- A. Install casework in strict accordance with manufacturer's recommendations at locations indicated in the drawings. Anchor base cabinets and tall cabinets to floor and walls. Anchor wall-hung cabinets to masonry walls with toggle bolts and to drywall with sheetmetal screws to studs.
- B. Furnish and install matching scribe strips and filler panels where cabinets meet wall. Install color matching or painted to match sealant at juncture after wall is painted.
- C. Casework supplier shall make all cutouts necessary to receive plumbing items.
- D. Coordinate installation of work furnished by the various trades to assure properly functioning equipment at the completion of the job.
- E. Verify lengths of countertops, splashes and bases. All tops 8'-0" in length or less to be one piece construction.
- F. Any glass marker boards or mirrors shown in the drawings are for coordination purposes only and are not part of the Casework Section.
- G. Obtain appliance and equipment submittals from the General Contractor in order to coordinate opening sizes, etc. for equipment.
- H. Provide grommets in countertops as required to provide access to electrical and computer outlets, as shown in electrical drawings.
- I. Install locks at locations indicated on the drawings.

3.3 ADJUSTING AND CLEANING

- A. Adjust all drawers and doors for proper operation and alignment. Doors shall be plumb and in plane.
- B. Ensure that all base cabinets and tall cabinets are shimmed or leveled for proper alignment with one another.
- C. Adjust magnetic catches for proper closure of doors.
- D. Just prior to Owner acceptance of building, clean and polish all casework inside and out using manufacturer's recommended methods and materials.

END OF SECTION 12 32 16

SECTION 12 36 61.16

SOLID SURFACING COUNTERTOPS

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, 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 SUMMARY

- A. Section includes solid surface material for window sills and countertop at reception desk.
- B. Related Sections
 - 1. Section 01 23 00, Alternates
 - 2. Section 04 20 00, Unit Masonry
 - 3. Section 05 40 00, Cold-Formed Metal Framing
 - 4. Section 06 10 53, Miscellaneous Rough Carpentry
 - 5. Section 07 92 00, Joint Sealants
 - 6. Section 09 22 16, Non-Structural Metal Framing
 - 7. Section 09 29 00, Gypsum Board
 - 8. Section 09 91 00, Painting

1.3 REFERENCES

- A. Use current Editions unless indicated otherwise.
- B. Engineered Wood Association (APA, *formerly American Plywood Association*)
 - 1. APA PS 1, Voluntary Product Standard, Structural Plywood
- C. ICPA SS-1-2001, Performance Standard for Solid Surface Materials
- D. 2010 ADA Standards for Accessible Design (SAD)
- E. 2012 Texas Accessibility Standards (TAS)
- F. Texas Health and Safety Code, Chapter 161, Subchapter Q, Installation of Asbestos
- G. Texas Occupations Code, Chapter 1954, Asbestos Health Protection

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00, Project Management and Coordination.

1.5 ACTION SUBMITTALS

- A. Submit manufacturer's product data describing fabrication, materials, and hardware.
- B. Submit detailed shop drawings including plan locations, top dimension and related walls.
- C. Samples for Initial Selection: Submit samples for each type of material exposed to view

1.6 INFORMATIONAL SUBMITTALS

- A. Submit Material Safety and Data Sheet (MSDS) for all materials.
- B. Maintenance Data: For solid surface material countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.7 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate countertops similar to that required for this Project, and whose products have a record of successful in-service performance.
- B. Installer Qualifications: Fabricator of countertops.

- C. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for fabrication and execution.
 - 1. Build mockup of typical countertop as shown on Drawings.
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver materials to the site until spaces are ready for installation of window sills and countertop.
- B. Store materials in covered, dry, temperature and humidity controlled space. Humidity level changes shall not exceed 20% and temperature changes shall not exceed more than 15° F in any 24 hour period.
- C. Protect from other trades.

1.9 FIELD CONDITIONS

- A. Field Measurements: Field verify dimensions of and countertop by field measurements prior to fabrication.
- B. Coordinate locations of utilities as required.

1.10 WARRANTY

- A. Provide written warranty against defects in material and workmanship for the work of this Section for a period of one year from the Date of Substantial Completion. Warranted defects shall include, but not be limited to, delamination of plastic surfacing, warping, deflection of shelves or tops, swelling of core material, loosening of fastenings or hinges, and misalignment of doors or drawers.
- B. Refer to Section 01 77 00, Closeout Procedures, for Warranty form.

2 PRODUCTS

2.1 MANUFACTURERS

- A. Solid Surface Material: Homogeneous-filled plastic resin complying with ICPA SS-1.
 - 1. DuPont, Corian Solid Surface
 - 2. Formica, Solid Surface
 - 3. Wilson-Art, Solid Surface
- B. Plywood
 - 1. Kirby Forest Products
 - 2. Louisiana-Pacific
 - 3. Temple-Inland, Inc.
 - 4. Weyerhaeuser

2.2 MATERIAL

- A. Countertops
 - 1. Solid Surface Material: Homogeneous-filled plastic resin complying with ICPA SS-1.
 - a. Type: Provide Standard type
 - b. Colors and Patterns: As selected by Architect from manufacturer's full range of colors.
- B. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, and touch sanded.
- C. Adhesive: Product recommended by solid surface material manufacturer.

2.3 FABRICATION

- A. Fabricate countertop according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."
- B. Configuration:
 - 1. Front: 1-1/2-inch (38-mm) laminated bullnose

- a. Countertops: 3/4-inch- (19-mm-) thick, solid surface material with front edge built up with same material.
- b. Fabricate countertops with shop-applied edges unless otherwise indicated. Comply with solid surface material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
- c. Countertops 96" or less in length to be one piece.
- d. Joints shall be held to a minimum and all joints shall be caulked with clear silicone sealant. Sealant shall be installed neat without excess and to the satisfaction of the Architect.

3 EXECUTION

3.1 INSPECTION

- A. Ensure that walls are finish painted prior to beginning installation of sills.
- B. Examine substrates to receive solid surface material countertops and conditions under which material will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install countertop level to a tolerance of 1/8 inch in 8 feet (3 mm in 2.4 m), 1/4 inch (6 mm) maximum. Do not exceed 1/64-inch (0.4-mm) difference between planes of adjacent units.
- B. Secure countertops to subtops with adhesive according to solid surface material manufacturer's written instructions. 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.
- C. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.
- D. Apply sealant to gaps at walls; comply with Section 07 92 00, Joint Sealants.

3.3 ADJUSTING AND CLEANING

- A. Just prior to Owner acceptance of building, clean and polish all window sills and countertop using manufacturer's recommended methods and materials.

END OF SECTION 12 32 16

SECTION 14 24 00

HYDRAULIC ELEVATORS

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Refer to Document 00 21 13, 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 SUMMARY

- A. Section includes machine room-less hydraulic passenger elevators as shown and specified.
- B. Related Requirements
 - 1. Section 01 50 00, Temporary Facilities and Controls
 - 2. Section 03 30 00, Cast-in-Place Concrete
 - 3. Section 04 20 00, Masonry
 - 4. Section 05 12 00, Structural Steel Framing
 - 5. Section 05 50 00, Metal Fabrications
 - 6. Section 09 21 16.23, Gypsum Board Shaft Wall Assemblies
 - 7. Section 09 22 16, Non-Structural Metal Framing
 - 8. Section 09 29 00, Gypsum Board
 - 9. Section 09 65 19, Resilient Tile Flooring
 - 10. Section 09 91 00, Painting
 - 11. Section 22 11 23, Domestic Water Pumps
 - 12. Section 28 13 16, Electronic Access Control System
- C. Work Not Included: General contractor shall provide the following in accordance with the requirements of the Model Building Code and ANSI A17.1 Code. For specific rules, refer to ANSI A17.1, Part 3 for hydraulic elevators. State or local requirements must be used if more stringent.
 - 1. Elevator hoist beam to be provided at top of elevator shaft. Beam must be able to accommodate proper loads and clearances for elevator installation and operation.
 - 2. Supply in ample time for installation by other trades, inserts, anchors, bearing plates, brackets, supports and bracing including all setting templates and diagrams for placement.
 - 3. Hatch walls require a minimum two hours of fire rating. Hoistway should be clear and plumb with variations not to exceed 1/2" at any point.
 - 4. Elevator hoistways shall have barricades, as required.
 - 5. Install bevel guards at 75° on all recesses, projections or setbacks over 2" (4" for A17.1 2000 areas) except for loading or unloading.
 - 6. Provide rail bracket supports at pit, each floor and roof. For guide rail bracket supports, provide divider beams between hoistway at each floor and roof.
 - 7. Pit floor shall be level and free of debris. Reinforce dry pit to sustain normal vertical forces from rails and buffers.
 - 8. Where pit access is by means of the lowest hoistway entrance, a vertical ladder of non-combustible material extending 42" minimum, (48" minimum for A17.1-2000 areas) shall be provided at the same height, above sill of access door or handgrips.
 - 9. All wire and conduit should run remote from the hoistways.
 - 10. When heat, smoke or combustion sensing devices are required, connect to elevator control cabinet terminals. Contacts on the sensors should be sided for 12 volt D.C.
 - 11. Install and furnish finished flooring in elevator cab.
 - 12. Finished floors and entrance walls are not to be constructed until after sills and door frames are in place. Consult elevator contractor for rough opening size. The general contractor shall supply the drywall framing so that the wall fire resistance rating is maintained, when drywall construction is used.

13. Where sheet rock or drywall construction is used for front walls, it shall be of sufficient strength to maintain the doors in true lateral alignment. Drywall contractor to coordinate with elevator contractor.
14. Before erection of rough walls and doors; erect hoistway sills, headers, and frames. After rough walls are finished; erect fascias and toe guards. Set sill level and slightly above finished floor at landings.
15. To maintain legal fire rating (masonry construction), door frames are to be anchored to walls and properly grouted in place.
16. The elevator wall shall interface with the hoistway entrance assembly and be in strict compliance with the elevator contractor's requirements.
17. General Contractor shall fill and grout around entrances, as required.
18. All walls and sill supports must be plumb where openings occur.
19. Locate a light fixture (200 lx / 19 fc) and convenience outlet in pit with switch located adjacent to the access door.
20. Provide telephone line, light fixture (200 lx / 19 fc), and convenience outlet in the hoistway at the landing where the elevator controller is located. Typically this will be at the landing above the 1st floor. Final location must be coordinated with elevator contractor.
21. As indicated by elevator contractor, provide a light outlet for each elevator, in center of hoistway.
22. For signal systems and power operated door: provide ground and branch wiring circuits.
23. For car light and fan: provide a feeder and branch wiring circuits to elevator control cabinet.
24. Controller landing wall thickness must be a minimum of 8 1/2 inches thick. This is due to the controller being mounted on the second floor landing in the door frame on the return side of the door. For center opening doors, the controller is located on the right hand frame (from inside the elevator cab looking out). These requirements must be coordinated between the general contractor and the elevator contractor.
25. Cutting, patching and recesses to accommodate hall button boxes, signal fixtures, etc.

1.3 DEFINITIONS

- A. Definitions in ASME A17.1/CSA B44 apply to work of this Section.

1.4 REFERENCES

- A. Use current editions unless noted otherwise.
- B. The American Society of Mechanical Engineers (ASME)
1. ASME A17.1, Safety Code for Elevators and Escalators
- C. ASTM International (ASTM)
1. ASTM A240 / A240M, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
 2. ASTM A1008 / A1008M, Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
 3. ASTM A1011 / A1011M, Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
 4. ASTM B221, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
 5. ASTM C1107 / C1107M, Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
 6. ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials
- D. Canadian Standards Association (CSA)
1. CSA B44, Safety Code for Elevators and Escalators
- E. National Fire Protection Association (NFPA)
1. NFPA 80, Standard for Fire Doors and Other Opening Protectives
 2. NFPA 252, Standard Methods of Fire Tests of Door Assemblies
- F. National Electrical Manufacturers Association (NEMA)

1. NEMA LD 3, High-Pressure Decorative Laminates (HPDL)
- G. Underwriters Laboratories Inc. (UL)
 1. UL 10B, Standard for Fire Tests of Door Assemblies
- H. 2010 ADA Standards for Accessible Design (SAD)
- I. 2012 Texas Accessibility Standards (TAS)
- J. Texas Health and Safety Code, Chapter 161, Subchapter Q, Installation of Asbestos
- K. Texas Occupations Code, Chapter 1954, Asbestos Health Protection

1.5 COORDINATION

- A. Coordinate installation of sleeves, block outs, elevator equipment with integral anchors, and other items that are embedded in concrete for elevator equipment. Furnish templates, sleeves, elevator equipment with integral anchors, and installation instructions, and deliver to Project site in time for installation.
- B. Coordinate locations and dimensions of other work specified in other Sections that relates to hydraulic elevators, including pit ladders; sumps and floor drains in pits; entrance subsills; electrical service; and electrical outlets, lights, and switches in hoistways, and pits.

1.6 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00, Project Management and Coordination.

1.7 ACTION SUBMITTALS

- A. Product Data: Include capacities, sizes, performances, operations, safety features, finishes, and similar information. Include product data for car enclosures; hoistway entrances; and operation, control, and signal systems.
- B. Shop Drawings
 1. Show equipment arrangement in the corridor, pit, and hoistway and/or optional control room. Provide plans, elevations, sections and details of assembly, erection, anchorage, and equipment location.
 2. Indicate elevator system capacities, sizes, performances, safety features, finishes and other pertinent information.
 3. Show floors served, travel distances, maximum loads imposed on the building structure at points of support and all similar considerations of the elevator work.
 4. Indicate electrical power requirements and branch circuit protection device recommendations.
- C. Samples for Initial Selection: For finishes involving color selection.
 1. Powder Coat paint selection: Submit manufacturer's standard selection charts for exposed finishes and materials.
 2. Plastic laminate selection: Submit manufacturer's standard and custom selection charts for exposed finishes and materials to include specified laminate (Weathered Ash 8842-WR)
 3. Metal Finishes: Provide standard metal samples.

1.8 INFORMATIONAL SUBMITTALS

- A. Manufacturer Certificates: Signed by elevator manufacturer, certifying that hoistway, pit layout and dimensions, as shown on Drawings, and electrical service including standby-power generator, as shown and specified, are adequate for elevator system being provided.
- B. Submit Material Safety and Data Sheet (MSDS) for all materials, products, and parts.

1.9 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For elevators to include in emergency, operation, and maintenance manuals. Submit manufacturer's/installer's standard operation and maintenance manual, in accordance with ASME A17.1/CSA B44.
- B. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted elevator use.

1.10 QUALITY ASSURANCE

- A. Installer Qualifications: Elevator manufacturer or an authorized representative who is trained and approved by manufacturer with minimum 15 years of experience in manufacturing, installing, and servicing elevators of the type required for the project.
- B. Major elevator components, including pump-and-tank units, plunger-cylinder assemblies, controllers, signal fixtures, door operators, car frames, cars, and entrances, shall be manufactured by single manufacturer.

1.11 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle materials, components, and equipment in manufacturer's protective packaging. Store materials, components, and equipment off of ground, under cover, and in a dry location.
- B. Elevators shall not be used for temporary service or for any other purpose during the construction period before Substantial Completion and acceptance by the purchaser unless agreed upon by Elevator Contractor and General Contractor with signed temporary agreement.

1.12 WARRANTY

- A. Provide written warranty against defects in material and workmanship for the work of this Section for a period of two years from the Date of Substantial Completion. Refer to Section 01 77 00, Closeout Procedures, for Warranty form.
- B. Submit manufacturer's special warranty wherein manufacturer agrees to repair, restore, or replace elevator work that fails in materials or workmanship within a period of **two** years from date of Substantial Completion. Failures include, but are not limited to, operation or control system failure, including excessive malfunctions; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.

2 PRODUCTS**2.1 MANUFACTURERS**

- A. Basis of Design: Furnish and install TK Elevator's endura Machine Room-Less hydraulic elevator or comparable product by one of the listed manufacturers.
- B. Subject to compliance with requirements, provide products by one of the following:
 - 1. Otis Elevator Co.
 - 2. Schindler Elevator Corp.

2.2 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with ASME A17.1/CSA B44.
- B. Accessibility Requirements: Comply with requirements for accessible elevators in the United States Access Board's ADA-ABA Accessibility Guidelines, ICC A117.1, the 2010 ADA Standards for Accessible Design (SAD), and the 2012 Texas Accessibility Standards (TAS).

2.3 MATERIALS, GENERAL

- A. All Elevator Cab materials including frame, buttons, lighting, wall and ceiling assembly, laminates and carpet shall have an EPD and an HPD, and shall meet the California Department of Public Health Standard Method V1.1-2010, CA Section 01350 as mentioned in 1.03.9 of this specification.
- B. Colors, patterns, and finishes: As selected by the Architect from manufacturer's full range of standard colors, patterns, and finishes.
- C. Steel:
 - 1. Shapes and bars: Carbon.
 - 2. Sheet: Cold-rolled steel sheet, commercial quality, Class 1, matte finish.

3. Finish: Factory-applied baked enamel for structural parts, powder coat for architectural parts. Color selection must be based on elevator manufacture's standard selections.
- D. Plastic laminate: Decorative high-pressure type, complying with NEMA LD3, Type GP-50 General Purpose Grade, nominal 0.050" thickness. Laminate selection must be based on elevator manufacture's full selections.
 1. Weathered Ash 8842-WR
- E. Flooring: Prepared to receive resilient flooring specified in Section 09 65 19, Resilient Tile Flooring.

2.4 ELEVATORS

- A. Elevator System, General: Manufacturer's standard elevator systems. Unless otherwise indicated, manufacturer's standard components shall be used, as included in standard elevator systems and as required for complete system.
 1. Model: endura MRL Twinpost above-ground 2-stage
 2. Type: Hydraulic Machine Room-Less, Passenger
 3. Rated Load: 3500 lb
 4. Rated Speed: 110 fpm
 5. Operation System: TAC32H
 6. Travel: 15'-0"
 7. Landings: 2 Total
 8. Auxiliary Operations:
 - a. Standby-power operation
 - b. Standby-powered lowering
 9. Car Enclosures
 - a. Clear inside Width: Not less than 80 inches
 - b. Clear inside Depth: Not less than 65 inches
 - c. Clear inside Height: Not less than 88 inches to underside of ceiling
 - d. Door Clear Height: Not less than 84 inches
 - e. Front Walls (Return Panels): Satin stainless steel, No. 4 finish with integral car door frames
 - f. Car Fixtures: Satin stainless steel, No. 4 finish
 - g. Side and Rear Wall Panels: Plastic laminate
 - h. Reveals: Black
 - i. Door Faces (Interior): Satin stainless steel, No. 4 finish
 - j. Door Sills: Aluminum
 - k. Ceiling: Enameled or powder-coated steel
 - l. Handrails: 1½ inches round anodized aluminum at rear of car
 - m. Floor prepared to receive resilient flooring specified in Section 09 65 19, Resilient Tile Flooring.
 10. Hoistway Entrances
 - a. Width: 42 inches
 - b. Height: 84 inches
 - c. Door Type: One-speed | LH Side opening
 - d. Frames: Stainless steel
 - e. Doors: Stainless steel
 - f. Sills: Aluminum
 11. Hall Fixtures: Satin stainless steel, No. 4 finish
 12. Additional Requirements:
 - a. Provide inspection certificate in each car, mounted under acrylic cover with frame made from satin stainless steel, No. 4 finish.
 - b. Provide hooks for protective pads in and one complete set of full-height protective pads.

2.5 SYSTEMS AND COMPONENTS

- A. Power Unit (Oil Pumping and Control Mechanism): A self-contained unit located in the elevator pit consisting of the following items:

1. NEMA 4/Sealed Oil reservoir with tank cover including vapor removing tank breather
 2. An oil hydraulic pump.
 3. An electric motor.
 4. Electronic oil control valve with the following components built into single housing; high pressure relief valve, check valve, automatic unloading up start valve, lowering and leveling valve, and electro-magnetic controlling solenoids.
- B. Pump: Positive displacement type pump specifically manufactured for oil-hydraulic elevator service. Pump shall be designed for steady discharge with minimum pulsation to give smooth and quiet operation. Output of pump shall not vary more than 10 percent between no load and full load on the elevator car.
- C. Motor: Standard manufacture motor specifically designed for oil-hydraulic elevator service. Duty rating – motors shall be capable of 80 starts per hour with a 30% motor run time during each start.
- D. Hydraulic Silencers: Install multiple oil hydraulic silencers (muffler device) at the power unit location. The silencers shall contain pulsation absorbing material inserted in a blowout proof housing.
- E. Piping: Size, type, and weight of piping as recommended by elevator manufacturer, with flexible connectors to minimize sound and vibration transmissions from power unit.
- F. Oil Control Unit: The following components shall be built into a single housing. Welded manifolds with separate valves to accomplish each function are not acceptable. Adjustments shall be accessible and be made without removing the assembly from the oil line.
1. Relief valve shall be adjustable and be capable of bypassing the total oil flow without increasing back pressure more than 10 percent above that required to barely open the valve.
 2. Up start and stop valve shall be adjustable and designed to bypass oil flow during start and stop of motor pump assembly. Valve shall close slowly, gradually diverting oil to or from the jack unit, ensuring smooth up starts and up stops.
 3. Check valve shall be designed to close quietly without permitting any perceptible reverse flow.
 4. Lowering valve and leveling valve shall be adjustable for down start speed, lowering speed, leveling speed and stopping speed to ensure smooth "down" starts and stops. The leveling valve shall be designed to level the car to the floor in the direction the car is traveling after slowdown is initiated.
 5. Provided with constant speed regulation in both up and down direction. Feature to compensate for load changes, oil temperature, and viscosity changes.
 6. Solid State Starting: Provide an electronic starter featuring adjustable starting currents.
 7. A secondary hydraulic power source (powered by 110VAC single phase) must be provided. This is required to be able to raise (reposition) the elevator in the event of a system component failure (i.e. pump motor, starter, etc.)
 8. Oil Type: Provide a zinc free, inherently biodegradable lubricant formulated with premium base stocks to provide outstanding protection for demanding hydraulic systems, especially those operating in environmentally sensitive areas.

2.6 CAR OPERATION STATION

- A. Car Operating Station, General: The main car control in each car shall contain the devices required for specific operation mounted in an integral swing return panel requiring no applied faceplate. Wrap return shall have a brushed stainless steel finish. The main car operating panel shall be mounted in the return and comply with handicap requirements. Pushbuttons that illuminate using long lasting LED's shall be included for each floor served, and emergency buttons and switches shall be provided per code. Switches for car light and accessories shall be provided.
- B. Emergency Communications System: Integral phone system provided.
- C. Auxiliary Operating Panel: N/A
- D. Column Mounted Car Riding Lantern: A car riding lantern shall be installed in the elevator cab and located in the entrance. The lantern, when illuminated, will indicate the intended direction of travel. The lantern will illuminate and a signal will sound when the car arrives at a floor where it will stop. The lantern shall remain illuminated until the door(s) begin to close.

- E. Special Equipment: Limited Access Operation: Card reader space.(card reader by others)
- F. Digital Services: Cloud-based IoT monitoring system comes standard with these options:
 - 1. ADA Phone - Code Compliant Cellular Connectivity
 - 2. A17.1 2019 Code - Enhanced Communications

2.7 OPERATION SYSTEMS

- A. Controller: Shall be integrated in a hoistway entrance jamb. Should be microprocessor based, software oriented and protected from environmental extremes and excessive vibrations in a NEMA 1 enclosure. Control of the elevator shall be automatic in operation by means of push buttons in the car numbered to correspond to floors served, for registering car stops, and by "up-down" push buttons at each intermediate landing and "call" push buttons at terminal landings.
- B. Service Panel – to be located outside the hoistway in the controller entrance jamb and shall provide the following functionality/features:
 - 1. Access to main control board and CPU
 - 2. Main controller diagnostics
 - 3. Main controller fuses
 - 4. Universal Interface Tool (UIT)
 - 5. Remote valve adjustment
 - 6. Electronic motor starter adjustment and diagnostics
 - 7. Operation of pit motorized shut-off valve with LED feedback to the state of the valve in the pit
 - 8. Operation of auxiliary pump/motor (secondary hydraulic power source)
 - 9. Operation of electrical assisted manual lowering
 - 10. Provide male plug to supply 110VAC into the controller
 - 11. Run/Stop button
- C. Automatic Light and Fan shut down: The control system shall evaluate the system activity and automatically turn off the cab lighting and ventilation fan during periods of inactivity. The settings shall be field programmable.
- D. Emergency Power Operation: (Battery Lowering 10-DOC) When the loss of normal power is detected, a battery lowering feature is to be activated. The elevator will lower to a predetermined level and open the doors. After passengers have exited the car, the doors will close and the car will shutdown. When normal power becomes available, the elevator will automatically resume operation. The battery lowering feature is included in the elevator contract and does not utilize a building-supplied standby power source.
- E. Special Operation:
 - 1. Limited Access Operation: A key switch shall be provided to initiate the Limited Access Operation. The activation of this operation shall restrict the operation of the elevator car calls to selected floors on a per-floor, per elevator basis. Travel to the restricted floors shall be allowed after the entry of the required access code via a card reader device supplied by others. The card reader entry shall override the car call restrictions and allow entry of a car call to a restricted floor.
- F. Digital Services:
 - 1. Cloud-based IoT Monitoring System (standard): Contractor shall provide a cloud-based IoT (internet of things) monitoring system capable of tracking door movements and timing, trips, power cycles, car calls, out-of-service events and modes. This observation will continue 24/7 and it shall be capable of providing service technicians a minimum of three recommended solutions for defined failure events and automatically dispatch service technicians in the event of failure(s) while sending notifications to end users of changes in their equipment's state via both email and mobile device. Access to IoT and related equipment data and status will be made available in both a web portal and mobile application secured by password and username with at least two-factor authentication. Finally, this system must be self-contained and not require internet provision by others.
 - 2. Along with the monitoring system, options are available.

3. ADA Phone – Code Compliant Cellular Connectivity: Contractor shall provide a phone service through a self-contained cellular based VoIP system. This system shall meet code, include a backup battery capable of powering the emergency communication equipment for 4+ hours in the event of a power outage. The solution shall have remote monitoring capability to ensure continuous connectivity with a means of remote troubleshooting. Remote monitoring capability shall include, at a minimum, the ability to monitor connectivity and power supply. Remote monitoring shall be capable of providing local alerts to response personnel when on-site intervention is required.
4. A17.1 2019 Code – Enhanced Communications: For jobs installed under enforcement of 2018 International Building Code or ASME A17.1-2019/CSA B44:19 Safety Code, contractor will provide a video camera necessary for viewing the elevator cab interior floor as well as a position indicator display in the cab operating panel capable of providing means of two-way, text-based communication when the emergency call button is engaged in the elevator car. These components, and associated cloud-based monitoring platform, will be non-proprietary in nature, allowing customization on where to direct emergency calls, while offering capability for any party to provide the emergency monitoring services.

2.8 DOOR-REOPENING DEVICES

- A. Door Operation: Provide a direct or alternating current motor driven heavy duty operator designed to operate the car and hoistway doors simultaneously. The door control system shall be digital closed loop and the closed loop circuit shall give constant feedback on the position and velocity of the elevator door. The motor torque shall be constantly adjusted to maintain the correct door speed based on its position and load. All adjustments and setup shall be through the computer based service tool. Door movements shall follow a field programmable speed pattern with smooth acceleration and deceleration at the ends of travel. The mechanical door operating mechanism shall be arranged for manual operation in event of power failure. Doors shall automatically open when the car arrives at the landing and automatically close after an adjustable time interval or when the car is dispatched to another landing. AC controlled units with oil checks, or other deviations are not acceptable.
 1. No Un-Necessary Door Operation: The car door shall open only if the car is stopping for a car or hall call, answering a car or hall call at the present position or selected as a dispatch car.
 2. Door Open Time Saver: If a car is stopping in response to a car call assignment only (no coincident hall call), the current door hold open time is changed to a shorter field programmable time when the electronic door protection device is activated.
 3. Double Door Operation: When a car stops at a landing with concurrent up and down hall calls, no car calls, and no other hall call assignments, the car door opens to answer the hall call in the direction of the car's current travel. If an onward car call is not registered before the door closes to within 6 inches of fully closed, the travel shall reverse and the door shall reopen to answer the other call.
 4. Nudging Operation: The doors shall remain open as long as the electronic detector senses the presence of a passenger or object in the door opening. If door closing is prevented for a field programmable time, a buzzer shall sound. When the obstruction is removed, the door shall begin to close at reduced speed. If the infra-red door protection system detects a person or object while closing on nudging, the doors shall stop and resume closing only after the obstruction has been removed.
 5. Door Reversal: If the doors are closing and the infra-red beam(s) is interrupted, the doors shall reverse and reopen. After the obstruction is cleared, the doors shall begin to close.
 6. Door Open Watchdog: If the doors are opening, but do not fully open after a field adjustable time, the doors shall recycle closed then attempt to open six times to try and correct the fault.
 7. Door Close Watchdog: If the doors are closing, but do not fully close after a field adjustable time, the doors shall recycle open then attempt to close six times to try and correct the fault.

8. Door Close Assist: When the doors have failed to fully close and are in the recycle mode, the door drive motor shall have increased torque applied to possibly overcome mechanical resistance or differential air pressure and allow the door to close.
- B. Door Protection Device: Provide a door protection system using microprocessor controlled infra-red light beams. The beams shall project across the car opening detecting the presence of a passenger or object. If door movement is obstructed, the doors shall immediately reopen.

2.9 CAR ENCLOSURES

- A. General: Provide steel-framed car enclosures with nonremovable wall panels, with removable car roof, access doors, power door operators, and ventilation.
 1. Provide standard railings complying with ASME A17.1/CSA B44 on car tops where required by ASME A17.1/CSA B44.
- B. Materials and Finishes:
 1. Walls: Cab type TKAP, reinforced cold-rolled steel with two coats factory applied baked enamel finish, with applied vertical wood core panels covered on both sides with high pressure plastic laminate.
 2. Laminate: Weathered Ash 8842-WR
 3. Reveals and frieze: a. Reveals and frieze: Stainless steel, no. 4 brushed finish
 4. Canopy: Cold-rolled steel with hinged exit.
 5. Ceiling: Downlight type, metal pans with suspended LED downlights and dimmer switch. Number of downlights shall be dependent on platform size with a minimum of six. The metal pans shall be finished with a stainless steel, no. 4 brushed finish.
 6. Cab Fronts, Return, Transom, Soffit and Strike: Provide panels faced with brushed stainless steel
 7. Doors: Horizontal sliding car doors reinforced with steel for panel rigidity. Hang doors on sheave type hangers with polyurethane tires that roll on a polished steel track and are guided at the bottom by non-metallic sliding guides.
 - a. Door Finish: Stainless steel panels: No. 4 brushed finish.
 - b. Cab Sills: Extruded aluminum, mill finish.
 8. Handrail: Provide 1.5' diameter cylindrical metal on side and rear walls on front opening cars and side walls only on front and rear opening cars. Handrails shall have a stainless steel, no. 4 brushed finish.
 9. Ventilation: Manufacturer's standard exhaust fan, mounted on the car top.
 10. Protection pads and buttons: Not required
- C. Car Top Inspection: Provide a car top inspection station with an "Auto-Inspection" switch, an "emergency stop" switch, and constant pressure "up and down" direction and safety buttons to make the normal operating devices inoperative. The station shall give the inspector complete control of the elevator. The car top inspection station shall be mounted in the door operator assembly.

2.10 HOISTWAY EQUIPMENT

- A. Platform: Fabricated frame of formed or structural steel shapes, gusseted and rigidly welded with a wood sub-floor. Underside of the platform shall be fireproofed. The car platform shall be designed and fabricated to support one-piece loads weighing up to 25% of the rated capacity.
- B. Sling: Steel stiles bolted or welded to a steel crosshead and bolstered with bracing members to remove strain from the car enclosure.
- C. Guide Rails: Steel, omega shaped, fastened to the building structure with steel brackets.
- D. Guides: Slide guides shall be mounted on top and bottom of the car.
- E. Buffers: Provide substantial buffers in the elevator pit. Mount buffers on continuous channels fastened to the elevator guide rail or securely anchored to the pit floor. Provide extensions if required by project conditions.

- F. Jack: A jack unit shall be of sufficient size to lift the gross load the height specified. Factory test jack to ensure adequate strength and freedom from leakage. Brittle material, such as gray cast iron, is prohibited in the jack construction. Provide the following jack type: Twin post holeless telescopic 2-stage. Two jacks piped together, mounted one on each side of the car with each having two telescopic sections designed to extend in a synchronized manner when oil is pumped into the Assembly. Each jack section will be guided from within the casing or the plunger assembly used to house the section. Each plunger shall have a high pressure sealing system which will not allow for seal movement or displacement during the course of operation. Each Jack Assembly shall have a check valve built into the assembly to allow for automatically re-synching the two plunger sections by moving the jack to its fully contracted position. The jack shall be designed to be mounted on the pit floor or in a recess in the pit floor. Each jack section shall have a bleeder valve to discharge any air trapped in the section..
- G. Automatic Self-Leveling: Provide each elevator car with a self-leveling feature to automatically bring the car to the floor landings and correct for over travel or under travel. Self-leveling shall, within its zone, be automatic and independent of the operating device. The car shall be maintained approximately level with the landing irrespective of its load.
- H. Wiring, Piping, and Oil: Provide all necessary hoistway wiring in accordance with the National Electrical Code. All necessary code compliant pipe and fittings shall be provided to connect the power unit to the jack unit. Provide proper grade inherently biodegradable oil as specified by the manufacturer of the power unit (see Power Unit section 2.04.G for further details)
- I. Pit moisture/water sensor located approximately 1 foot above the pit floor to be provided. Once activated, elevator will perform "flooded pit operation", which will run the car up to the designated floor, cycle the doors and shut down and trip the circuit breaker shunt to remove 3 phase power from all equipment, including pit equipment.
- J. Motorized oil line shut-off valve shall be provided that can be remotely operated from the controller landing service panel. Also a means for manual operation at the valve in the pit is required.

2.11 HOISTWAY ENTRANCES

- A. Doors and Frames: Provide complete hollow metal type hoistway entrances at each hoistway opening bolted\knock down construction.
 - 1. Manufacturer's standard entrance design consisting of hangers, doors, hanger supports, hanger covers, fascia plates (where required), sight guards, and necessary hardware.
 - 2. Main landing door & frame finish: Stainless steel panels, no. 4 brushed finish with no. 4 brushed finish entrance frame.
 - 3. Typical door & frame finish: Stainless steel panels, no. 4 brushed finish with no. 4 brushed finish entrance frame.
- B. Integrated Control System: the elevator controller to be mounted to hoistway entrance above 1st landing. The entrance at this level, shall be designed to accommodate the control system and provide a means of access to critical electrical components and troubleshooting features. See section 2.09 Control System for additional requirements.
- C. At the controller landing, the hoistway entrance frame shall have space to accommodate and provide a lockable means of access (group 2 security) to a 3 phase circuit breaker. See section 2.11 Miscellaneous Elevator Components for further details
- D. Interlocks: Equip each hoistway entrance with an approved type interlock tested as required by code. Provide door restriction devices as required by code.
- E. Door Hanger and Tracks: Provide sheave type two point suspension hangers and tracks for each hoistway horizontal sliding door.
 - 1. Sheaves: Polyurethane tires with ball bearings properly sealed to retain grease.
 - 2. Hangers: Provide an adjustable device beneath the track to limit the up-thrust of the doors during operation.
 - 3. Tracks: Drawn steel shapes, smooth surface and shaped to conform to the hanger sheaves.
- F. Hoistway Sills: Extruded metal, with groove(s) in top surface. Provide mill finish on aluminum.

2.12 SIGNAL EQUIPMENT

- A. General: Provide hall-call and car-call buttons that light when activated and remain lit until call has been fulfilled. Provide buttons and lighted elements illuminated with LEDs.
- B. Car-Control Stations: Provide manufacturer's standard recessed car-control stations. Mount in return panel adjacent to car door unless otherwise indicated.
 - 1. Mark buttons and switches for required use or function. Use both tactile symbols and Braille.
 - 2. Provide "No Smoking" sign matching car-control station, either integral with car-control station or mounted adjacent to it, with text and graphics as required by authorities having jurisdiction.
- C. Emergency Communication System: Two-way voice communication system, with visible signal, which dials preprogrammed number of monitoring station and does not require handset use. System is contained in flush-mounted cabinet, with identification, instructions for use, and battery backup power supply.
- D. Firefighters' Two-Way Telephone Communication Service: When required by authorities having jurisdiction, provide flush-mounted cabinet or telephone jack in car and required conductors in traveling cable for firefighters' two-way telephone communication service specified in Division 28.
- E. Hall Push-Button Stations: Provide one hall push-button station at each landing.
 - 1. Provide units with flat faceplate for mounting with body of unit recessed in wall.
 - 2. **Equip units for keycard access control for calling elevator and for indicating applicable direction of travel. Refer to specification section 28 13 16 Electronic Access Control System for additional information.**
 - 3. If required by authorities having jurisdiction, provide telephone jack in each unit for firefighters' two-way telephone communication service specified in Division 28.
- F. Hall Lanterns: Provide single arrow at terminal landings. Provide units mounted in both car door jambs.
- G. Hall Annunciator: With each hall lantern, provide audible signals indicating car arrival and direction of travel. Signals sound once for up and twice for down. At manufacturer's option, audible signals may be placed on cars.
- H. Standby-Power Elevator Selector Switches: Provide switches, as required by ASME A17.1/CSA B44, where indicated. Adjacent to switches, provide illuminated signal that indicates when normal power supply has failed.
- I. Emergency Pictorial Signs: Fabricate from materials matching hall push-button stations, with text and graphics as required by authorities having jurisdiction, indicating that in case of fire, elevators are out of service and exits should be used instead. Provide one sign at each hall push-button station unless otherwise indicated.

2.13 MISCELLANEOUS ELEVATOR COMPONENTS

- A. Lockable three phase circuit breaker with auxiliary contact with shunt trip capability to be provided. Circuit breaker to be located behind locked panel (Group 2 security access) at controller landing entrance jamb and should be sized according to the National Electrical Code.
- B. Lockable single phase 110V circuit breaker for cab light and fan to be provided. Circuit breaker to be located behind locked panel (Group 2 security access) at controller landing entrance jamb should be sized according to the National Electrical Code

2.14 FINISH MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, commercial steel, Type B, exposed, matte finish
- B. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, commercial steel, Type B, pickled
- C. Stainless-Steel Sheet: ASTM A240/A240M, Type 304
- D. Aluminum Extrusions: ASTM B221, Alloy 6063
- E. Plastic Laminate: High-pressure type complying with NEMA LD 3, Type HGS for flat applications

3 EXECUTION

3.1 EXAMINATION

- A. Examine elevator areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work. Verify critical dimensions and examine supporting structure and other conditions under which elevator work is to be installed.
- B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install elevator systems components and coordinate installation of hoistway wall construction.
 - 1. Work shall be performed by competent elevator installation personnel in accordance with ASME A17.1, manufacturer's installation instructions and approved shop drawings.
 - 2. Comply with the National Electrical Code for electrical work required during installation.
- B. Perform work with competent, skilled workmen under the direct control and supervision of the elevator manufacturer's experienced foreman.
- C. Supply in ample time for installation by other trades, inserts, anchors, bearing plates, brackets, supports, and bracing including all setting templates and diagrams for placement.
- D. Welded Construction: Provide welded connections for installation of elevator work where bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance, and replacement of worn parts. Comply with AWS standards for workmanship and for qualification of welding operators.
- E. Coordination: Coordinate elevator work with the work of other trades, for proper time and sequence to avoid construction delays. Use benchmarks, lines, and levels designated by the Contractor, to ensure dimensional coordination of the work.
- F. Install machinery, guides, controls, car and all equipment and accessories to provide a quiet, smoothly operating installation, free from side sway, oscillation or vibration.
- G. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with cars. Where possible, delay final adjustment of sills and doors until car is operable in shaft. Reduce clearances to minimum safe, workable dimensions at each landing.
- H. Erect hoistway sills, headers, and frames before erection of rough walls and doors; erect fascia and toe guards after rough walls finished. Set sill units accurately aligned and slightly above finish floor at landings.
- I. Lubricate operating parts of system, where recommended by manufacturer.
- J. Set sills flush with finished floor surface at landing. Fill space under sill solidly with nonshrink, nonmetallic grout.

3.3 FIELD QUALITY CONTROL

- A. Acceptance Testing: On completion of elevator installation and before permitting elevator use (either temporary or permanent), perform acceptance tests as required and recommended by ASME A17.1/CSA B44 and by governing regulations and agencies.
- B. Advise Owner, Architect, and authorities having jurisdiction in advance of dates and times that tests are to be performed on elevators.

3.4 ADJUSTING

- A. Make necessary adjustments of operating devices and equipment to ensure elevator operates smoothly and accurately.

3.5 CLEANING

- A. Before final acceptance, remove protection from finished surfaces and clean and polish surfaces in accordance with manufacturer's recommendations for type of material and finish provided. Stainless steel shall be cleaned with soap and water and dried with a non-abrasive surface; it shall not be cleaned with bleach-based cleansers.

- B. At completion of elevator work, remove tools, equipment, and surplus materials from site. Clean equipment rooms and hoistway. Remove trash and debris.
 - 1. Use environmentally preferable and low VOC emitting cleaners for each application type. Cleaners that contain solvents, pine and/or citrus oils are not permitted.

3.6 PROTECTION

- A. At time of Substantial Completion of elevator work, or portion thereof, provide suitable protective coverings, barriers, devices, signs, or other such methods or procedures to protect elevator work from damage or deterioration. Maintain protective measures throughout remainder of construction period.
 - 1. Provide car with temporary enclosure, either within finished car or in place of finished car, to protect finishes from damage.
 - 2. Provide strippable protective film on entrance and car doors and frames.
 - 3. Provide padded wood bumpers on entrance door frames covering jambs and frame faces.
 - 4. Provide other protective coverings, barriers, devices, signs, and procedures as needed to protect elevator and elevator equipment.
 - 5. Do not load elevators beyond their rated weight capacity.
 - 6. Engage elevator Installer to provide full maintenance service. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleanup, and adjustment as necessary for proper elevator operation at rated speed and capacity. Provide parts and supplies same as those used in the manufacture and installation of original equipment.
 - 7. Engage elevator Installer to restore damaged work, if any, so no evidence remains of correction. Return items that cannot be refinished in the field to the shop, make required repairs and refinish entire unit, or provide new units as required.

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to operate elevator(s). Review emergency provisions, including emergency access and procedures to be followed at time of failure in operation and other building emergencies. Train Owner's personnel in normal procedures to be followed in checking for sources of operational failures or malfunctions.
- B. Check operation of elevator with Owner's personnel present before date of Substantial Completion. Determine that operation systems and devices are functioning properly.

3.8 MAINTENANCE

- A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 24 months' full maintenance by skilled employees of elevator Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper elevator operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
 - 1. Perform maintenance during normal working hours.
 - 2. Include 24-hour-per-day, 7-day-per-week emergency callback service with response time of two hours or less.

END OF SECTION 14 24 00

NEW DISTRICT ADMINISTRATION BUILDING

New Caney Independent School District



Issue for Bid

New Caney ISD CSP # 999-2023

May 8, 2025

GPD Group Professional Corporation

2121 Sage Road, Suite 240

Houston, Texas 77056

GPD Group Project No. 2023140.00



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New Caney ISD New Administration Building

New Caney Independent School District

GPD Group Project No. 2023159.00
Pasadena ISD CSP#999-2023

May 8, 2025

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M-105-D1	MECHANICAL FIRST FLOOR AREA – D1
M-106-D1.2	MECHANICAL FIRST FLOOR AREA – D1.2
M-107-E1	MECHANICAL FIRST FLOOR AREA – E1
M-108-F1	MECHANICAL FIRST FLOOR AREA – F1
M-109-G1	MECHANICAL FIRST FLOOR AREA – G1
M-110-A2	MECHANICAL SECOND FLOOR AREA – A2
M-111-B2	MECHANICAL SECOND FLOOR AREA – B2
M-112-C2	MECHANICAL SECOND FLOOR AREA – C2
M-113-D2	MECHANICAL SECOND FLOOR AREA – D2
M-114-D2.2	MECHANICAL SECOND FLOOR AREA – D2.2
M-115-E2	MECHANICAL SECOND FLOOR AREA – E2
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P-110-A1 PLUMBING FIRST FLOOR AREA – A1
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P-113-D1 PLUMBING FIRST FLOOR AREA – D1
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P-115-E1 PLUMBING FIRST FLOOR AREA – E1
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E-105-D1 ELECTRICAL LIGHTING FIRST FLOOR AREA – D1
E-106-D1.2 ELECTRICAL LIGHTING FIRST FLOOR AREA – D1.2
E-107-E1 ELECTRICAL LIGHTING FIRST FLOOR AREA – E1
E-108-F1 ELECTRICAL LIGHTING FIRST FLOOR AREA – F1
E-109-G1 ELECTRICAL LIGHTING FIRST FLOOR AREA – G1
E-111-A2 ELECTRICAL LIGHTING SECOND FLOOR AREA – A2
E-112-B2 ELECTRICAL LIGHTING SECOND FLOOR AREA – B2
E-113-C2 ELECTRICAL LIGHTING SECOND FLOOR AREA – C2
E-114-D2 ELECTRICAL LIGHTING SECOND FLOOR AREA – D2
E-115-D2.2 ELECTRICAL LIGHTING SECOND FLOOR AREA – D2.2
E-116-E2 ELECTRICAL LIGHTING SECOND FLOOR AREA – E2

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E-204-C1	ELECTRICAL POWER FIRST FLOOR AREA – C1
E-205-D1	ELECTRICAL POWER FIRST FLOOR AREA – D1
E-206-D1.2	ELECTRICAL POWER FIRST FLOOR AREA – D1.2
E-207-E1	ELECTRICAL POWER FIRST FLOOR AREA – E1
E-208-F1	ELECTRICAL POWER FIRST FLOOR AREA – F1
E-209-G1	ELECTRICAL POWER FIRST FLOOR AREA – G1
E-210-A2	ELECTRICAL POWER SECOND FLOOR AREA – A2
E-211-B2	ELECTRICAL POWER SECOND FLOOR AREA – B2
E-212-C2	ELECTRICAL POWER SECOND FLOOR AREA – C2
E-213-D2	ELECTRICAL POWER SECOND FLOOR AREA – D2
E-214-D2.2	ELECTRICAL POWER SECOND FLOOR AREA – D2.2
E-215-E2	ELECTRICAL POWER SECOND FLOOR AREA – E2
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E-401	ELECTRICAL ONE-LINE DIAGRAM
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T-101	TECHNOLOGY COMPOSITE FLOOR PLAN – LEVEL 1
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T-103-A1	TECHNOLOGY FIRST FLOOR AREA – A1
T-104-B1	TECHNOLOGY FIRST FLOOR AREA – B1
T-105-C1	TECHNOLOGY FIRST FLOOR AREA – C1
T-106-D1	TECHNOLOGY FIRST FLOOR AREA – D1
T-107-D1.2	TECHNOLOGY FIRST FLOOR AREA – D1.2
T-108-E1	TECHNOLOGY FIRST FLOOR AREA – E1
T-109-F1	TECHNOLOGY FIRST FLOOR AREA – F1
T-110-G1	TECHNOLOGY FIRST FLOOR AREA – G1
T-111-A2	TECHNOLOGY SECOND FLOOR AREA – A2
T-112-B2	TECHNOLOGY SECOND FLOOR AREA – B2
T-113-C2	TECHNOLOGY SECOND FLOOR AREA – C2
T-114-D2	TECHNOLOGY SECOND FLOOR AREA – D2
T-115-D2.2	TECHNOLOGY SECOND FLOOR AREA – D2.2
T-116-E2	TECHNOLOGY SECOND FLOOR AREA – E2
T-117-F2	TECHNOLOGY SECOND FLOOR AREA – F2
T-118-G2	TECHNOLOGY SECOND FLOOR AREA – G2
T-201	TECHNOLOGY OVERALL FIRE ALARM PLAN – LEVEL 1

T-202	TECHNOLOGY OVERALL FIRE ALARM PLAN – LEVEL 2
T-203	TECHNOLOGY OVERALL ERRC SYSTEM PLAN – LEVEL 1
T-204	TECHNOLOGY OVERALL ERRC SYSTEM PLAN – LEVEL 2
T-205	TECHNOLOGY ERRC SYSTEM PLAN - ROOF
T-301	TECHNOLOGY ENLARGED PLAN
T-401	TECHNOLOGY DETAILS
T-402	TECHNOLOGY DETAILS
T-403	TECHNOLOGY DETAILS
T-404	TECHNOLOGY DETAILS
T-405	TECHNOLOGY DETAILS
T-406	TECHNOLOGY SCHEMATIC DESIGN
T-407	TECHNOLOGY SCHEMATIC DESIGN
T-408	TECHNOLOGY SCHEMATIC DESIGN

END OF DOCUMENT 00 01 15

SECTION 21 01 00

FIRE PROTECTION OPERATING AND MAINTENANCE MANUALS

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.

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.

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 21 01 00

SECTION 21 05 00

FIRE PROTECTION GENERAL PROVISIONS

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.

2 PRODUCTS – NOT USED**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 21 05 00

SECTION 21 05 10

FIRE PROTECTION CONTRACT QUALITY CONTROL

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.

2 PRODUCTS**2.1 REFERENCE APPLICABLE SPECIFICATION SECTIONS.****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 21 05 10

SECTION 21 05 12

FIRE PROTECTION SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA

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: $\frac{1}{4}'' = 1'-0''$.
- 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.

2 PRODUCTS - NOT USED

3 EXECUTION - NOT USED

END OF SECTION 21 05 12

SECTION 21 05 13

ELECTRICAL PROVISIONS OF FIRE PROTECTION WORK

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.

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.

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 21 05 13

SECTION 21 10 00

FIRE SPRINKLER SYSTEMS

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.

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.
- H. Systems serving walk-in 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 1/4 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
- B. Siamese free standing fire department connection with chrome plated finish, local fire department thread, dust caps and chains, escutcheon, body, and 3/4 inch automatic drip marked SPRINKLER – FIRE DEPARTMENT CONNECTION.
 - 1. 4" X 2-1/2" 2-way
 - 2. 6" X 2-1/2" 3-way
 - 3. 6" X 2-1/2" 4-way
 - 4. 8" X 2-1/2" 6-way

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 3/4 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 21 10 00

SECTION 22 01 00

PLUMBING OPERATING AND MAINTENANCE MANUALS

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.

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.

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 22 01 00

SECTION 22 05 00

PLUMBING GENERAL PROVISIONS

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 reproducible drawings 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.

2 PRODUCTS – NOT USED

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 22 05 00

SECTION 22 05 10

PLUMBING CONTRACT QUALITY CONTROL

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.

2 PRODUCTS**2.1 REFERENCE APPLICABLE SPECIFICATION SECTIONS****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 22 05 10

SECTION 22 05 12

PLUMBING SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA

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.

2 PRODUCTS - NOT USED.

3 EXECUTION - NOT USED

END OF SECTION 22 05 12

SECTION 22 05 13

ELECTRICAL PROVISIONS OF PLUMBING WORK

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.

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 $\frac{3}{4}$ hp and larger, and provide capacitor-start single-phase motors for $\frac{1}{2}$ hp and smaller, except $\frac{1}{6}$ 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.

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 22 05 13

SECTION 22 05 15

PLUMBING EARTHWORK

1 GENERAL

- A. Excavate and backfill for pipe trenches for underground piping, and excavate for structures installed as part of plumbing work.

2 PRODUCTS - NOT USED

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 22 05 15

SECTION 22 05 16

EXCAVATING, BACKFILLING AND COMPACTING FOR UTILITIES OUTSIDE BUILDING SLAB

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/ft³)
 - 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.

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.

3 EXECUTION

3.1 EXCAVATION

- A. General:
 - 1. All utility trenches shall be constructed in conformance with OSHA trench safety standards.
 - 2. Sheet piling 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 be 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 22 05 16

SECTION 22 05 17

PLUMBING ACCESS DOORS

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.

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

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 22 05 17

SECTION 22 05 19

PRESSURE AND TEMPERATURE INSTRUMENTS

1 GENERAL

1.1 WORK INCLUDED

- A. This section specifies gauges, thermometers, wells and/or pressure and temperature test stations to be installed as specified.

1.2 RELATED WORK

- A. Division 22, Plumbing
 - 1. Plumbing General Provisions
 - 2. Pipe and Pipe Fittings, General
 - 3. Valves, Strainers and Vents

2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS - GAUGES AND THERMOMETERS

- A. Trerice
- B. Taylor
- C. Marsh
- D. Weksler
- E. Marshalltown
- F. Weiss
- G. Miljoco

2.2 PRESSURE GAUGES

- A. Case and Ring: 4 inch type 304 stainless steel; liquid filled case with stainless steel bayonet ring.
- B. Dial: White aluminum with black markings
- C. Window: Clear acrylic
- D. Tube: Phosphor bronze and forged brass socket.
- E. Gauge accuracy: +/- 1 percent over operating range.
- F. For pulsating service, provide impulse dampers.
- G. Without flange for pipe mounting.
- H. With flange for wall mounting.

- I. Weiss Model: Domestic Water 4CTS LF (Lead Free) 0-100 PSI

2.3 THERMOMETER WELLS

- A. Brass or type 300 stainless steel. Machined bar stock, 1-piece construction (Lead Free).
- B. Where installed in insulated piping or vessels, provide with extension neck to match insulation thickness.
- C. Provide metal-to-metal contact with bulb chamber for maximum sensitivity.
- D. Wells shall be sized to extend a minimum of 50 percent into pipe.

2.4 THERMOMETERS IN PIPING SYSTEMS OR VESSELS

- A. Die cast aluminum case with baked epoxy finish.
- B. Adjustable angle 9 inch scale length.
- C. Clear acrylic window.
- D. Brass stem, length to match well.
- E. Red reading organic spirit filled-in magnifying glass column.
- F. White background with black figures and markings.
- G. Brass stems and union connections (Lead Free).
- H. Accuracy: +/- 1 percent of scale range.
- I. Range:
 - 1. Hot water lines: 30 deg. F to 240 deg. F.

3 EXECUTION

3.1 INSTALLATION

- A. Install in accordance with drawing details and manufacturer's recommendations.
- B. Provide a ball valve at each gauge (Lead Free).
- C. Locate gauges and thermometers to be easily readable from the floor at a 5 foot-6 inch eye level. Use adjustable angle or rigid stem as required. Install gauges in upright position.
- D. Install gauges in the following locations: across pumps, storage tanks, heat exchangers.
- E. Install thermometer in the following locations: At storage tanks, across heat exchangers, across boiler, leaving side of water heater, leaving water side of tempered water valves, and hot water supply and return lines.
 - 1. Hot water lines: 30 deg. F to 240 deg. F.
 - 2. Tempered water valves 0 deg. F to 120 deg. F.

END OF SECTION 22 05 19

SECTION 22 05 23

VALVES, STRAINERS AND VENTS

1 GENERAL

1.1 SECTION INCLUDES

- A. Plumbing Valves
- B. Pipe strainer and suction diffusers.

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. Provide with memory stop for balancing valves.
 - 5. Where Viega ProPress fittings are used, Viega ProPress ball valves may be used.
 - 6. 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. Apollo
 2. Crane
 3. Dezurik
 4. Jenkins
 5. Keystone
 6. Kitz
 7. Milwaukee Valve
 8. Nibco
 9. Jomar
- 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. Apollo
 - b. Keystone
 - c. Kitz
 - d. Milwaukee
 - e. Mission Duocheck
 - f. 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. Watts 909-QT-S-LF.
 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 full size to nearest floor drain. Apollo RP4ALF-YS or Watts 909-NRS-BB-S-LF.
- 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.
- M. Provide memory stops for all valves used for throttling service. Valves for throttling service shall be butterfly, plug, globe or ball type.

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. Apollo
 - 2. Crane
 - 3. Keckley
 - 4. Kitz
 - 5. Mueller
 - 6. McAlear
 - 7. Muesco
 - 8. Nibco
 - 9. Zurn

2.3 VALVE SCHEDULE

- A. Domestic Service
 - 1. Gas shut-off service: UL approved for natural gas service.
 - a. Nibco Ball Valve, full port through 1 inch: T-585-70-UL
 - b. Nibco Ball Valve conventional port 1-1/4 inch through 3 inch: T-580-70-UL
 - 2. 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 4 inch and larger: LD-2000 EDPM Gaskets
- 3. 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)

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. Use butterfly valves and ball valves in circulating water systems, for balancing duty.
- E. 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.
- F. Provide isolation valves in domestic water lines to isolate all equipment, restrooms, hose bibbs, and where shown on the drawings.
- G. 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. Cup insulation at all valves handles for handle clearance.
- H. Provide clearance for installation of insulation and access to valves.
- I. 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 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. Provide charts and drawings listing functions of each valve and its location. Place charts and drawings as directed by owner; 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 and provided in pdf format to the owner. 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 22 05 23

SECTION 22 05 33

PIPE HEAT TRACING

1 GENERAL

1.1 WORK INCLUDED

- A. Furnish and install a complete industrial, constant wattage, UL listed system of electric pipe heat tracing and controls on all make-up water piping outdoors above grade to prevent freezing. The heat tracing system shall conform to ANSI/IEEE Standard 515-1989.
- B. Protect the pipe, valves, fittings, meters and appurtenances. Apply sufficient cable and overheat thermostat to protect the entire system.

1.2 SUBMITTALS

- A. Submit shop drawings and product data as specified in Section 22 05 12.
- B. Submit detailed calculations for length of heat tracing cable per foot of pipe, based on actual length of piping installed.
- C. Submit manufacturer's certified capacity charts with selections plotted thereon.
- D. Submit manufacturer's installation instructions.
- E. Submit full load ampere requirement and voltage for branch circuit.

2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Raychem Corporation
- B. Thermon Manufacturing Company

2.2 COMPONENTS

- A. Self-regulating heater.
 - 1. The self-regulating heater shall consist of two 16 AWG tinned-copper bus wires embedded in parallel in a self-regulating polymer core that varies its power output to respond to temperature all along its length, allowing the heater to be crossed itself without overheating and to be cut in the field. The heater shall be covered by a radiation cross-linked modified polyolefin dielectric jacket.
 - 2. In order to provide energy conservation, and to prevent overheating, the heater shall have a self-regulating factor of at least 90%.
 - 3. The heater shall operate on a line voltage of 120 VAC without the use of transformers.
 - 4. The heater shall be sized according to the following. The required heater output rating is in watts per foot at 50°F (heater selection based on 1-1/2 inch fiberglass insulation on metal piping).
 - 5. The heater shall be XL-Trace as manufactured by Raychem Corporation or XL-Econotrace as manufactured by Thermon Manufacturing Company.

6. Power connection, end seal, splice and tee kits components shall be applied in the field.
7. The system shall be controlled by an ambient sensing thermostat set at 40°F either directly or through an appropriate contactor.
8. Provide an end-of-circuit voltage indicating light

3 EXECUTION

3.1 INSTALLATION

- A. Install and start up the pipe heat tracing system in accordance with the manufacturer's Installation, Start-up and Service Instructions.
- B. Install the pipe heat tracing cable under the pipe insulation.
- C. Apply "Electrically Traced" signs to the outside of the thermal insulation.
- D. Ground fault protection of the equipment shall be provided per the 1996 National Electrical Code, Article 427-22.
- E. Provide a cast aluminum weatherproof NEMA-4 rated junction box for installation of the cable, with pilot light to indicate operation of the cable.
- F. Use only electrical components as recommended by the manufacturer.

3.2 ELECTRICAL WORK

- A. Furnish and install the wire, conduit and raceway systems required for the automatic operation of the pipe heat tracing system. Conform to the National Electrical Code.
- B. The specified wiring work includes:
 1. Wiring of control instruments between thermostat and junction boxes
 2. Installation of thermostat and junction boxes
 3. Wiring from the heat tracing cable to the junction boxes
- C. Related branch circuit power wiring from the junction box to ground fault type circuit is specified to be provided in Division 26.
- D. Provide devices and appurtenances as specified in Division 26.
- E. Identify each circuit at each terminal with a separate tag.
- F. Color code wires in accordance with IPCEA Standards.
- G. Make all joints and connections with approved mechanical connectors.

3.3 TESTING OF THE PIPE HEAT TRACING SYSTEM

- A. Test the pipe heat tracing system:
 1. Simulate freezing outside air conditions
 2. Measure the amperage draw of the heat tracing system
 3. Compare to the manufacturer's capacity rating of the actual system
 4. After installation and before and after installing the thermal insulation, subject heat to testing using a 1000 VDC megger. Minimum insulation resistance should be between 20 to 1000 megohms regardless of the length.

- B. Submit records of test for approval prior to substantial completion; insert in the Owner's Manual.

END SECTION 22 05 33

SECTION 22 07 19

PLUMBING PIPING INSULATION

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.

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 $\frac{3}{4}$ " 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 $\frac{3}{4}$ " 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 $\frac{1}{2}$ " 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 1/2" 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 or 2.2" x 3/4# duct wrap with 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.

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" & 3/4" 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 water.
 - 2. Cold water in exterior walls and within 8 feet of exterior wall.
 - 3. Cold water in boiler/mechanical rooms subject to freezing.
 - 4. Make-up water
 - 5. Horizontal sanitary drain piping that receives condensate
 - 6. 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

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 1/2" 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

<u>INSULATED UNIT</u>	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 22 07 19

SECTION 22 11 16

DOMESTIC WATER PIPING AND APPURTENANCES

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

2 PRODUCTS

2.1 PIPING AND FITTINGS

- A. Below Slab on Grade Piping for Water Entries:
 - 1. 2 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.

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 located above accessible ceilings. Where there is not an accessible ceiling, provide access panels. Refer to sizing and placement data as indicated in PDI Standard PDI-WH-201.

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. Prior to starting work, verify system is complete, flushed and clean.
- B. Inject chorine disinfectant in liquid, powder, tablet or gas form throughout the system to obtain 50 to 80 Mg/L residual.
- C. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 20% of the outlets.
- D. Retain disinfectant in system for 8 hours (minimum), 24 hours (maximum). During the disinfection process, operate all valves and accessories.
- E. If final disinfectant residual tests less than 25 Mg/L, repeat treatment.
- F. Flush disinfectant from system until chemical and bacteriological tests prove water quality equal to that of the service main.
- G. Take samples no sooner than 24 hours after flushing from at least 10% of the outlets and from the water entry.
 - 1. Obtain a minimum of one water sample flushing from at least 10% of the outlets and from the water entry.
 - 2. Take samples from faucets located at highest point in the building, and farthest point from the main water supply.
- H. After final flushing, remove aerators, clean and replace.
- I. Chemical and bacteriological tests shall be conducted by a state certified laboratory.
- J. The firm performing the disinfection shall have chemical laboratory experience.
- K. Provide a laboratory report to indicate the following information.
 - 1. Name and address of the approved laboratory testing the samples.
 - 2. Name and location of the project and date the samples were obtained.
 - 3. Mg/L chlorine during retention.
 - 4. Mg/L chlorine after flushing.
 - 5. The coliform organism count. (An acceptable test shall show absence of coliform organisms.)
- L. If analysis does not satisfy the specified minimum requirements, repeat the disinfection procedure.

- M. Submit for approval to the Architect/Engineer a copy of the laboratory report and the certification of performance. An approved copy of each document shall be inserted in the Owner's manual.

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 22 11 16

SECTION 22 11 23

DOMESTIC WATER PUMPS

1 GENERAL

1.1 WORK INCLUDED

- A. General characteristics for pumps specified in Division 22 - Plumbing.

1.2 RELATED WORK

Requirements for pumps are specified in other sections of Division 22 - Plumbing, including the following:

- A. Division 22 Plumbing - Electrical Provisions of Plumbing Work.

1.3 PUMP SELECTION

- A. Select pumps conservatively for scheduled conditions. Furnish pumps that have reasonably high efficiencies, with peak efficiency at or near rated conditions. Select pumps that will operate stably at 15' suction lift despite substantial reduction in head or substantial increase in delivery.
- B. If the pumps proposed are not considered suitable, submit manufacturer's data on other pumps, for review.
- C. Scheduled design flow, design head, pump efficiency, and motor horsepower are the minimum acceptable.
- D. The pump curve shall rise continuously from maximum flow to cut-off.
- E. Shut-off head approximately 10 percent greater than design head, unless otherwise indicated in pump schedules.
- F. Pump brake horsepower shall not exceed the motor horsepower rating over the entire operating range from shut-off to run-out.
- G. Select the pump for operation at or near peak efficiency.
- H. Cavitation-free at all points on the curve.
- I. Impeller diameter shall not exceed 90 percent of the maximum published diameter.

1.4 PUMP SIZE AND TYPE

- A. Provide motor-driven pumps of the type and speed scheduled. Select pumps that are not overloaded throughout the entire range of pump operation. Provide pump connection sizes as indicated.
- B. Submit copies of manufacturer's performance curves, as shop drawings on each pump. Clearly mark the curves for each pump to indicate the diameter of the impeller and the selection point.

1.5 CERTIFIED DATA

- A. Submit factory certified pump curves showing pump performance characteristics with pump and system operating points plotted. Curves shall include as a minimum, flow (gallons per minute), head (feet of water), all available impeller diameters (inches), efficiency (percent), net positive suction head required (feet of water), brake horsepower, pump size and pump model. Show pump curves with system curve plotted.

2 PRODUCTS**2.1 DOMESTIC HOT WATER CIRCULATING PUMPS (SMALL) FRACTIONAL HORSEPOWER**

- A. Pump Construction:
1. Wet-rotor, in-line, single stage
 2. Bronze housings with 1/2" and 3/4" sweat connections
 3. Stainless steel housing with union threaded connections
 4. Integrated check valve inside union fitting on a sweat pump housing
 5. Built-in 5-foot, 115 volt AC line cord with NEMA 3 Prong male plug or line cord
 6. Built-in timer
 7. Aquastat thermostatic control
- B. Acceptable manufacturers:
1. Armstrong
 2. Wil
 3. Grundfos

2.2 SUBMERSIBLE SUMP PUMPS AND SEWAGE EJECTORS

- A. Pump Construction:
1. Hermetically sealed motor
 2. Positive action air operated diaphragm switch
 - a. High water alarm contact
 3. Housing and base cast iron construction
- B. Provide an alarm terminal cabinet.
1. In the event of a high water alarm, energize a pulsing 2" diameter red signal light with graphic "sump pump high water alarm".
- C. Test the sump pump package by operation of the completed system through four cycles of operation.
1. Fill the sump to operational levels
 2. Visually check level controls
 3. Pump operation
 4. Verify absence of piping leaks, sump leaks, excessive noise, and excessive vibration
 5. Verify alarms
 6. Verify pump capacity
- D. Sump pump package capacity shall be as scheduled.
- E. Acceptable Manufacturers:
1. Hydromatic
 2. Little Giant Pump Co.
 3. Weil

4. Goulds
5. Grundfos
6. Crane (Barnes) Air Pumps
7. Ebara
8. Zoeller Pumps

2.3 FLOW INDICATOR

- A. Flow Indicator
 1. Bronze Construction
 2. Rotating wheel
 3. Line Size
 4. Double Window
 5. Ernst Flow Industries Model EFI E-57-3

3 EXECUTION

3.1 INSTALLATION

- A. Install the pumps in accordance with Manufacturer's "Installation, Start-up and Service Instructions".
 1. Provide access space around pumps for service.
 2. Lubricate pumps prior to start-up.
 3. Install hot water circulator horizontally, properly supported to wall, in an accessible location for testing and maintenance at a height not to exceed 60" above finished floor. Install line size Ernst bronze rotating wheel, flow indicator with double window, downstream of circulator.
- B. Provide a line size isolation valve and strainer on the pump suction and a line size silent check valve and balancing valve on the pump discharge.
- C. Support piping adjacent to the pump such that no weight is carried on the pump casing. Decrease from pipe size with eccentric reducer on suction side and concentric increaser on discharge side.
- D. Ensure pumps:
 1. Operate at specified system fluid temperatures without vapor binding and cavitation.
 2. Are non-overloading in parallel and individual operation.
 3. Operate within 25 percent of midpoint of published maximum efficiency curve.
- E. Refer to pump detail on the Contract Drawings for piping accessories to be provided.

3.2 ALIGNMENT FOR BASE MOUNTED PUMPS

- A. Set the pump on a concrete inertia base or concrete housekeeping pad as specified. Anchor, level and grout.
- B. Align the pump and driver in accordance with Hydraulic Institute Standards for centrifugal, rotary and reciprocating pumps.
- C. Realign the pump and driver after initial leveling of pump base before placing the grout and again after the grout has set and the foundation bolts are tightened. Recheck the alignment after the piping has been connected.

3.3 MANUFACTURER START-UP SERVICE ALIGNMENT

- A. After installation, the pumps and motors are to be aligned by the manufacturer or their representative utilizing a dial indicator. After completion, a formal report must be submitted by the Manufacturer to the Engineer prior to final acceptance. This report must include pump serial number, location, beginning and final alignment at a minimum.
 - 1. Technicians, as required, shall be trained and experienced in the work they perform (Contractor start-up / alignment is unacceptable).
- B. Before starting pumps, but after connecting piping:
 - 1. Align shafts and coupling with a precision dial indicator alignment instrument to the minimum tolerances .004 (TIR) per inch of coupling radius or as recommended by the manufacturer, whichever is the greater.
 - 2. Tabulate the actual pump alignment reading with manufacturer's minimum tolerances.
 - 3. Submit readings for approval.
 - 4. Include the approved readings in the Owner's Maintenance Manual.

3.4 FINAL PUMP FLOW CALIBRATION

- A. Based on the results of the final phases of the test and balance sequences, if the flow of the unthrottled pump is more than 10% above the scheduled values:
 - 1. Request detailed instructions from the pump manufacturer for the correct impeller diameter.
 - 2. Trim the impeller to the diameter recommended by the manufacturer, employing precision machinery.
- B. Enter the information on the final configuration of the pump in the Owner's Manual.
 - 1. Modify the pump nameplate to reflect the correct head and flow data and the impeller diameter.

3.5 SPARE PARTS

- A. Provide the following spare parts and material to the Owner for his use after the warranty period.
 - 1. A mechanical seal for each pump
 - 2. A set of bearings for each pump

END OF SECTION 22 11 23

SECTION 22 13 16

SOIL, WASTE AND SANITARY DRAIN PIPING, VENT PIPING AND APPURTENANCES

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

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
 - c. MiFab Mi-XHub
 - 2. No-Hub Clamps - Vents
 - a. Husky SD – 2000
 - b. Mission Rubber Co., LLC Heavy Weight Couplings
 - c. Clamp-All Hi-TorQ 80 or approved equal
 - d. Mifab Mi-XHub
- 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. Transition couplings by Mission or Fernco are acceptable.
- 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.
 - 4. Heavy bodied solvent cement (gray) only. Medium body solvent cement (clear) not acceptable.
- C. Below Slab on Grade Piping for Grease Waste:
 - 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.
 - 4. Heavy bodied solvent cement (gray) only. Medium body solvent cement (clear) not acceptable.

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 discharge.

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 1/4-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-, eighth-, 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. Hub Drains. Install hub drains where indicated, with the top of the hub 1/2 above the finished floor, unless otherwise indicated on the drawings.
- C. 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.

- D. 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 for 1 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 22 13 16

SECTION 22 14 13

ROOF DRAINAGE PIPING AND APPURTENANCES

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

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
- B. All No-Hub clamps must have 4 bands minimum. Sizes 5" through 10" shall have six bands minimum.
 - 1. No-Hub Clamps – Storm:
 - a. Husky SD 4000
 - b. Clamp-All Hi-Torq 125
 - c. MiFab Mi-XHub
- C. 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. Transition couplings by Mission or Fernco are acceptable.

2.2 STORM PIPE AND FITTINGS

- A. Above Ground 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
 6. Provide Hold-Rite pipe restraints as required by CISPI.
- B. Below Slab on Grade:
1. Provide Schedule 40 PVC plastic pipe and DWV fittings with solvent welded joints. Pipe and fittings shall conform to ASTM D 1784-82.
 2. Heavy bodied solvent cement (gray) only. Medium body solvent cement (clear) not acceptable.

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 for 1 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 22 14 13

SECTION 22 20 00

PLUMBING PIPE AND PIPE FITTINGS - GENERAL

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

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.

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.

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 manufacturer, 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.
- 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.
 - 2. Snap-lock sleeves thru non-fire rated drywall are acceptable.
- 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 22 20 00

SECTION 22 33 13

TANKLESS ELECTRIC WATER HEATER

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.

2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Chronomite
- B. EEMAX

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.

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 22 33 13

SECTION 22 34 32

GAS-FIRED DOMESTIC WATER HEATER (High Efficiency)

1 GENERAL

1.1 WORK INCLUDED

- A. Gas-fired domestic hot water heating systems, including hot water heaters, storage tanks, control valves, and pressure and temperature relief valves, as required.

1.2 RELATED ITEMS

- A. Division 22 Plumbing:
 - 1. Domestic Water Piping
 - 2. Gas Piping
 - 3. Flue Piping
 - 4. Plumbing Piping Insulation

1.3 CERTIFICATION

- A. Provide water heater listed by UL Laboratories, according to ANSZ21.10 Standards governing storage-type water heaters. Must meet ASHRAE/IESNA 90.1-1999 and be design-certified by Underwriter's Laboratories for 180°F water. Must meet SCAQMD Rule 1146.2 for low-nox emissions.

1.4 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.

2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. A.O. Smith
- B. Rheem
- C. Lochinvar
- D. PK- Hidra

2.2 CAPACITY

- A. Water heaters shall have the storage capacity and gallons per hour recovery at 100°F rise as scheduled.

2.3 TANK

- A. Construct the tank with a 125 psi ASME rating in accordance with the ASME Code, Section IV. Tank shall have a seamless glass-lined steel tank construction.

- B. Powered Anodes.

2.4 BURNER

- A. A spiral-shaped heat exchanger placed entirely inside the tank which shall be glass-lined on the flue gas side to protect against acidic flue gas condensate.
- B. Heater shall have a down-fired power burner designed for precise mixing of air and gas for optimum efficiency, requiring no special calibration on start-up.

2.5 INSULATION

- A. Insulate the water heater with factory applied foam insulation and trim with a heavy-gauge, enameled steel jacket.

2.6 CONTROLS

- A. Furnish 120V controls for heaters of 100,000 BTUH and above. Controls shall be an integrated solid-state temperature and ignition control device with integral diagnostics, LED fault display capability, and a digital display of temperature system.

2.7 FLUE

- A. This water heater(s) shall be suitable for sealed combustion direct-venting with 4" diameter Polypropylene Pipe (UL 1738) air intake pipe and 4" diameter Polypropylene Pipe (UL 1738 exhaust pipe for a total of 70 feet of intake and 70 feet of exhaust. Provide a properly sized thermal expansion tank as scheduled on drawings. Refer to manufacturer's installation instructions for material types used in air intake and exhaust pipe use.

2.8 CARBON MONOXIDE MONITORING SYSTEM

- A. Provide and install a manual reset Carbon Monoxide Detector located within the boiler room when combustion air is ducted to boilers. The Carbon Monoxide Detector and the boilers shall be interlocked so that the burners will not operate when the level of CO in the room rises above 50ppm. The Carbon Monoxide detector shall disable the boiler's burner upon loss of power to the detector.
- B. Carbon Monoxide Sensor with two year warranty by U.S. Draft Co. Model CGM-605 with model XB expansion module.
 - 1. Provided with pre-programmed dry contacts to shut down equipment during unsafe operation.
 - 2. NEMA 1 Enclosure
 - 3. Complies with Texas State Boiler Code 65.603-2015
 - 4. Additional features shall include 0-10 VDC control signal out, visual alarm and audible alarm.
 - 5. Provide expansion board for additional equipment interlocks.

3 EXECUTION

3.1 INSTALLATION

- A. Install a line size valve in the cold water supply close to each heater and a line size plug cock in the gas supply close to each heater.

- B. Provide approved dielectric couplings at all cold water and hot water connections to storage tank, and at pressure and temperature relief valve connection.
- C. Install according to manufacturer's specifications and pipe as shown.
- D. Install water heater in galvanized drain pan piped to floor drain. Provide ¾" outlet connection. Elevate water heater tank bottom above drain pan as to not allow standing water inside of drain pan to touch bottom of tank.
- E. Provide and install acid neutralization box for each heater on condensate from exhaust vent.

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.
- B. Startup procedure shall include a functional test of Carbon Monoxide Detector. Simulate an alarm condition and demonstrate the functionality of the detector shutting down the appliances. Owner / Engineer shall be present to witness test.

END OF SECTION 22 34 32

SECTION 22 40 00

PLUMBING FIXTURES AND FIXTURE CARRIERS

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.

2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Plumbing Fixtures (Vitreous China):
 - 1. American Standard.
 - 2. Crane
 - 3. Toto
 - 4. Eljer
 - 5. Zurn
- B. Plumbing Faucets:
 - 1. Chicago.
 - 2. T&S Brass.
 - 3. Symmons
 - 4. Zurn
- C. Supports and Carriers:
 - 1. Wade
 - 2. Zurn
 - 3. J.R. Smith.
 - 4. Josam.
 - 5. Watts
 - 6. MIFAB
- D. Flush Valves:
 - 1. Sloan
 - 2. Zurn
 - 3. Toto

- E. Supplies, Stops and Chrome Plated Tubular Brass:
 - 1. McGuire
 - 2. Chicago
 - 3. Zurn
- F. Water Closet Seats:
 - 1. Beneke
 - 2. Church
 - 3. Olsonite
 - 4. Bemis
 - 5. Centoco
- G. Electric Drinking Fountains:
 - 1. Halsey Taylor
 - 2. Elkay
 - 3. Oasis
- H. Floor Drains:
 - 1. Wade
 - 2. J.R. Smith
 - 3. Zurn
 - 4. MIFAB
 - 5. Watts
 - 6. Josam
- I. Cleanouts:
 - 1. Wade
 - 2. J.R. Smith
 - 3. Zurn
 - 4. MIFAB
 - 5. Watts
 - 6. Josam
- J. Shower Valves
 - 1. Chicago
 - 2. Acorn
 - 3. Symmons
 - 4. Bradley
 - 5. Moen Commercial
- K. Stainless Steel Sinks:
 - 1. Elkay
 - 2. Just
- L. Mop Sinks:
 - 1. Crane Fiat
 - 2. Stern Williams
 - 3. Acorn
- M. Roof Drains:
 - 1. Wade
 - 2. J.R. Smith
 - 3. Zurn
 - 4. MIFAB

- 5. Watts
- 6. Josam
- N. Thermostatic Mixing Valves
 - 1. Lawler
 - 2. Symmons
 - 3. Leonard
- O. Emergency Safety Equipment
 - 1. Bradley
- P. Shock Arrestors:
 - 1. Precision Products
 - 2. Sioux Chief
 - 3. Watts
- Q. Backflow Preventors
 - 1. Watts
 - 2. Febco
 - 3. Wilkins
 - 4. Beeco
- R. Hose Bibbs
 - 1. Wade
 - 2. Chicago
 - 3. Josam
 - 4. Woodford
 - 5. Zurn
 - 6. J.R. Smith
 - 7. MIFAB
- S. Wall Hydrants
 - 1. Wade
 - 2. Woodford
 - 3. Zurn
 - 4. J.R. Smith
 - 5. Josam
 - 6. MIFAB
- T. Solids Interceptors (Point of Use)
 - 1. Wade
 - 2. J.R. Smith
 - 3. Zurn
 - 4. Josam
 - 5. MIFAB
- U. Solids Interceptor (Pre-cast Concrete)
Park USA

2.2 REQUIREMENTS

- A. Refer to the drawings for equipment to be supplied.

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.
- K. Trap primer valves installed in concealed spaces shall have approved access doors for accessibility.

END OF SECTION 22 40 00

SECTION 22 63 11

GAS PIPING AND APPURTENANCES

1 GENERAL

1.1 WORK INCLUDED

- A. Furnish and install steel gas pipe inside buildings, including the supply line from the meter, service lines to gas equipment and appliances, termination of the service line with a plug valve, drip leg, and final connection to equipment and appliances with unions.
- B. Coordinate service line from utility main and extend to meter. Coordinate installation of the service line and meter with Gas Company.
- C. Extend steel gas piping from meter to inside the building to all fixtures, appliances and equipment requiring gas.

1.2 RELATED WORK

- A. Division 22 Plumbing
 - 1. Plumbing Pipe and Fittings
 - 2. Valves and Vents

1.3 UTILITY CONNECTIONS

- A. Make arrangements for and pay all fees and connection charges for obtaining service to the building.

2 PRODUCTS

2.1 PIPE AND FITTINGS - ABOVE GRADE

- A. Pipe 2 inch and Smaller:
 - 1. Schedule 40 ASTM A 53 black steel pipe
 - 2. Factory fabricated socket weld fittings.
- B. Pipe Larger than 2 inch:
 - 1. Schedule 40 ASTM A 53 black steel pipe.
 - 2. Factory fabricated butt weld fittings for welded steel pipes shall conform to ASTM A-234 WPB (seamless weld fittings).
- C. Unions:
 - 1. Standard 150 lb. (300 lb. water, oil or gas) malleable iron.
 - 2. Ground joint unions, with bronze seat.
 - 3. Flange joints for pipe larger than 2 inch in diameter.
- D. Flanges:
 - 1. Steel flanges. ANSI B16.5 and ASTM A-105.

2.2 PIPE AND FITTINGS - BELOW GRADE OUTSIDE BUILDING

- A. Polyethylene pipe shall be ASTM D3350 Grade PE24 cell classification and ASTM D1248 Class B material classification.
- B. Pipe shall be medium density polyethylene PE 2406 and PE 2708 manufactured by Poly Pipe Industries, Inc. or Performance Pipe.

- C. Polyethylene yellow molded butt fittings for use with medium density polyethylene pipe shall meet testing requirements of ASTM D2513 and resin material listing of ASTM D3350 with PPI designation of PE 2406 as manufactured by Central Plastics Co.

2.3 VALVES

- A. See Section 22 05 23.

2.4 GAS PRESSURE REGULATOR

- A. Size the gas pressure regulator in accordance with the manufacturer's recommendations for flow quantities and reduced pressure as required for all equipment. Coordinate final equipment gas pressure requirements prior to ordering regulators. Provide American Meter Company regulators or approved equal, suitable for outdoor installation. Regulators outside exposed to weather shall be installed with vent in vertical down position.
- B. All line pressure regulators shall be listed in accordance with ANSI (American National Standard) Z21.80 and CSA (Canadian Standards Association Standard) 6.22.

3 EXECUTION**3.1 INSTALLATION**

- A. Installation Standards: Install gas piping in accordance with recommendations of the National Fire Protection Association.
- B. Drip Legs: Install a capped drip leg 6 inches long at the base of each vertical rise.
- C. Coating and Wrapping. Coat and wrap underground piping in accordance with the service utility company standards.
- D. Sleeves.
 - 1. Encase gas piping running in or through solid partitions with thin wall metal conduit. Sleeve piping and fittings shall be two pipe sizes, but not less than 1 inch larger than encased gas piping.
- E. Do not install gas piping exposed to view inside public area, or occupied spaces, without prior written approval.
- F. Weld all gas piping above grade.
- G. Provide test ports and isolation valves to enable proper testing of system in the future.
- H. Provide isolation valve and unions across regulators for proper removal.
- I. Provide transition risers where below grade polyethylene pipe changes to steel pipe above grade.
- J. Gas Pressure Regulators / Vents:
 - 1. Piping shall be sized in accordance with the regulator manufacturer's instructions. Never use pipe sizes smaller than the vent size; smaller pipe sizes restrict the gas flow. Where there is more than one regulator at a location, each regulator shall have a separate vent to the roof / outdoors. Headers with various installed devices can cause regulator malfunction.
 - 2. Support the vent pipe to eliminate strain on the regulator diaphragm case.
 - 3. Install vent piping from regulators to location to prevent gas smells from entering building. Do not locate the vent line terminus near windows, fans, or

- other ventilation equipment. See the installation instructions furnished with the regulator.
4. Install double elbows and insect screen at end of piping to prevent moisture and insects from entering. Always point outdoor vent pipes in the downward position to reduce the possibility of rain, snow, sleet, and other moisture entering the pipe.
 5. When installed inside building route vents horizontally and terminate through building sidewall. The vent must be piped to the outside atmosphere using the shortest length of pipe, the fewest possible pipe elbows, and a pipe diameter as large as the vent size or larger. If a long gas run must be used, increase the pipe one nominal size every ten feet to keep the flow restriction as low as possible. Vents terminating through roof must have prior approval from Architect before installation. Through roof penetrations shall be minimized.
 6. Regulators installed outside or on roof top: Install regulator vent turned downward with insect screen over vent opening. The vent shall be designed to prevent the entry of water, insects, or other foreign materials that could cause blockage.
 7. Ensure the end of the vent line is away from ANY potential ignition sources. It is the installer's responsibility to ensure the vent line is exhausting to a safe environment
 8. Adhere to all applicable codes and regulations.

3.2 TESTING GAS PIPING

- A. Preliminary gas test as required by Code, but minimum test pressure of 50 PSI held for not less than eight hours without noticeable drop.
- B. Test joints with a soap solution while lines are under pressure.
- C. Repair leaks.
- D. Final gas test shall be with a 24 inch column of mercury or a diaphragm gauge with a minimum dial size of 3-1/2 inches with a set hand and a pressure range not to exceed twenty (20) psig with 2/10-pound increments. The minimum test pressure shall not be less than ten (10) psi and the maximum test pressure shall not exceed twelve (12) psig. This test will be observed for no less than (30) thirty minutes with no drop in pressure.
- E. Provide copy of gas pressure test reports in Operations & Maintenance Manual.
- F. Provide Railroad Commission of Texas Pipeline Safety Form PS-86B.
 1. To find form online, go to: Texas School Gas Test Form

3.3 IDENTIFICATION CONDUCTOR

- A. Spiral A #12 AWG insulated copper conductor the full length of the thermoplastic piping system. Fasten to the pipe at 3 foot intervals with plastic tie wraps.
- B. Terminate at each end in a 12 inch x 12 inch x 4 inch FRP junction box.
 1. Bolted gasketed cover with stainless steel screws.
 2. Screw type terminal strip.
 3. Legend on cover "gas pipe identification conductor."
- C. Set in concrete pad.

3.4 PAINT EXPOSED OUTSIDE GAS PIPE

- A. Interior and Exterior Gas piping shall be protected from rust.

- B. Paint pipe with a flat alkyd coating, clean pipe prior to painting by preparing surface by hand tool cleaning per SSPC-SP2-82, applying one coat of Glidden Y-590 Rustmaster Metal Primer White and top coat of Yellow Alkyd Flat Enamel.

END OF SECTION 22 63 11

SECTION 23 01 00

HVAC OPERATING AND MAINTENANCE MANUALS

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.

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.

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 23 01 00

SECTION 23 05 00

MECHANICAL GENERAL PROVISIONS

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.

2 PRODUCTS – NOT USED**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 40 hours dedicated instructor time.
 - 2. 8 hours on each of 5 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 23 05 00

SECTION 23 05 10

HVAC CONTRACT QUALITY CONTROL

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

- A. Mock-up a fan/coil unit 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 23 05 10

SECTION 23 05 12

HVAC SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA

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: $\frac{1}{4}'' = 1'-0''$.
- 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.

2 PRODUCTS - NOT USED

3 EXECUTION - NOT USED

END OF SECTION 23 05 12

SECTION 23 05 13

ELECTRICAL PROVISIONS OF HVAC WORK

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.

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.

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 23 05 13

SECTION 23 05 14

HVAC CONDENSATE DRAIN PIPING SYSTEM

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. Fan/Coil Units
 - 3. Air Handling Units
 - 4. Chilled Water Pumps
 - 5. Air Compressor Storage Tanks
 - 6. Equipment Drain Pans
 - 7. Heat Pump Units

2 PRODUCTS

2.1 PIPE MATERIAL

- A. Type "L" copper with drainage pattern fittings.

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 23 05 14

SECTION 23 05 17

HVAC ACCESS DOORS

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.

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

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 23 05 17

SECTION 23 05 18

VARIABLE FREQUENCY INVERTER

1 GENERAL

1.1 WORK INCLUDED

- A. Furnish and install a variable frequency inverter for the following equipment items.
 - 1. Variable Volume Air Handling Units.
 - 2. Pumps.

1.2 RELATED WORK

- A. Division 23 Mechanical
 - 1. Electrical Provisions of Mechanical Work.
 - 2. Air Handling Units
 - 3. Pumps
 - 4. Building Management Control System Sequences

1.3 COOPERATION WITH OTHER TRADES

- A. Coordinate this work with work under Division 26 Electrical to ensure that intended functions are achieved.
- B. Coordinate the size of the variable frequency inverter with the equipment being served by the inverter. The rated current output amps are to be equal to or greater than motor rated full load amps.

1.4 SUBMITTALS

- A. Submit manufacturer's information and shop drawings as specified.
 - 1. Complete technical details.
 - 2. Dimensions and manufacturer's installation manual.
 - 3. Schematic diagrams of the circuitry and field connections.
 - 4. Manufacturer's start-up manual.

1.5 STANDARDS

- A. UL.
- B. CSA.
- C. ISO 9001
- D. NEC.
- E. FCC.

1.6 WARRANTY

- A. The manufacturer shall provide a full parts and labor warranty for a period of five (5) years from substantial completion.

2 PRODUCTS**2.1 ACCEPTABLE MANUFACTURERS**

- A. ABB

2.2 CABINET

- A. The inverter and all accessories shall be provided within a wall mounted UL Listed NEMA 1 enclosure in interior AHU mechanical rooms and in NEMA 12 enclosure with deadsides and removable hinged, gasketed doors with provisions for locking in all Plant locations. Cabinet shall be constructed of metal for reduction of radio frequency interference (RFI) and electromagnetic frequency interference.

2.3 INTERFERENCE WITH OTHER SYSTEMS

- A. The inverter shall be designed and constructed to comply with IEEE Standard 519-1993 with respect to line noise and RFI generation. All units shall generate less than 3% total harmonic distortion back to the incoming power line at the point of common connection with sensitive equipment. A harmonic analysis shall be submitted with the approval drawings to verify compliance with the latest version of IEEE-519 voltage and current distortion limits as shown in Table 1.2 and 10.3 at the point of common coupling (PCC). The PCC shall be defined as the consumer-utility interface or primary side of the main distribution transformer.
- B. Dual DC Bus filtered chokes (factory installed and wired in the drive enclosure) equivalent to 5% input line reactors shall be provided to minimize harmonics reflected onto the input line.
 - 1. Shall not interfere with computer and other electronic systems in the building.
 - 2. If not inherently protected, provide a suitable isolation transformer.
 - 3. The system shall not produce spikes on the incoming line.
- C. Any inverter that generates sufficient electrical line noise to interfere with the operation of sensitive building equipment shall be field modified or replaced by the inverter supplier at no additional cost to the Owner.

2.4 PROTECTIVE CIRCUITS

- A. Provide the following protection:
 - 1. Input line fuses or molded case circuit breaker rated at 100 AIC.
 - 2. Input line noise suppression with MOV's (metal oxide varistors) and snubber circuits. MOV's shall be provided across incoming line terminals, AC input reactors, DC choke filters, and transistors to protect inverter from voltage surges and spikes.
 - 3. Protection of solid state inverter devices by limiting output current to 110% of inverter rating, automatically prevent overcurrent trip due to momentary overload conditions.
 - 4. Current limiting DC buss fuse between input and output sections of inverter.
 - 5. Input overvoltage trip at 480 vac + 10% trip.
 - 6. Input undervoltage at 480 vac - 10% trip
 - 7. Instantaneous overcurrent protection of solid state inverter devices.
 - 8. Individual overcurrent protection of solid state inverter devices.
 - 9. Output overvoltage trip.
 - 10. Loss of input phase, phase reversals, or blown fuse.
 - 11. Thermal overload trip for overload protection of solid state devices.

12. Ground fault protection on start-up.
13. Output line to line short circuit protection.
14. Phase to phase short circuit or severe overload conditions of output.
15. Overload of motor.
16. Frequency stall.
17. DC buss high voltage.
18. Control function error.
19. Heatsink over temperature (Max. operating ambient: 122 degrees F)
20. Controller able to operate without a motor or any other equipment connected to the output (To facilitate startup and troubleshooting).
21. Capable of restarting into a rotating motor without component damage.
22. Shut down safely without component failure in the event of a sustained power loss, and will automatically return to normal operation, if start is "on" and power is restored.
23. Shut down safely without component failure in the event of a momentary power loss. Automatically return to normal operation if the start is "on", and normal power is restored. Capable of establishing speed control without shutdown or component failure.
24. Designed for input power contactor opening or closing while control is activated, without damage to the controller.
25. Automatically reset trip resulting from overcurrent, undervoltage, overvoltage, or over temperature, and automatically restart after removal, or correction of the faulty condition.
26. Provide status lights or digital display for indication of failure conditions, and form C relay provided for remote indication. Digital display or status lights to indicate power on, at speed, and drive enabled.
27. Operation and fault diagnostic function circuits shall be built into each inverter that provides information in determining the cause and source of a fault.
Diagnostics to provide the following information:
 - a. Operating mode at trip (Accel, Decel, Constant speed).
 - b. Output current at trip.
 - c. Output voltage at trip.
 - d. Additional faults that occurred simultaneously or immediately before displayed tripped.Any drive requiring separate card to provide this information shall provide a diagnostic card for each drive.
28. DC link reactor.
29. Input power disconnect, lockable type.
30. Input power disconnect switch / circuit breaker, with lockable type handle.

2.5 OPERATOR DEVICES

- A. The following operator devices shall be door or remote mounted:
 1. Digital keypad and LCD provided to perform all parameter adjustments, operation monitoring, and operation programming.
 2. Power on indication light.
 3. Flush mounted meters or digital display to indicate output voltage, output frequency, and output current, in percent of maximum 0 to 100%.
 4. Manual/Off/Auto 3 position selector switch (hand-off-auto) and manual speed setting control to provide the following control sequences:
 - a. In automatic mode, controller shall follow an external control signal and respond to remote start-stop contact.
 - b. In manual (hand) mode, controller shall follow speed signal set via door mounted keypad and start/stop switch. Switching from "hand" to "auto" and vice versa shall require a single keystroke to a dedicated changeover

- key. Inverters requiring multiple keystrokes and/or reprogramming of internal parameters to accomplish changeovers are not acceptable.
- c. An integral "safety interlock" protection shutdown circuit shall be provided for interface with firestats, smoke detectors, high static pressure limit switches, vibration switches, etc.
 - 5. Programmable lockout code to prevent unauthorized programming.
 - 6. Critical frequency avoidance capability (up to 3 resonant points).

2.6 FIELD ADJUSTMENTS

- A. The following shall be adjustable in the field:
 - 1. Maximum Speed: 0 to 125% adjustable.
 - 2. Minimum Speed: 0 to 100% adjustable.
 - 3. Acceleration/deceleration rates: 0 to 3600 sec.
 - 4. Instantaneous overcurrent trip: 50% to 2000%.
 - 5. Volts/hertz ratio: Field adjustable to 16 patterns or set for automatic selection of proper V/F load profile to operate motor without overdriving or overloading.
 - 6. Current limit circuit: 60 to 100%.
 - 7. Carrier frequency: 6 to 16 KHZ.
 - 8. Control interface: selectable to follow a 0-5 VDC, 0-10 VDC, 4-20 MA, either direct or indirect acting.
 - 9. Control signal Bias: 0 to 80 HZ.
 - 10. Control signal gain: 0 to 80 HZ.
 - 11. Calibration of remote speed signal: 0 to 80 HZ.

2.7 ELECTRICAL CONSTANT SPEED BYPASS

- A. Provide all components and circuitry necessary to provide manual bypass of the inverter. The bypass package shall be mounted in a cabinet common with the inverter and shall be constructed in such a manner that the inverter can be removed for repair while still operating the motor in the "bypass" mode. Manual bypass shall contain the following:
 - 1. Two contactors mechanically interlocked via a three position through the door selector switch to provide the following control:
 - a. "Inverter" Mode connects the motor to the output of the inverter.
 - b. "Bypass" Mode connects the motor to the input sine wave power. Transfer must occur with input disconnect open. Motor is protected via thermal overload.
 - c. "Off" Mode disconnects motor from all input power.
 - 2. A molded case circuit breaker or fused disconnect switch with door interlocked handle (lock out type) that interrupts input power to both the bypass circuitry and the drive.
 - 3. An input contactor, interlocked with both the thermal motor overload and external safeties which disconnects power to the motor regardless of the mode of operation (either "inverter" or "bypass" mode).
 - 4. A thermal overload to provide protection of motor in the bypass mode.
 - 5. A safety interlock circuit that disconnects power to the motor (regardless of the mode of operation – "inverter" or "bypass") in response to a signal from the thermal overload and/or external safety circuits.
 - 6. Line voltage to 24 volt DC power source, fused per NEC, shall provide power to all bypass control circuits.

2.8 SERIAL COMMUNICATIONS

- A. The VFD shall have the capability of communicating with the EMS control system via an RS-485 serial port.

- B. VFD shall be provided with protocol information specific to the selected EMS control manufacturer and shall be pre-configured at the factory to automatic communications, without the need for field programming.
- C. Serial communications capabilities shall be included, but not limited to: run/stop control, speed set adjustment, proportional/integral or PID control adjustments, current limit and accel/decel time adjustments. The drive shall also have the capability of allowing the DDC system to monitor the following feedback signals: process variable, output speed/frequency, current, torque, power (KW), operating hours, kilowatt hours; relay outputs, and diagnostic warning and fault information.
- D. The VFD shall allow the DDC system to control the drive's digital and analog outputs and monitor all drive digital and analog inputs via the serial interface.
- E. Provide BACnet interface card.

3 EXECUTION

3.1 INSTALLATION

- A. Installation as per manufacturer's recommendations and requirements.
 - 1. Inverter chassis is properly grounded.
 - 2. Line, Load, Control, and Fire/Safety wiring are installed in separate conduits.
 - 3. Both ends of conduit entering and leaving VFD into AHU cabinets and motors must be sealed air tight.

3.2 MANUFACTURER START-UP SERVICE

- A. Factory trained personnel shall be provided for start-up to meet requirements for extended warranty, minimum (1) day per unit.
 - 1. The manufacturer shall provide start-up commissioning of the VFD and its optional circuits by a factory certified service technician who is experienced in start-up and repair services. Sales personnel and other agents who are not factory certified shall not be acceptable as commissioning agents.
 - 2. Start-up services shall include checking for verification of proper operation and installation for the VFD, its options and its interface wiring to the building automation system.
 - 3. Adjustable devices, components, and assemblies to assure optimum performance.
 - 4. Make final adjustments to the installed drive to assure proper operation of the fan system. Obtain performance requirements from installer of driven loads.
 - 5. Assistance will be provided to the Owner (upon request) to determine the optimum capacitance for per factory correction and avoidance of potential resonance problems and will determine optimum line filter required.
 - 6. A written report, duly signed by the technician detailing set points of adjustable devices, amperages recorded, and any other pertinent data. This information is to be included in the operation and maintenance manual.
- B. Input DC voltage to dry motor windings when fan is not in operation at the following locations:
 - 1. Cooling tower fan motor
 - 2. Motors downstream of coils
 - 3. Rooftop unit motors

3.3 DEMONSTRATION AND TRAINING

- A. Provide system demonstration and training to personnel, Owner, and/or Owner's selected representatives. Provide a minimum of 4 hours of technical training.
- B. Demonstrate operation of controllers in the automatic and manual modes.
- C. Provide a minimum of two days of technical training for the owner's operating and technical staff. Schedule training with owner's authorized representatives, during normal business hours and not less than 30 days prior to planned session.
- D. Training may be consecutive or random, at Owner's option.

END OF SECTION 23 05 18

SECTION 23 05 19

HVAC PRESSURE AND TEMPERATURE INSTRUMENTS

1 GENERAL

1.1 WORK INCLUDED

- A. This section specifies gauges, thermometers, wells and/or pressure and temperature test stations to be installed as specified.

1.2 RELATED WORK

- A. Division 23, Mechanical
 - 1. 23 05 00 - Mechanical General Provisions
 - 2. 23 20 00 - Pipe and Pipe Fittings, General
 - 3. 23 05 23 - Valves, Strainers and Vents
 - 4. 23 21 13 - Hot Water and Chilled Water Piping, Valves and Appurtenances

2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS - GAUGES AND THERMOMETERS

- A. Trerice
- B. Taylor
- C. Marsh
- D. Weksler
- E. Marshalltown
- F. Weiss
- G. Miljoco

2.2 PRESSURE GAUGES

- A. Case and Ring: 4" type 304 stainless steel; liquid filled case with stainless steel bayonet ring.
- B. Dial: White aluminum with black markings
- C. Window: Clear acrylic
- D. Tube: Phosphor bronze and forged brass socket.
- E. Gauge accuracy: +/- 1% over operating range.
- F. For pulsating service, provide impulse dampers.
- G. Without flange for pipe mounting.

- H. With flange for wall mounting.
- I. Weiss Model: LF44S-1B or equal.

2.3 THERMOMETER WELLS

- A. Brass or type 300 stainless steel. Machined bar stock, 1-piece construction.
- B. Where installed in insulated piping or vessels, provide with extension neck to match insulation thickness.
- C. Provide metal-to-metal contact with bulb chamber for maximum sensitivity.
- D. Wells shall be sized to extend a minimum of 50% into pipe.

2.4 THERMOMETERS IN PIPING SYSTEMS OR VESSELS

- A. Die cast aluminum case with baked epoxy finish.
- B. Adjustable angle 9" scale length.
- C. Clear acrylic window.
- D. Brass stem, length to match well.
- E. Red reading organic spirit filled-in magnifying glass column.
- F. White background with black figures and markings.
- G. Brass stems and union connections.
- H. Accuracy: +/- 1% of scale range.
- I. Range:
 - 1. Hot water lines: 30°F to 240°F.
 - 2. Chilled water lines: 0°F to 100°F or 120°F
 - 3. Condenser water: 0°F to 100°F.

2.5 PRESSURE AND TEMPERATURE TEST STATIONS

- A. "Test Station" fitting to receive either a temperature or pressure probe. Fitting shall be solid brass with two valve cores of Nordel.
 - 1. Fitted with a color coded cap strap with gasket.
 - 2. Acceptable Manufacturer: Peterson Equipment Company.
 - 3. Provide with extension neck to match insulation thickness.
- B. Provide to the Owner a fitted case with:
 - 1. Two 0-100 psi pressure gauges as specified and adapters with 1/8" OD probe.
 - 2. Four 5" stem pocket testing thermometers.
 - a. Two with range 25°F to 125°F for chilled water and condenser water.
 - b. Two with range 0°F to 220°F for hot water.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install in accordance with drawing details and manufacturer's recommendations.
- B. Provide a ball valve at each gauge.
- C. Locate gauges and thermometers to be easily readable from the floor at a 5'-6" eye level. Use adjustable angle or rigid stem as required. Install gauges in upright position.
- D. Install gauges in the following locations: across pumps, chiller cooler and condenser, storage tanks, heat exchangers.
- E. Test wells for automatic temperature controls shall be furnished by Building Management Control Section and installed by Mechanical Contractor.
- F. Install thermometer in the following locations: Across chiller cooler and condenser, storage tanks, across heat exchangers, across boiler, leaving side of water heater, leaving water side of tempered water valves, common chilled and hot water lines.
 - 1. Hot water lines: 30°F to 240°F.
 - 2. Chilled water lines: 0°F to 100°F or 120°F
 - 3. Condenser water 0°F to 100°F.

END OF SECTION 23 05 19

SECTION 23 05 23

HVAC VALVES, STRAINERS AND VENTS

1 GENERAL

1.1 SECTION INCLUDES

- A. HVAC Valves
- B. Pipe strainer and suction diffusers.

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°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.
- C. Balancing Valves
 - 1. Provide balancing valves with:
 - a. Corrosion resistant plug with resilient seal when required.
 - b. O-ring stem seal.
 - c. Permanently lubricated, corrosion resistant bearings.
 - 2. Connections
 - a. Through 2" pipe size use threaded connections.
 - b. For valves 2-1/2" pipe size and larger shall be provided with 150 psig flange connections.
 - 3. Provide each valve with:
 - a. Memory stop.
 - b. Plastic drip cap.
 - c. 1/8" gauge tap.
- D. 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 piping is insulated, ball valves shall be equipped with 2" extended handles of

- non-thermal conductive material. Provide a protective sleeve that allows operation of the valve without breaking the vapor seal or disturbing the insulation.
5. Provide with memory stop for balancing valves.
- E. 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" and smaller.
 3. Flange pipe sizes 2-1/2" and larger.
 4. Use screw to solder adapters for copper tubing.
 5. Use grooved body valves with mechanical grooved jointed piping.
- F. Valve Operators
1. Where butterfly valves are provided:
 - a. Provide gear operators on valves 6" and larger.
 - b. Where valves are located 7' or more above the finished floor in equipment room areas provide chain-operated sheaves. Extend chains to about 5' 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" and smaller.
 - d. Provide worm gear operators on discharge side of pumps for balancing, for all sizes of valves.
 - e. All valves 2-1/2" and larger provided by Milwaukee Valve shall be provided with gear operators.
- G. Acceptable Manufacturers
1. Dezurik
 2. Crane
 3. Nibco
 4. Keystone
 5. Milwaukee Valve
- H. Check Valves
1. Bronze body, 2" and smaller, bronze disc (Teflon disc for steam service), regrinding swing check, screw-in cap, threaded connection.
 2. Iron body, 2-1/2" 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.
 3. Acceptable Manufacturers
 - a. Mission Duocheck
 - b. Nibco
 - c. Keystone
 - d. Milwaukee Valve
- 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.

- M. Provide memory stops for all valves used for throttling service. Valves for throttling service shall be butterfly, plug, caged or ball type.
- N. Condenser Water Basin Float Valve:
 - 1. Ductile Iron valve, body and cover
 - 2. Stainless steel trim
 - 3. Fully adjustable high and low level settings
 - 4. Stainless steel float, float linkage and float rod
 - 5. Flow clean strainer
 - 6. CV Flow Control for opening and closing
 - 7. ASTM A 536, B16.42, 150# Class
 - 8. Stilling well
 - 9. Acceptable Manufacturer: CLA-VAL

2.2 PIPE SYSTEMS STRAINERS

- A. Body:
 - 1. "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" size and smaller with screw connections rated 400 psi WOG.
 - 2. Over 2" 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".
 - 2. With 0.45 perforations in piping systems 2-1/2" and 3".
 - 3. With 0.125 perforations in piping systems 4" 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 owners review.
- E. Acceptable Manufacturers
 - 1. Crane
 - 2. Keckley
 - 3. Zurn
 - 4. Mueller
 - 5. McAlear
 - 6. Muesco

2.3 SUCTION DIFFUSER

- A. For each pump as shown on the drawing, provide an angle type suction diffuser. Body is to fit both the pump inlet and suction pipe size.
- B. Components:
 - 1. Inlet straightening vanes.
 - 2. Removable end cap.
 - 3. Gauge ports.
 - 4. Threaded strainer blow down port.

- 5. Adjustable support foot.
- 6. Removable magnetic insert.
- C. The screen shall be as specified for pipe system strainers.
- D. Provide an additional fine mesh disposable strainer for use during start up operations.
 - 1. Remove after 30 days operation and all flushing is complete.
 - 2. Attach to piping for owners review.
- E. Construction:
 - 1. 2" size and smaller with screw connections rated 400 psi WOG.
 - 2. Over 2" size with flanged connections, rated 125 psi WOG.
- F. Fabricate screens of Monel or type 304 stainless steel:
 - 1. With 20 mesh woven wire in piping systems through 2".
 - 2. With 0.045 perforations in piping systems 2-1/2" and 3".
 - 3. With 0.125 perforations in piping systems 4" and larger.

2.4 VALVE SCHEDULE

- A. Hydronic Service
 - 1. Chilled Water Service
 - a. Ball Valves up to 2": Nibco T-585-70-66 w/Nib-Seal insulated Handle
 - b. Butterfly Valve 2-1/2" and larger: Nibco LD - 2000
Keystone Figure 222
 - 2. Heating & Condenser Water Service
 - a. Ball Valves up to 2": Nibco T-585-70-66
 - b. Butterfly Valve 2-1/2" and larger: Nibco LD - 2000
Keystone Figure 222
 - 3. Check Valve:
 - a. Nibco Check Valve: T - 413 - B
 - b. Nibco Check Valve 2-1/2" and larger: F - 918 - B
 - c. Nibco Check Valve 2-1/2" and larger: W - 920 -W (Wafer)
 - d. Keystone Check 2-1/2" and larger: FIQ 810

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 circulating water systems, for balancing duty. Provide infinite position gear operator with memory stop.
- 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" valve for pipes 6" and larger.
 - 2. 3/4" valve for pipes smaller than 6".
 - 3. Terminate with pipe plug.
 - 4. Drain valves shall be ball valves.
- E. 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.

- F. Provide clearance for installation of insulation and access to valves.
- G. Provide access where valves are not exposed.
- H. Provide float valves / stilling wells in cooling tower or condenser water basins for water level control. Provide stilling wells around float valve to prevent turbulence ripples or wind interference.
- I. Butterfly valves shall be installed per ASME B31.3 Process Piping, and ASME B16.5 Pipe Flanges and Flanged.

3.3 PIPE SYSTEMS STRAINERS

- A. Provide an additional fine mesh disposable strainer for use during start up operations.
 - 1. Remove after 30 days operation and all flushing is complete.
 - 2. Attach to piping for owners review.
- B. Provide strainer in supply piping for all coil connections.
- C. Provide strainer in condenser water piping entering chiller.

3.4 WATER SYSTEM AIR VENTS

- A. Provide manual air vents at high points and at any other air pockets of closed circulating pipe systems. Extend 3/8" hard drawn copper tubing discharge drains to nearest floor or hub drain. Provide 1/4" Ball Valve as specified.
- B. Where high point vents are not readily accessible provide additional valves at vent termination.

END OF SECTION 23 05 23

SECTION 23 05 33

HVAC PIPE HEAT TRACING

1 GENERAL

1.1 WORK INCLUDED

- A. Furnish and install a complete industrial, constant wattage, UL listed system of electric pipe heat tracing and controls on all make-up water piping outdoors above grade to prevent freezing. The heat tracing system shall conform to ANSI/IEEE Standard 515-1989.
- B. Protect the pipe, valves, fittings, meters and appurtenances. Apply sufficient cable and overheat thermostat to protect the entire system.

1.2 SUBMITTALS

- A. Submit shop drawings and product data as specified in Section 23 05 12
- B. Submit detailed calculations for length of heat tracing cable per foot of pipe, based on actual length of piping installed.
- C. Submit manufacturer's certified capacity charts with selections plotted thereon.
- D. Submit manufacturer's installation instructions.
- E. Submit full load ampere requirement and voltage for branch circuit.

2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Raychem Corporation
- B. Thermon Manufacturing Company

2.2 COMPONENTS

- A. Self-regulating heater.
 - 1. The self-regulating heater shall consist of two 16 AWG tinned-copper bus wires embedded in parallel in a self-regulating polymer core that varies its power output to respond to temperature all along its length, allowing the heater to be crossed itself without overheating and to be cut in the field. The heater shall be covered by a radiation cross-linked modified polyolefin dielectric jacket.
 - 2. In order to provide energy conservation, and to prevent overheating, the heater shall have a self-regulating factor of at least 90%.
 - 3. The heater shall operate on a line voltage of 120 VAC without the use of transformers.
 - 4. The heater shall be sized according to the following. The required heater output rating is in watts per foot at 50°F (heater selection based on 1-1/2 inch fiberglass insulation on metal piping).
 - 5. The heater shall be XL-Trace as manufactured by Raychem Corporation or XL-Econotrace as manufactured by Thermon Manufacturing Company.

6. Power connection, end seal, splice and tee kits components shall be applied in the field.
7. The system shall be controlled by an ambient sensing thermostat set at 40°F either directly or through an appropriate contactor.
8. Provide an end-of-circuit voltage indicating light

3 EXECUTION

3.1 INSTALLATION

- A. Install and start up the pipe heat tracing system in accordance with the manufacturer's Installation, Start-up and Service Instructions.
- B. Install the pipe heat tracing cable under the pipe insulation.
- C. Apply "Electrically Traced" signs to the outside of the thermal insulation.
- D. Ground fault protection of the equipment shall be provided per the 1996 National Electrical Code, Article 427-22.
- E. Provide a cast aluminum weatherproof NEMA-4 rated junction box for installation of the cable, with pilot light to indicate operation of the cable.
- F. Use only electrical components as recommended by the manufacturer.

3.2 ELECTRICAL WORK

- A. Furnish and install the wire, conduit and raceway systems required for the automatic operation of the pipe heat tracing system. Conform to the National Electrical Code.
- B. The specified wiring work includes:
 1. Wiring of control instruments between thermostat and junction boxes
 2. Installation of thermostat and junction boxes
 3. Wiring from the heat tracing cable to the junction boxes
- C. Related branch circuit power wiring from the junction box to ground fault type circuit is specified to be provided in Division 26.
- D. Provide devices and appurtenances as specified in Division 26.
- E. Identify each circuit at each terminal with a separate tag.
- F. Color code wires in accordance with IPCEA Standards.
- G. Make all joints and connections with approved mechanical connectors.

3.3 TESTING OF THE PIPE HEAT TRACING SYSTEM

- A. Test the pipe heat tracing system:
 1. Simulate freezing outside air conditions
 2. Measure the amperage draw of the heat tracing system
 3. Compare to the manufacturer's capacity rating of the actual system
 4. After installation and before and after installing the thermal insulation, subject heat to testing using a 1000 VDC megger. Minimum insulation resistance should be between 20 to 1000 megohms regardless of the length.

- B. Submit records of test for approval prior to substantial completion; insert in the Owner's Manual.

END SECTION 23 05 33

SECTION 23 05 48

VIBRATION ISOLATION

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.

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. 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.
- B. Spring isolators shall be free standing and laterally stable without any housing and complete with a molded neoprene cup or ¼ inch (6mm) neoprene acoustical friction pad between the base plate and the support. All mountings shall have leveling bolts that must be rigidly bolted to the equipment. Installed and operating heights shall be equal. The ratio of the spring diameter divided by the compressed spring height shall be no less than 0.8. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. Submittals shall include spring diameters, deflection, compressed spring height and solid spring height.
- C. Curb mounted rooftop equipment shall be mounted on spring isolation curbs. The lower member shall consist of a sheet metal Z section containing adjustable and removable steel springs that support the upper floating section. The upper frame must provide continuous support for the equipment and must be captive so as to resiliently resist wind forces. All

directional neoprene snubber bushings shall be a minimum of 1/4 inch (6mm) thick. Steel springs shall be laterally stable and rest on 1/4 inch (6mm) thick neoprene acoustical pads. Hardware must be plated and the springs provided with a rust resistant finish. The curbs waterproofing shall consist of a continuous galvanized flexible counter flashing nailed over the lower curbs waterproofing and joined at the corners by EPDM bellows. All spring locations shall have access ports with removable waterproof covers. Lower curbs shall have provision for 2 inches (50mm) of insulation.

- D. 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.
- E. Flexible spherical expansion joints shall employ Peroxide cured EPDM in the covers, tubes and frictioning of the reinforcement. Reinforcement must be DuPont Kevlar. Solid steel rings shall be used within the raised face rubber ends to prevent pullout. No substitutions for the DuPont Kevlar or the solid steel embedded flange rings are acceptable. Sizes 2 inch (50mm) and larger shall have two spheres reinforced with a metal ring between spheres to maintain shape and complete with split ductile iron or steel flanges with hooked or similar interlocks. Sizes 16 inch (400mm) to 24 inch (600mm) may be single sphere. Sizes 3/4 inch (20mm) to 1-1/2 inch (40mm) may have threaded bolted flange assemblies, one sphere and cable retention. 14 inch (300mm) and smaller connectors shall be rated at 250 psi (17 BAR) up to 190°F (88°C) with a uniform drop in allowable pressure to 190 psi (13 BAR) at 250°F (121°C). 16 inch (400mm) and larger connectors are rated 180 psi (12 BAR) at 190°F (88°C) and 135 psi (9 BAR) at 250°F (121°C). Safety factors to burst and flange pullout shall be a minimum of 3/1. All joints must have permanent markings verifying a 5 minute factory test at twice the rated pressure. Concentric reducers to the above specifications may be substituted for equal ended expansion joints.

High pressure joints shall be substituted for the above where operating pressures are higher than standard. Expansion joints shall be installed in piping gaps equal to the length of the expansion joints under pressure. Control rods need only be used in unanchored piping locations where the manufacturer determines the installation exceeds the pressure requirement without control rods. Control rods are not desirable in seismic work. If control rods are used, they must have 1/2- inch (12mm) thick Neoprene washer bushings large enough in area to take the thrust at 1000 psi (6.9 N/mm²) maximum on the washer area. Standard diameter bolt washers are not acceptable.

Submittals shall include two test reports by independent consultants showing minimum reductions of 20 DB in vibration accelerations and 10 DB in sound pressure levels at typical blade passage frequencies on this or a similar product by the same manufacturer. All expansion joints shall be installed on the equipment side of the shut off valves.

2.3 ISOLATOR APPLICATION

EQUIPMENT	ISOLATOR TYPE	MINIMUM DEFLECTION
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EQUIPMENT	ISOLATOR TYPE	MINIMUM DEFLECTION
Air Handling Units		
Floor Mounted – up to 15 HP	B	1"
Floor Mounted – 20 HP and Over	B	1.5"
Suspended	D	1"
Chiller	A	0.35"
Pump (Above Grade)	B	1.5"
Suspended Fan Coil Units	D	0.5"
Floor Mounted Fan Coil Units	A	0.35"
Condensing Units	A	0.35"
In-Line Fans	D	0.5"
Roof Mounted HVAC Equipment	C	2"

2.4 PIPING ISOLATOR APPLICATIONS

EQUIPMENT	ISOLATOR TYPE
Floor Mounted Pumps	E
Suspended Pumps	E
Chiller Pipe Connections	E

2.5 FLEXIBLE CONNECTIONS IN PIPING AT PUMPS

- A. Provide flexible connections at suction and discharge of chilled water, and hot water pumps, piping connections on chillers and where indicated on drawings. Refer to schedule above.

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 23 05 48

SECTION 23 05 93

TESTING, BALANCING AND ADJUSTING (TAB) OF ENVIRONMENTAL SYSTEMS

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.
 - 4. Local firm (Houston Area) required.

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.

2 PRODUCTS - NOT USED

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 23 05 93

SECTION 23 05 94

COORDINATION OF TESTING AND BALANCING

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.

2 PRODUCTS / NOT USED

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

[illegible]

COORDINATION OF TESTING AND BALANCING

SECTION 23 05 94

END OF SECTION 23 05 94

23 05 94-4

GPD Group 2023159.00

SECTION 23 07 13

EXTERNAL DUCT INSULATION

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.

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.
 - e. 3M Fire Barrier Duct Wrap
- 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 100°F 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 100°F 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. On circumferential joint, the 2" flange on the facing shall be stapled with 9/16" outward clinch steel staples on 2" centers and taped using 3" wide foil tape applied with additional adhesive of Foster 85-75. Cover all seams, joints, pin penetrations and other breaks with foil tape and glue.
- F. 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 23 07 13

SECTION 23 07 16

VESSEL INSULATION

1 GENERAL

1.1 WORK INCLUDED

- A. Furnish and install insulation for both high and low temperature vessels.
- B. Low temperature installations include expansion tanks, air eliminators, chiller nozzles, chiller heads and other vessels containing liquids 60°F and below.
- C. High temperature installations include expansion tanks, air eliminators, domestic water storage tanks, boiler stack / transition and other vessels containing liquids above 60°F.

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 vessel 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 vessel 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 vessel, 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 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.

1.4 RELATED WORK

- A. Division 9 Finishes. Painting and color-coding

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Glass fiber pipe & tank insulation:
 - 1. Schuller Type 817
 - 2. Owens-Corning Type 705
 - 3. Knauf 2.8 PCF
- B. Closed cell, non-wicking pipe & tank insulation:
 - 1. Armaflex FS, 2" thickness
- C. Aluminum Jacketing:
 - 1. Childers
 - 2. Pabco
 - 3. RPR
- D. Monel Staples
 - 1. Bostich Monel
 - 2. Duo-Fast Monel
 - 3. Markwell Monel
- E. Fiberglass reinforcing cloth mesh:
 - 1. Perma Glass Mesh
 - 2. Alpha Glass Mesh
 - 3. Childers Chil-Glas
 - 4. Foster Mast a Fab
- F. Weather Resistant Coating:
 - 1. WB Armaflex Finish

2.2 CEMENT, MASTICS, SEALANTS, ADHESIVES AND COATINGS

- A. Adhesive: Provide Childers CP-127 or Foster 85-60 fiberglass adhesive to seal insulation for low temperature vessels.
- B. Adhesive / Joint Sealant: Provide Armaflex 520 adhesive to seal insulation for low and temperature vessels.
- C. Lagging Adhesive / Coating: Furnish Childers CP50AHV2 or Foster 30-36 lagging adhesive / coating to provide a finish coat and to secure finish cloth for high temperature vessels.
- D. Insulation Joint Sealant: Use Childers CP-76 or Foster 95-50 to seal the joints of insulation on low temperature vessels.

- E. Metal Jacketing Sealant: Use Childers CP-76 or Foster 95-44 on all metal jacketing laps outdoors.
- F. Vapor Barrier Coating: Indoors - Use Childers CP-38 or Foster 30-80 vapor barrier coating finish to coat the canvas finish on low temperature vessels. Permeance shall be 0.013 perms or less as tested by ASTM E96. Coating must comply with MIL-C-19565C, Type II and be QPL listed. Permeance shall be 0.03 perms or less at 30 mils, dry. Tested at 100°F and 90% RH per ASTM F 1249 and by Hypalon rubber based.
- G. Weather Barrier Mastic: Furnish Childers CP-10/11 or Foster 46-50 weather barrier mastic and reinforcing mesh for outdoor finish.
- H. Reinforcing Mesh: Furnish 10 X 10 white glass or polyester reinforcing mesh.

PART 3 - EXECUTION

3.1 HIGH TEMPERATURE VESSELS (FIBERGLASS)

- A. Apply a first layer of insulating board. Band the board on immediately after application, using bands on 12" centers, drawn tight and securely fastened.
- B. Apply successive layers of insulation as specified for the first layer, with joints staggered. After insulation has been applied, finish with Childers CP-38 or Foster 30-80 vapor barrier coating reinforced with glass or polyester reinforcing mesh per manufacturer's recommendations. Provide a flood coat of Childers CP-10/11 or Foster 46-50 with Foster Mast a Fab polyester or Chil Glas #10 reinforcing mesh.
- C. To insulate removable heads, provide two equal sections of heavy-gauge, galvanized sheet metal covers, angle reinforced and lined with insulation board. Make covers easily removable to allow free access to the heads for inspection, cleaning and dismantling. Provide suitable flanges on the sections with neoprene gaskets between them, permitting a tight seal when the two sections are bolted together. Fill the voids with glass fiber wall cavity insulation.

3.2 LOW TEMPERATURE VESSELS (CLOSED CELL)

- A. Apply a layer of insulating board. Band the insulation on immediately after application, using bands on 12" centers, drawn tight and securely fastened.
- B. To insulate removable heads, provide two equal sections of heavy-gauge, galvanized sheet metal covers, angle reinforced and lined with insulation board. Make covers easily removable to allow free access to the heads for inspection, cleaning and dismantling. Provide suitable flanges on the sections with neoprene gaskets between them, permitting a tight seal when the two sections are bolted together. Fill the voids with closed cell insulation.
- C. Apply weather protective finish on closed cell insulation. Provide a minimum of three coats.

3.3 ALUMINUM JACKETING (Insulated vessels outdoors above grade)

- A. Apply aluminum jacket on vessels according to manufacturer's recommendations using aluminum strapping and metal jacketing sealant to provide weather tight covering.
- 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.

- C. Install straps on 12" centers.

3.4 VESSEL INSULATION REQUIREMENTS

- A. Insulate all low and high temperature vessels located exterior (outside) of the building, including the following:
 - 1. Air separators
 - 2. Expansion Tanks
 - 3. Chemical feeders
 - 4. Chilled water system volume tanks
 - 5. Insulation thickness shall match thickness of adjoining pipe insulation
- B. Insulate all low temperature vessels located interior (inside of the building, including the following:
 - 1. Air separators
 - 2. Chemical feeders
 - 3. Chilled water system volume tanks
 - 4. Insulation thickness shall match thickness of adjoining pipe insulation
- C. Insulate the following high temperature vessels located interior (inside the building).
 - 1. Air Separators
 - 2. Insulation thickness shall match thickness of adjoining pipe insulation
- D. As indicated on the drawings

END OF SECTION 23 07 16

SECTION 23 07 19

HVAC PIPING INSULATION

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, condensate piping and make-up 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 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

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 3/4" 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 1/2" 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 100°F 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 100°F 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 1/2" 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.

3 EXECUTION

3.1 INTERIOR PIPING

- A. Cover all hot water 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. Cover all chilled water piping with rigid foam insulation.
 - 1. Adhere the vapor barrier jacket longitudinal seam with vapor barrier adhesive.
 - 2. 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 1/2" wide glass filament tape.
 - 3. Apply a tack coat of fitting mastic over the insulation and tape.
 - 4. Neatly embed with 10 x 10 fiberglass cloth into the tack coat.
 - 5. Apply mastic over the fiberglass cloth to a thickness where the fabric is not visible after completion.
 - 6. 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.
- C. Install hanger with protective shield, on the outside of all insulation.
- 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 Foster 8142W over all exposed insulation.
- G. Piping to be insulated as specified above:
 - 1. Chilled water and heating water
 - 2. Make-up 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 1/2" 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 1/2" 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 1/2" 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 100°F 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

<u>INSULATED UNIT</u>	<u>THICKNESS (Inches)</u>
Refrigerant Piping	1-1/2
Chilled Water Piping (through 2" pipe)	1-1/2
Chilled Water Piping (2-1/2" pipe and Larger)	2
Condensate Drains	1
Heating Water Piping 2" Pipe and Larger	2
Heating Water Piping 1-1/2" Pipe and Smaller	1-1/2
Exterior Chilled and Hot Water Piping, 5" Pipe and Larger	2
Exterior Chilled and Hot Water Piping 4" Pipe and Smaller	1-1/2
Underground Piping Covering, 1-1/2" Pipe and Smaller	1
Underground Pipe Covering 2" Pipe and Larger	1-1/2

END OF SECTION 23 07 19

SECTION 23 08 00

MECHANICAL COMMISSIONING COORDINATION

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.

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 1.0°F and a resolution of + or - 0.2°F). 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.

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 23 08 00

SECTION 23 09 33

BUILDING MANAGEMENT AND CONTROL SYSTEM

1 GENERAL

1.1 SCOPE

- A. Provide and install a complete Building Management and Control System (BMCS), including industrial instrumentation necessary to obtain functions and results specified. A complete system includes items such as sensors, valves, dampers, valve and damper operators, DDC panels, relays, terminal equipment controllers, mounting brackets and thermowell, etc. Integrate all components to provide a complete and functioning system.
- B. Temperature Control System components:
 - 1. Electronic instruments as specified
 - 2. Electric instruments as specified
 - 3. Microcomputer instruments as specified
- C. All control devices of the same type product shall be of a single manufacturer.
- D. Control, power and interlock wiring necessary to accomplish sequences specified in this Section shall be provided and installed by the Control Subcontractor. Materials and methods of execution as specified in Division 26, Electrical.
 - 1. Coordinate current characteristics of all electrical instruments and equipment with Division 26 of the specifications and related electrical drawings.
- E. The entire Building Management and Control System (BMCS) shall be installed by the Automation System Manufacturer or Authorized Distributor.
 - 1. All components and elements
 - 2. The testing and acceptance procedure
- F. The manufacturer of the building automation system shall provide documentation supporting compliance with ISO-9002 (Model for Quality Assurance in Production, Installation, and Servicing). The intent of this specification requirement is to ensure that the products from the manufacturer are delivered through a Quality System and Framework that will assure consistency in the products delivered for this project.
- G. The entire Building Management and Control System (BMCS) shall be installed, Commissioned, and tested; all performed by the Automation System Manufacturer or Authorized Distributor if approved by engineer.
 - 1. All components and elements.
 - 2. Start-up and point verification.
 - 3. The testing and acceptance procedure.

1.2 RELATED WORK

- A. Division 23, Mechanical
- B. Division 26, Electrical

1.3 SUBMITTALS

- A. Submit items of the Building Management and Control System (BMCS).

1. Temperature control equipment & Field devices.
2. Wiring & Flow diagrams.
3. Sequence of operation.
4. Complete, detailed, control and interlock-wiring diagram.
5. Indicate mechanical and electrical equipment furnished and electrical interlocks, indicating terminal designation of equipment. Respective equipment manufacturers shall furnish through the Mechanical Contractor, approved drawings of equipment to be incorporated in this diagram.
6. Submit Input / Output summary of all points.
7. Submit an outline of testing procedures from section Testing and Acceptance.
8. 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.
9. Submit sample of space temperature sensor and guards for review prior to purchase or installation.

B. Owner shall have final review and approval prior to start of work.

1.4 COOPERATION WITH OTHER TRADES

- A. Furnish control valves, temperature sensing element wells, flow and pressure sensing devices, dampers and other similar devices to the Mechanical Contractor in a timely manner for installation under the Building Management and Control System (BMCS), Subcontractor's supervision.

1.5 WARRANTY

- A. Provide with a manufacturer's parts and labor warranty for a period of two years from substantial completion. Warranty shall also include unlimited telephone technical support, sequence and graphical modifications. Through warranty period and at the end of warranty period firmware shall be updated to be the most current version available.

2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Delta by Team Solutions

2.2 SYSTEM ARCHITECTURE

- A. The Building Management and Control System (BMCS) shall consist of an information-sharing network of stand-alone Direct Digital Control Panels (DDCP) to monitor and control equipment as specified of the control sequence and input/output summary.
- B. "Information sharing" shall be defined as: The function of each DDCP to exchange data on the network trunk with other DDCP's without the need for additional devices such as network managers, gateways or central computers.
- C. "Stand-alone" shall be defined as: The function of each DDCP to independently monitor and control connected equipment through its own microcomputer.

2.3 COMMUNICATIONS PROCESSING

- A. The BMCS shall operate as a high speed true token-pass peer-to-peer communication network residing on a BACnet IP. Resident processors in each DDCP shall provide for full

exchange of system data between other DDCP's on the network trunk. Systems that limit data exchange to a defined number of system points or communicate via gateways to route proprietary devices and objects to BACnet are not acceptable.

- B. Systems that operate via polled response or other types of protocols that rely on a central processor or similar device to manage DDCP to DDCP communications may be considered only if a similar device is provided as a stand-by. Upon a failure or malfunction of the primary device, the stand-by shall automatically, without any operator intervention, assume all BMCS network management activities.
- C. The failure of any DDCP on the network shall not affect the operation of other DDCP's. All DDCP failure shall be annunciated at the specified alarm printers and terminals.
- D. Network shall support a minimum communications speed of 115.2 Kbps.
- E. The network shall support a minimum of 100 DDC controllers and PC workstations.
- F. Each PC workstation shall support a minimum of 4 peer-to-peer networks, either by hardwired connection or dial up.
- G. The system shall support integration of third party systems (fire alarm, security, lighting, PCL, chiller, boiler) via panel mounted open protocol processor. This processor shall exchange data between the two systems for inter-process control. All exchange points shall have full system functionality as specified herein for hardwired points. Provide examples of 5 reference projects utilizing gateways required for this project.

2.4 DDCP HARDWARE

- A. Each DDCP shall consist of a 32-bit microprocessor and controller, power supply, input / output boards and communication board. All program and point databases shall be stored in battery-backed RAM. Provide a minimum of 1.2 MEG RAM in each DDCP to allow for point expansion and trend data storage.
- B. Each DDCP shall incorporate a real-time clock.
- C. Each DDCP shall be provided with two RS232 communications port. Connecting an operator terminal, whether portable or stationery, shall allow the user to communicate with the entire network.
- D. Each DDCP shall provide for input / output connections to field equipment. The following point types shall be supported:
 - 1. Analog inputs - for measuring sensed variables. Inputs shall be capable of accepting voltage, resistance, current or pressure signals.
 - 2. Analog outputs - for controlling end devices. Outputs shall be capable of producing voltage, resistance, current or pressure signals. Pneumatic outputs shall be provided with a manual override for adjusting outputs in the event of a power loss at the DDCP.
 - 3. Digital inputs - for monitoring dry contacts such as relays, switches, pulses, etc.
 - 4. Digital outputs - to control two position devices such as starters, actuators, relays, etc.
- E. Each DDCP shall be listed under UL916 (Energy Management Systems), and shall be tested to comply with sub-part J of Part 15 FCC rules for Class A computing equipment.
- F. Each DDC Controller shall have sufficient memory to support its own operating system

and databases, including:

1. Control processes
 2. Energy management applications
 3. Alarm management applications including custom alarm messages for each level alarm for each point in the system.
 4. Historical/trend data for points specified
 5. Maintenance support applications
 6. Custom processes
 7. Operator I/O
 8. Dial-up communications
 9. Manual override monitoring
- G. Operator shall have the ability to manually override automatic or centrally executed commands at the DDC Controller via local, point discrete, on-board hand/off/auto operator override switches for digital control type points and gradual switches for analog control type points.
1. Switches shall be mounted either within the DDC Controllers key-accessed enclosure, or externally mounted with each switch keyed to prevent unauthorized overrides.
 2. DDC Controllers shall monitor the status of all overrides and inform the operator that automatic control has been inhibited. DDC Controllers shall also collect override activity information for reports.
- H. DDC Controllers shall provide local LED status indication for each digital input and output for constant, up-to-date verification of all point conditions without the need for an operator I/O device. Graduated intensity LEDs or analog indication of value shall also be provided for each analog output. Status indication shall be visible without opening the panel door.
- I. In the event of the loss of normal power, there shall be an orderly shutdown of all DDC Controllers to prevent the loss of database or operating system software. Non-volatile memory shall be incorporated for all critical controller configuration data and battery backup shall be provided to support the real-time clock and all volatile memory for a minimum of 72 hours.
1. Upon restoration of normal power, the DDC Controller shall automatically resume full operation without manual intervention.
 2. Should DDC Controller memory be lost for any reason, the user shall have the capability of reloading the DDC Controller via the local RS-232C port, via telephone line dial-in or from a network workstation PC.
 3. Upon restoration of normal power, the DDC Controller shall automatically resume full operation without manual intervention.

2.5 PROGRAMMING FUNCTIONS

- A. Resident software in each DDCP shall provide custom programming of control strategies.
1. Point database
 2. Operator interface
 3. Network communications
 4. Facilities and energy management functions
- B. Programming of control and energy management strategies shall be accomplished via a high-level computer language such as BASIC, JC BASIC, C, or Powers Process Control Language. A standard math processor shall be part of the programming language. All analog loops shall be capable of proportional, integral and derivative control.

- C. Each DDCP shall incorporate an operator interface program (OIP) that provides an English language user interface. The OIP shall allow the user to program, interrogate, command and edit the BMCS via a self-prompting method. Operator terminals, whether textual or graphical, shall be able to access the entire network from any DDCP. Access shall be accomplished in a transparent fashion; that is, the operator shall not be required to address specific DDCP's in order to display or command system points.

2.6 FACILITY MANAGEMENT SOFTWARE

- A. The BMCS shall be provided with standard and custom report generation functions that include:
 - 1. Alarm summaries
 - 2. Motor status summaries
 - 3. Point displays by type, system, status, overrides, failures, location, equipment and enabled/disabled.
 - 4. Program listings
- B. All reports shall be either displayed or printed by:
 - 1. Operator request.
 - 2. Time of day.
 - 3. Event conditions (such as in response to an alarm, interlock, etc.).
- C. All reports shall be time and date stamped.
- D. An alarm-processing program shall be provided to annunciate those points designated as alarmable. Alarm points shall, upon alarm occurrence, be displayed or printed at designated terminals.
- E. Historical trend data shall be collected and stored at each DDCP for later retrieval. Retrieval shall be manual or automatic. Any point, physical or calculated, may be designated for trending. The system shall allow for two methods of trend collection: Either by a pre-defined time interval sample or upon a pre-defined change of value. Trend data shall be presented in a columnar format. Each sample shall be timed stamped. Trend reports may be a single point or may be a group of points, up to a maximum of (8) points in any single group. Any point, regardless of physical location in the system may become part of a multiple point group.
- F. Each BMCS network shall provide a point-monitoring function that can display single or multiple points in a continuous updated fashion for dynamic displays of point values.
- G. A database and configuration report program shall be provided that allows the user to interrogate BMCS status. As a minimum, the user shall be able to: Verify available RAM at each DDCP, verify DDCP status (on-line, off-line, and failed) and set the system clock.
- H. Any invalid operator entry shall result in an error message.
- I. DDCP's shall contain a password access routine that will assign an operator to one of three level of access. Level 1 shall permit display function only, level 2 shall additionally permit commanding of system points and level 3 shall additionally permit full program and database editing.
- J. DDCP's shall provide for the accumulation of totalized values for the purposes of run-time or energy totalization. Totalized values may be displayed or printed automatically or by operator request.

2.7 ENERGY MANAGEMENT SOFTWARE

- A. The BMCS shall be provided with an optimal start program such that the building may be divided into ten zones for optimum start. Warm-up and cool-down shall occur in sequence with succeeding zones starting only after the preceding zone has completed its warm-up or cool-down.
 - 1. The optimum start-up time of assigned equipment shall be determined based on a software calculation that takes into consideration outdoor air conditions, space conditions, and building thermal characteristics ("U" factor).
 - 2. The optimum start program shall control start-up of the cooling and heating equipment to achieve the target occupancy space temperature at the precise time of building occupancy.
 - 3. A built-In "learning" technique shall cause the BMCS to automatically adjust itself to the most affective time to start equipment based on historical data.
- B. The BMCS shall be provided with an operator interactive time of day (TOD) program. TOD programming and modifying shall be accomplished in a calendar-like format that prompts the user in English language to specify month, year, day and time and associated point commands. It shall be possible to assign single points or groups of points to any on or off time. Appropriate time delays shall be provided to "stagger" on times.
 - 1. TOD shall incorporate a holiday and special day schedule capability, which will automatically bring up a pre-defined holiday or special day schedule of operation. Holidays or special days can be scheduled up to one year in advance.
 - 2. In addition to the time dependent two-state control, TOD also provides time dependent setpoint control. This control provides the capability to output assignable, proportional setpoint values in accordance with the time of day and day of week. This program shall be used to accomplish night setback, morning warm-up and normal daily operating setpoints of all control system loops controlled by the BMCS. As with the two-state control, time dependent setpoint control shall be subject to the holiday schedule. The setpoints desired shall be user definable at any operator terminal.
 - 3. The operator shall be capable of reading and/or altering all sorted data pertaining to time of day, day of week, on/off times, setpoint values, and holiday designation.
 - 4. The TOD program shall also provide an override function that allows the user to conveniently change a start or stop time for any point up to one week in advance. The override command shall be temporary. Once executed the TOD program shall revert to its original schedule.
 - 5. The TOD program shall interface with the optimal start program (OSP) such that stop times may be assigned by OSP.
- C. Additional Program functions required are to be installed and programmed as requested by end user at no additional cost:
 - 1. Enthalpy optimization.
 - 2. Supply air reset.
 - 3. Hot water reset.
 - 4. Chilled water reset.
 - 5. Volumetric control.
 - 6. Dead band control. Install dual set points as requested by user.
 - 7. All specified energy management programs, whether or not applicable to this project shall be provided such that the owner may enable the program at a future date without the need to purchase additional software or modify existing software.

2.8 WEB SERVER ACCESSIBILITY

- A. Industry leading encryption technology to provide accessibility of an unlimited number of clients through a standard web browser.
- B. Building Manager's ability to access, view and command critical building information in real time over the intranet or internet.
 - 1. Alarm Display
 - 2. Point Commanding
 - 3. Graphic Display
 - 4. Scheduling
 - 5. Running Reports
 - 6. Point Details
- C. Building Manager's access must be compatible with a wide range of mobile device platforms including but not limited to Apple IOS, Android, and Microsoft Windows. Mobile access shall match features and abilities available via a desktop computer browser.
- D. The web browser shall provide the same view of the system graphics, schedules, or logs etc and provide the same interface methodology as provided by the GUI.
- E. The web browser client shall support at a minimum, the following functions.
 - 1. User log in identification and password requirement with administrator defined access privileges.
 - 2. Alarm management system shall provide pop ups that show how many active alarms active at the time of login.
- F. Graphical screens developed for the GUI shall be the same screens used for the Web browser client. Any animated graphical objects supported by the GUI shall be supported by the Web browser.
- G. Storage of the graphical screens shall be in the server, without requiring and graphics to be stored on the client machine.
- H. Realtime values displayed on the Web page shall update automatically without requiring a manual "refresh" of the Web page.
- I. Scheduling shall be set using graphical input, without requiring and keyboard entry from the operator.
- J. Graphic screens on the Web browser client shall support hyperlinks to other locations on the internet or on intranet sites, through the definition of the URL for the desired link.

2.9 REMOTE NOTIFICATION

- A. Remote notification sends Alarm and System Event information to various notification devices as indicated below but not limited to. Operators can receive their building automation system alarms without restricting them to dedicated workstations.
 - 1. Alphanumeric pagers
 - 2. Numeric pagers
 - 3. Email
 - 4. Phones via voice or short message service (SMS)

2.10 POINT EXPANSION MODULES

- A. Capable of extending its input/output capabilities via special purpose modules.
 - 1. Modules may be mounted remote from the DDCP.
 - 2. Shall support communication on an RS-485 BACnet MS/TP network.

2.11 TERMINAL EQUIPMENT CONTROLLERS

- A. Provide for control of each piece of equipment, including, but not limited to, the following:
 - 1. Variable Air Volume (VAV) boxes
 - 2. Constant Air Volume (CAV) boxes
 - 3. Dual Duct Terminal Boxes
 - 4. Unit Conditioners
 - 5. Heat Pumps
 - 6. Unit Ventilators
 - 7. Room Pressurization
 - 8. Fan Coil Units
- B. Include the following items:
 - 1. All input and outputs necessary to perform the specified control sequences.
 - a. Analog outputs shall be industry standard signals such as 24V floating control.
 - 2. Sufficient memory to accommodate point database, operating programs, local alarming and local trending.
 - 3. All databases and programs shall be stored in non-volatile EEPROM, EPROM and PROM, or minimum of 100-hour battery backup shall be provided.
 - 4. Return to full normal operation without user intervention after a power outage of unlimited duration.
 - 5. Operation programs shall be field selectable for specific applications.
 - 6. Specific control strategy requirements, allowing for additional system flexibility.
 - 7. Controllers that require factory changes of all applications are not acceptable.

2.12 ELECTRONIC DAMPER ACTUATORS

- A. Two position damper operators:
 - 1. Spring return to full travel position.
 - 2. Built in auxiliary switches (motor end switches)
 - a. Switch shall be fully adjustable so that cut-in/cut-out points may be preset at any point within angular travel of the motor.
 - 3. Minimum torque 60-in-lb
- B. Modulating damper operators:
 - 1. Sized with sufficient reserve power to provide smooth modulating action and tight close off against the system pressure
 - 2. Select the operator with available torque to exceed the maximum required operating torque by not less than 100%
 - 3. Minimum torque 100 in-lb

2.13 ETHERNET CARD

- A. Ethernet Card:
 - 1. Local area network connection interface card.

2.14 CONTROL CABINETS

- A. Fully enclosed NEMA 1 for indoors, NEMA 4 for outdoors.

1. Powder coat painted on all sides
2. Cabinet with continuously piano type hinged door
3. Locking latch
4. All locks shall use a common key
5. Devices on the panel face must be identified with engraved nameplates.
6. Panels or termination panels must be identified with engraved nameplates.
7. Provide enamel beige finish and extruded aluminum alloy frame UL 50 certified.

2.15 AUTOMATIC CONTROL VALVES

- A. Pressure ratings: Minimum 125 psig or 1.25 times maximum system operating pressure.
- B. Construction:
 1. 2" and smaller:
 - a. Screwed.
 - b. Bodies and internal parts: Bronze, stainless steel or other approved corrosion-resistant metal.
 2. 2-1/2" and larger:
 - a. Flanged.
 - b. Bodies: Cast iron or cast steel.
 - c. Seats and parts exposed to fluid: Bronze, stainless steel or other approved corrosion-resistant metal.
 3. Characterized port ball valves are acceptable for VAV terminal units only.
- C. Modulating straight through water valves: Equal percentage contoured throttling plugs.
- D. Three Way Mixing Valves: Linear throttling plugs allowing total flow through valve to remain constant regardless of position.
- E. Sizes: By Automatic Control System Manufacturer for fully modulating operation.
 1. Minimum pressure drop: Equal to pressure drop of coil or exchanger.
 2. Maximum pressure drop: 5.5 psi.
 3. Relief and bypass valves: Sized according to pressure available.
 4. 2-position valves: Line size.
 5. Manual by-pass operator.
- F. Electronic Actuator:
 1. Direct coupled installation
 2. Visual and electronic stroke indicator
 3. Die-cast aluminum housing
 4. Manual override
 5. Self-lubricating bearing and gear train
 6. Automatic calibration
 7. Automatic duty cycle protection
 8. Overload and stall protection
 9. Non-spring return
 10. Floating /0-10 VAC / 4-20mA operation
 11. UL approved
 12. Provide smooth modulating action and tight close off against the system pressure.
 13. Torque to exceed the maximum required operating torque by not less than 150%.
 14. Actuator input signal shall be compatible with output DDC controller.
 15. Provide weatherproof enclosure (exterior use).
 16. Damper actuators not acceptable for valves.

2.16 FLOW SWITCHES

- A. Wetter parts made of type 316 stainless steel.
 - 1. Designed for mounting in pipe tee.
 - 2. Watertight, dust-tight, and corrosion resistant enclosure.
 - 3. Paddle shall be factory fabricated to accommodate pipe sizes used.
 - 4. Switching action shall be single pole double throw.
- B. Approved manufacturer:
 - 1. ITT McDonald Miller #FS7-4WL for piping over 8", FS7-4W for chilled water.
 - 2. ITT McDonald Miller #FS7-4L for piping over 8", FS7-4 for hot and condenser water.
- C. Remote Flow Solid-State Flow Detection:
 - 1. Extended length flow probe
 - 2. Cabinet-mounted control monitor
 - 3. Wetted parts, 316 stainless steel probe
 - 4. Optional temperature and wire-break outputs
 - 5. Flow and temperature switch points
 - 6. LED bar graph display for status indication
- D. Approved Manufacturer:
 - 1. IFM Effector

2.17 DIFFERENTIAL PRESSURE SWITCHES

- A. Wet/wet differential pressure switch
 - 1. Integral Mounting Frame
 - 2. Watertight, dust-tight, and corrosion resistant enclosure.
 - 3. Wetted materials of brass and fluoroelastomer.
 - 4. Externally adjustable set point
- B. Approved manufacturer:
 - 1. Square D #9012GGW4
 - 2. Dwyer #DXW-11-153-1
 - 3. Carrier #HK06ZC033

2.18 TEMPERATURE LOW LIMIT SWITCH

- A. Responsive to the coldest 1' section of its length.
 - 1. Double pole single throw switch
 - 2. 20' capillary
 - 3. Line voltage with bellows actuated switch
 - 4. Auto reset for outdoor installation
 - 5. Manual reset for indoor installation

2.19 TEMPERATURE AND HUMIDITY SENSORS

- A. Space Temperature Sensors
 - 1. Thermister with resistance of 10,000 ohms at 77°F.
 - 2. Accuracy shall be +/-1/2°F.
 - 3. Range of 55° to 95° F.
 - 4. Surface Mounted
 - a. Two lines custom segmented display with icons.

- b. Fully programmable in GCL
 - c. USB Service port, software enabled or disabled. Service tool not required.
 - d. Smartphone and tablet integration
 - e. External input.
 - 5. Location and height to be approved by Architect/Engineer prior to installation.
- B. Space / Duct Humidity Sensor
 - 1. Capacitance element in the space or duct as required and output a 4 to 20 MA signal proportional to 0 to 100% RH to the DDC.
 - 2. Capacitance element shall be field replaceable and not require calibration.
 - 3. Accuracy shall be +/-2% in the range from 20 to 95% RH.
 - 4. Relative humidity sensors shall have the sensing element of inorganic resistance media.
 - 5. Provide manufacturers calibration certificate.
 - 6. Surface Mounted
 - a. Two lines custom segmented display with icons.
 - b. Fully programmable in GCL
 - c. USB Service port, software enabled or disabled. Service tool not required.
 - d. Smartphone and tablet integration
 - e. External input.
- C. Duct Temperature Sensors
 - 1. Range of 20° to 120°F.
 - 2. Single point sensing of temperature.
 - 3. Averaging elements of sufficient length to sense temperature across 2/3 duct width.
 - 4. Averaging elements of sufficient length to provide accurate, representative indication and control.
 - 5. Averaging elements of sufficient length to prevent variances in temperature or stratification.
- D. Liquid Immersion Temperature Sensors
 - 1. Platinum type resistance temperature detector (RTD).
 - 2. Match sensor range to medium being monitored.
 - a. Hot water range 30° to 250°F.
 - b. Chilled Water 20° to 70°F.
 - 3. Furnish stainless steel wells for installation by Mechanical Contractor.
 - 4. Locate all sensors in field with Owner/Engineer present.
 - 5. System accuracy for liquid temperature sensing shall be +/-1/2°.
 - 6. Sensors must be removable from wells.
- E. Outside Air / Freezer / Cooler Sensors
 - 1. Range of -58° to 122°F.
 - 2. Weatherproof sun shield.
 - 3. External trim material corrosion resistant with all parts assembled into water tight, vibration-proof, heat resistant assembly.
 - 4. Minimum of 8' long leads.
 - 5. Encapsulated into Type 304 stainless steel tubes with low conductivity moisture proofing material and lag extension for thickness of insulation.

2.20 CURRENT SENSITIVE RELAYS

- A. Ensure compatibility with VFD applications for variable speed motor status.

1. Provide with adjustable set point.
2. Relays must be mounted and not hung by power wires thru CT.
3. Provide split-core type current sensors.
4. Loop powered.
5. LED Status.
6. Acceptable Manufacturer: Veris Industries / Hawkeye
7. Relays shall close status contacts in response to current flow in power leads to the equipment being monitored.

2.21 DIFFERENTIAL PRESSURE TRANSDUCER

- A. Transducers to convert differential pressures to 4-20 MA analog outputs.
 1. Solid state pressure sensor with accuracy of +/- 1% of calibration range.
 2. Factory calibrated and have zero and span trimmers for field calibration.
 3. Range shall be selected to match the medium being monitored.
 4. Pressure snubbers to protect from pressure pulses and a 3-way bypass / valve assembly to protect the transducer from overpressure damage during start-up.
 5. LCD Display
 6. Acceptable Manufacturer: Rosemount 1151 or 3051 Pressure Transmitter

2.22 FLOW DIFFERENTIAL PRESSURE SWITCH

- A. The pressure sensing element shall be of the convoluted diaphragm type for sensitivity to system differential pressure.
 1. Select the pressure range based on the sensed differential pressure.
 2. The unit shall be protected against overpressure to the full static pressure rating.
 3. Accuracy: +/- 2% of full scale.
- B. Switch assembly.
 1. Reed switch.
 2. NEMA-4 enclosure.
 3. Threaded boss conduit entrance.
 4. SPST action.
 5. Voltage and rating as required for the control circuit.
- C. Wetted parts shall be made of type 303 stainless steel.
- D. Install an isolation valve in each sensing pipe leg to permit servicing without shutting the system down.

2.23 ELECTRIC REMOTE BULB THERMOSTAT

- A. Two position remote bulb thermostat:
 1. Bimetal controlled.
 2. Sealed mercury switches.
 3. Provide specified control action.
 4. Adjustment can be made by removing unit cover.
 5. Element with capillary length as required for the location.

2.24 ELECTRIC SPACE THERMOSTAT

- A. Two position space thermostat.
 1. Single Pole switch actuated by bi-metal sensing element.
 2. Range shall be 60°F to 90°F.
 3. Removable external knob adjustment means.

2.25 HIGH STATIC PRESSURE SWITCH

- A. With manual reset switch
 - 1. Approved manufacturer: Cleveland AFS-460.

2.26 INSERTION FLOW SENSORS

- A. Electromagnetic Flow Meter
 - 1. Retractable hot tap flow sensor
 - 2. Accuracy: +/- 1% of full scale
 - 3. Custom thread-o-let 400 psi / 250°F rated
 - 4. Installed into a 1" full port ball valve
 - 5. Provided with an insertion depth gage
 - 6. Line size from 2-1/2 to 72 inches
 - 7. Metering range from 0.1 to 20 f/sec (200:1 turndown).
 - 8. Remote NEMA 4 wall mounted LCD display
 - 9. Field Pro Software & Communicator
 - 10. Warranty two years
 - 11. Approved Manufacturer: Onicon Electromagnetic Flow Meter F-3500 Series

2.27 CONTROL DAMPERS

- A. Opposed blade dampers.
 - 1. Frames of 13-gauge galvanized sheet metal.
 - 2. Provisions for duct mounting.
 - 3. Damper blades not exceeding 8" in width.
 - 4. Blades of two sheets of 16-gauge galvanized sheet metal.
 - 5. Blades suitable for high velocity performance.
 - 6. Bearings of nylon or oil-impregnated, sintered bronze.
 - 7. Shafts of 1/2" zinc-plated steel
 - 8. Leakage does not exceed 1/2% based on 2000 fpm and 4" static pressure.
 - 9. Replaceable resilient seals along top, bottom and sides of frame and blade edge.
 - 10. Submit leakage and flow characteristics data with shop drawings.
 - 11. Linkage shall be concealed out of the air stream within damper frame.
 - 12. Acceptable Model is Ruskin Model CD60.

2.28 PHOTO CELL CONTROL

- A. Light Sensitive Resistor.
 - 1. 4-20 output or switch.
 - 2. On = 3.0 / fc. Off 10.0 / fc.
 - 3. UL Approved.

2.29 DRAIN PAN FLOAT SWITCH

- A. Rated at 10 Amps.
 - 1. Shuts off equipment if water level becomes too high.
 - 2. DPDT Contacts.

2.30 BY-PASS AUTOMATIC SHUT-OFF TIMERS

- A. Rated at 10 Amps, 125 VAC
 - 1. Shuts off equipment with timed switch
 - 2. White decorated timer

3. Without hold feature
4. Time Cycle 60 minutes

2.31 CO₂ SENSOR

- A. Telaire Model T5100 CO₂/Temperature Sensor or approved equal
 1. Local visual indication of CO₂ levels in enclosed spaces.
 2. Pre-calibrated with factory default settings of 1000 ppm and 1500 ppm CO₂ levels
 3. Bright LED indicator transitions between green, yellow, and red as the CO₂ threshold is exceeded.
 - a. Accuracy: +/- 30 ppm @ 72°F
 - b. Output: 0-10 V (100Ω output impedance) and NTC 20k Thermister

2.32 EMERGENCY SHUTDOWN STATION

- A. Lockdown Switch:
 1. Mushroom Red Button
 2. Latches when depressed
 3. Reset with key
 4. Sign "LOCKDOWN"

2.33 EMERGENCY POWER HVAC STATION

- A. After Hours A/C Switch:
 1. Yellow Mushroom Button within a clear plastic cover
 2. Momentary contact configuration
 4. Sign "Emergency Power HVAC"
 5. Manufactured by STI Model # SS2231HV-EN

3 EXECUTION

3.1 INSTALLATION

- A. The control system shall be installed and final adjustments made by full-time employees of the factory-approved BMCS Building Management Control Subcontractor.
- B. The contractor shall collaborate through Architect / Engineer and Owner to determine the Owner's preference for naming conventions, etc. before entering the data in to the system.
- C. Due to actual operational or space conditions, it may be necessary for the Contractor to make sequence of operation modifications and/or controller adjustments, change the location or type of sensor to obtain proper operation and coverage of the system in each room or space. These change, if requested by the Owner or Engineer, shall be performed at no additional cost to the Owner. Therefore labor allowances should be made for such changes and adjustments if requested.

3.2 INTERLOCK AND SAFETY CIRCUITS

- A. Close the outdoor air dampers when the related HVAC unit supply or exhaust fan is de-energized:
 1. The damper and actuators are specified in this section.
 2. Outdoor air damper shall be fully opened before related air handling unit fan is energized for 100% outside air use.

3. Provide motorized outside air dampers for the following:
 - a. Supply fans
 - b. AHUs
 - c. Exhaust fans (except kitchen exhaust)
- B. Close the chilled and hot water valves to the coil when the related unit is de-energized.
- C. Interlock each chiller to start its dedicated chilled and condenser water pumps. Interlock flow switch and pump auxiliary contacts in series to chiller safety terminal strip.
 1. On shutdown provide a circuit to permit the chilled water pumps and condenser water pumps to run while the chillers pump down as required by the manufacturer.
 2. As per manufacturer's recommendations
- D. Primary chilled water control:
 1. Operating and safety controls are furnished as an integral part of the water-chilling unit and not specified in this section.
 2. Provide flow switches located in the chilled water and condenser water piping to each water-cooled liquid chiller.
 - a) Interlock to prevent operation in the absence of flow.
 - b) This may not be the prime controller to start/stop the chiller.
 - c) Interlock thru pump auxiliary contacts.
 3. Provide a high limit temperature sensor in each primary chilled water pump loop.
- E. Exhaust/Supply Fans:
 1. Interlock the related exhaust and supply fans and the related outside air damper.
 2. Interlock the exhaust fans with the related air-handling unit through software.
 3. Interlock related exhaust fan for dishwasher with time delay off relay.
 4. Interlock related exhaust fan for kiln with time delay off relay
 5. Interlock kitchen hood related supply and exhaust fans.
 6. Provide additional interlocks as indicated on fan schedule and on drawings.
 7. Interlock electrical and mechanical room exhaust fans with thermostat.
 8. Interlock refrigerant monitor with mechanical room purge system.
 9. Interlock science room related supply and exhaust fans.
 10. Interlock outside air supply fans for VAV air-handling unit with air-handling unit status point.
- F. Cooling Tower Fan Safety Interlock: Provide interlock wiring for the vibration sensor, oil level switch and oil pump on each cooling tower fan.
- G. Freeze Protection:
 1. Provide a freeze protection sequence to ensure proper operation of equipment during a freeze condition not limited to the following:
 - a. Outside Air Handling Units & Supply Fans with heating and cooling coils: If unit is in occupied or unoccupied mode, upon the triggering of software point indicating a freeze condition or the low temperature sensor (freeze stat) indicates a freeze condition, the system will be disabled, close the outside air damper, open both heating and cooling valves to enable full flow condition. If heating coil discharge air sensor indicates a failure to control and is below setpoint then enable software point indicating a freeze condition, disable unit, close outside air damper, and open both heating and cooling valves to enable full flow condition. Ensure HW & CHW pumps are operational.
 - b. Boilers - Enable during a freeze condition.
 - c. Chillers – Open isolation valves then command by-pass valve to dump

- water into basin or by-pass tower. Enable condenser water pumps during a freeze condition.
- d. Air Cooled Chillers – Open isolation valves, then enable pumps, run cycle for 15 minutes per hour, open all chilled water valves.
 - e. Protect coils downstream of DX cooling coil with freeze protection. If unit is in occupied or unoccupied mode, upon the triggering of software point indicating a freeze condition or the low temperature sensor (freeze stat) indicates a freeze condition, the system will be disabled, close the outside air damper, disable the DX cooling coil. If coil discharge air sensor indicates a failure to control and is below setpoint then enable software point indicating a freeze condition.
- 2. Temperature low limit switch wired with double pole single throw switch with one switch leg hard-wired to de-energize fan and one switch leg to signal BMCS.
- H. Drain Pan Float Protection:
- 1. Interlock to shut down unit and close valves.
 - 2. Cooling Coils mounted above ceiling and in roof mounted units.
 - 3. Provide for each cooling coil location.
 - 4. Signal BMCS alarm point
- I. Domestic Water System:
- 1. Interlock in-line circulating pumps at water heaters with return water pipe mounted thermostat to cycle pump with return water temperature.
 - 2. Interlock high temperature entering water solenoid valve with thermostat on discharge side of tempered water mixing valves.
- J. Emergency Shutdown Station:
- 1. Provide an emergency mushroom style push / pull station shutdown switch in the Administration Area or as directed by Owner / Architect.
 - 2. Signal the building automation system to de-energize the HVAC equipment.
 - 3. This is to stop exhaust fans and outside air units immediately.
 - 4. Other air handling units, chillers and equipment shall be shut down in an orderly manner so as to not damage the equipment.
 - 5. Once stopped, the system may only be restarted with a key operated switch located adjacent to the shutdown switch.
- K. Science Room Utility Controllers:
- 1. Interlock the utility controllers with related air-handling unit through software.
- L. Copper Tube Boiler:
- 1. Interlock each boiler to start its dedicated primary circulating pump. Interlock flow switch and pump to boiler safety terminal strip.
 - 2. On startup enable boiler and primary pump prior to starting secondary system pump until primary loop temperature reaches 105 degrees as per manufacturer's recommendations.
 - 3. Disable secondary pump if boiler goes into alarm or fails to produce heating water within 30 minutes.
- M. Hydronic Heating Boiler:
- 1. Interlock each boiler to start its dedicated pump.
 - 2. On startup enable boiler prior to starting primary pump. Boiler should reach operating temperature prior to starting system pump as per manufacturer's recommendations.
 - 3. Disable system pump if boiler goes into alarm or fails to produce heating water within 30 minutes.

- N. Condensing and Non-Condensing Hot Water Boilers:
 - 1. Interlock each boiler to start its dedicated pump.
 - 2. Install communication cable between each boiler and master controller specified by boiler manufacturer.
- O. Emergency Power HVAC:
 - 1. Provide one momentary style push switch as indicated on the drawings or as directed by Owner / Architect. Coordinate final location with the Owner / Architect prior to installation.
 - 2. Signal the building automation system to energize the Emergency Power HVAC sequencing as outlined below.

3.3 GRAPHICS

- A. Furnish as-built drawings indicating finally corrected "as installed" diagram(s) of the complete Building Management Control System.
 - 1. Modification of existing control systems shall be included.
 - 2. These must be as-built and any changes during the warranty period drawings must be revised and updated.
 - 3. Provide final sequence of operation in written format.
- B. Provide a set of the "as installed" diagram(s) of the complete control system laminated in plastic and hung in the main mechanical room or as directed by Owner.
- C. Provide a color-coded floor plan of the building showing the location of each system, and the area served by each AHU or related zone. These must be of professional quality. Floor plan is to hang in main mechanical room near central control panel.
- D. Provide computer graphics for each system.
- E. Provide final graphic room numbers as selected by District. Any changes during the warranty period shall be included.

3.4 IDENTIFICATION

- A. Provide a laminated engraved nameplate on all control panels and devices shown on the "as installed" control diagrams. Coordinate engraving with nomenclature used on the diagrams.
- B. A black-white-black laminated plastic engraved identifying nameplate shall be secured to each terminal cabinet, and control panels. Identifying nameplates shall have 1/2 inch high, engraved letters.

3.5 WIRING FOR BUILDING MANAGEMENT AND CONTROL SYSTEMS

- A. Furnish and install all wire, conduit, raceways and cable systems required for the complete operation of the Building Management and Control System.
- B. All wiring for the Building Management and Control System is specified in this section and includes, but is not limited to:
 - 1. Wiring of interlock system.
 - 2. Wiring of control instruments.
 - 3. Wiring of control panels.
 - 4. Wiring of related power supplies, i.e. transformers.

5. Wiring of 120 VAC power circuits for control panels and devices.
- C. All materials and methods specified in this section shall comply with the requirements specified in Division 26 of this specification.
- D. All power supply requirements shall be connected to the building electrical distribution system in an approved manner. Do not connect control equipment of circuits common with other building loads or devices.
- E. Temperature control wiring shall be jacketed cables installed with or without conduit as specified below or single conductors installed in conduit. Control wiring shall have minimum 300V insulation for low voltage wiring and 600V insulation for line voltage wiring.
- F. All line voltage control wiring, all low voltage control wiring which is exposed in the central plant, penthouse, and other similar spaces; all low voltage control wiring which is routed through concealed inaccessible locations shall be installed in conduit.
- G. All low voltage control wiring which is routed through concealed accessible locations may be run without conduit provided that the wiring run without conduit is properly supported from the building structure on maximum 5' centers and does not depend upon the ceiling grid or the ceiling support system for support. Wiring run in plenum spaces shall be plenum rated. Support all plenum wiring in accessible locations in bridle rings, J-hooks, D rings. Plenum wiring is not to be supported within building structure or attached to conduit raceways. All low voltage wiring must be installed through supports. Wires shall be supported on 5' centers and identified at each termination point and at 50' centers minimum. Install wire parallel or perpendicular to the structural features of the building.
- H. Line and low voltage control wiring shall not be installed in the same conduit with control wiring and shall not be installed in the same conduit with power wiring.
- I. All wiring associated with building management and control system cover shall be as follows:
 1. Sensor jacket color, Green
 2. MSTP communications, Yellow
 3. All THHN wiring shall comply with Division 26 insulation color identification

3.6 EXHAUST AND SUPPLY FANS

- A. Provide interlocks as scheduled on the plans unless shown on the electrical drawings.
- B. Provide BMCS override to disable operation of all exhaust and supply fans interlocked and/or specified throughout project.
- C. Provide by-pass timers for fans indicated in Fan Schedule and in the following locations:
 1. Fume Hoods
 2. Science Room exhaust fans

POINT DESCRIPTION	TYPE	DEVICE
Start/stop	DO	Control Relay
Outside Air Damper	DO	Electronic Operator

POINT DESCRIPTION	TYPE	DEVICE
Fan Status	DI	Current Sensitive Relay

3.7 SYSTEM OVER-RIDE

- A. Provide manual over-ride push buttons and pilot lights installed in a single control panel at the main central plant for all functions.
1. Overrides shall be located within a locked panel.
 2. Provide override switch for:
 - a. Chilled water central plant
 - b. Hot water central plant
 - c. Each Air Handling unit
 - d. Existing systems
 - e. Exhaust & supply fans

3.8 BUILDING ELECTRICAL USAGE

- A. Provide digital monitoring of the building KVA and KWH. Coordinate with the switchgear manufacturer.
- B. Electrical Quality monitoring:
1. Monitor Watts, VA, VAR, Demand, Imbalance, and Power Factor.

3.9 MISCELLANEOUS

- A. Lighting Control:
1. Provide individual time/photo-cell and time based control of each lighting contactor specified in Division 26.
 2. Provide momentary push buttons located in Executive Director F117 to energize exterior lighting for a preprogrammed length of time. Coordinate final location with owner prior to installation.
 - a. Provide separate control of each contactor.

POINT DESCRIPTION	TYPE	DEVICE
Lighting Contactor	DO	Control Relay
Momentary Control Switch	DI	Switch

- B. Photocell: Provide a photocell mounted on the north side of the building. Location is to be approved by Owner / Architect / Engineer.

POINT DESCRIPTION	TYPE	DEVICE
Photocell	AI	Contact

- C. Outside Air: Provide a temperature sensor and a humidity sensor to monitor outside air conditions.

POINT DESCRIPTION	TYPE	DEVICE
Outside Temperature	AI	Thermistor
Outside Humidity	AI	Humidity Sensor

- D. Temperature Sensor: Provide a temperature sensor in each MDF and IDF rooms to monitor space conditions.

POINT DESCRIPTION	TYPE	DEVICE
MDF/IDF Temperature	AI	Space Sensor

3.10 EXISTING AUTOMATION SYSTEM

- A. The new system shall be fully integrated with the existing Building Automation System Host computer located at the School District maintenance facility.

3.11 FAN POWERED TERMINAL UNIT COORDINATION

- A. Equipment furnished in this section and installed by Section 23 36 16:
- Automatic temperature control card (DDC).
 - Damper Actuator
- B. Equipment furnished and installed by Section 23 36 16:
- Damper.
 - Multi-point flow sensor.
 - Power transformer.
 - Controller enclosure.

3.12 VARIABLE FREQUENCY DRIVE INTERFACE

- A. Interface to the VFD directly
- B. Interface may be hardwired or via RS-485
- C. The following points shall be available at a minimum:

<u>Point Name</u>	<u>Type</u>
Start-stop	DO
Drive alarm	DI
Last fault	AI
Reset drive	DO
Percent output	AI
Frequency output	AI
Speed	AI
Current	AI
Power	AI
Drive temperature	AI
KWH	AI
Run time	AI

3.13 VARIABLE VOLUME AIR HANDLING UNIT WITH SPLIT DEHUMIDIFICATION UNIT

MOUNTED ON TOP (AHU-6/OAU-5)

- A. Split dehumidification units are furnished with a chilled water coil and a hot water heating coil in the PREHEAT position. Control shall be as follows:
1. A duct mounted sensor sensing supply air temperature shall, acting through the Direct Digital Control Panel, modulate the valve on the cooling coil and the valve on the hot water coil, in sequence, to maintain the desired discharge air temperature of 55°F. The supply fan shall be started and stopped from the BMCS System.
 2. Provide a temperature low limit switch located on the discharge side of the hot water preheat coil or the entering side of the cooling coil to de-energize the air handling unit and supply fan, close the outside air damper, open the hot water valve 100%, start the boiler and hot water pump, signal an alarm to the BMCS when the temperature drops below 32°F. Device shall be manual reset.
 3. Open OA damper and start supply fan before starting Air Handling Unit. Provide end switch to ensure damper is in the open position in either the manual (hand) or auto position of the motor starter.

POINT DESCRIPTION	TYPES	DEVICE
Supply Fan Start/Stop	DO	Control Relay
AHU Status	DI	Current Sensitive Relay
Discharge Air Temperature	AI	Duct Thermistor
CHW Valve	AO	Electronic Operator
Outside Air Damper	DO	Electronic Operator
Freeze Status	DI	Temperature Low Limit Switch
HW Pre Heat Valve	AO	Electronic Operator

- B. AHU consists of a chilled water coil, a fan, and a variable speed drive.
1. The unit shall be started and stopped from the BMCS system.
 2. Discharge air temperature control:
 - a. A sensor far enough from the fan discharge to be truly representative of the average temperature shall modulate the valve on the cooling coil to maintain setpoint. Reference drawing schedule for discharge temperature.
 3. Variable air volume control:
 - a. Duct static pressure sensor shall be located in the duct at a position approximately 2/3 the distance from the fan in the longest duct run. Location is to be approved by Engineer and coordinated with Section 23 05 93.
 - b. The static pressure sensors shall, through the DDC panel, accept the signal from the operating control sensor to:
 - i. Transmit a signal to the supply fan motor speed controller.

- ii. Modulate the fan speed to maintain the desired static pressure.
 - iii. Coordinate signal with the fan motor speed controller.
4. Install a static pressure high limit safety device to de-energize the system.
- a. Manual reset.

POINT DESCRIPTION	TYPES	DEVICE
Start/Stop	DO	Control Relay
AHU Status	DI	Current Sensitive Relay
Discharge Air Temperature	AI	Space Thermistor
CHW Valve	AO	Electronic Operator
Duct Static Pressure	AI	Static Pressure Sensor
Variable Speed Fan	AO	Motor Controller

3.14 VARIABLE AIR VOLUME OUTSIDE AIR HANDLING UNIT (OAU-1, OAU-4)

- A. Each unit shall consist of a supply air fan, hot water coil and chilled water coil.
- B. BMCS shall enable unit operation and open outside air damper. Interlock OAU operation with the related air handling units.
- C. Variable air volume control:
 - 1. Duct static pressure sensor shall be located in the duct at a position approximately 2/3 the distance from the fan in the longest duct run. Location is to be approved by Engineer and coordinated with Section 23 05 93.
 - 2. The static pressure sensors shall, through the DDC panel, accept the signal from the operating control sensor to:
 - a. Transmit a signal to the supply fan motor speed controller.
 - b. Modulate the fan speed to maintain the desired static pressure.
 - c. Coordinate signal with the fan motor speed controller.
 - 3. Install a static pressure high limit safety device to de-energize the system.
 - a. Manual reset.

POINT DESCRIPTION	TYPES	DEVICE
Start/Stop	DO	Control Relay
Supply Fan Status	DI	Current Sensitive Relay
Supply Fan Variable Speed Motor	AO	Motor Controller
Differential Across Filters	DI	High / Low limit Switch
OA Dampers	DO	Control Relay
Static Pressure	AI	Static Pressure Sensor

POINT DESCRIPTION	TYPES	DEVICE
CHW Valve	AO	Electronic Operator
HW Coil Leaving Air Temperature	AI	Averaging Duct Thermistor
CHW Coil Leaving Air Temperature	AI	Averaging Duct Thermistor
HW Valve	AO	Electronic Operator
Static Pressure High Limit	DI	Static Pressure Switch
Freeze Status	DI	Temperature Low Limit Switch

3.15 OUTSIDE AIR VARIABLE VOLUME TERMINAL UNITS (OAVAV-)

- A. Each unit shall consist of a pressure independent variable volume damper and a duct mounted hot water coil. The terminal unit's damper shall be interlocked with the associated AHU fan.
1. The Controls Contractor shall furnish the terminal box manufacturer with a controller to be factory mounted. The controller shall display cfm, temperature, and damper position.
 2. A space CO₂ sensor shall provide input to the central BMCS controller. The BMCS shall monitor CO₂ levels of the zones served by the associated air handling unit and modulate the pretreated outside air damper to maintain set point 800 PPM (adjustable).

POINT DESCRIPTION	TYPES	DEVICE
Primary Air	AO	Variable Volume Damper Operator
Discharge Air Temperature	AI	Duct Thermistor
Freeze Status	DI	Temperature Low Limit Switch
Outside Air HW Valve	AO	Electronic Operator

3.16 OUTSIDE AIR HANDLING UNIT CONTROL (OAU-2, OAU-3)

- A. These units are furnished with a chilled water coil and a hot water heating coil in the PREHEAT position. Control shall be as follows:
1. A duct mounted sensor sensing supply air temperature shall, acting through the Direct Digital Control Panel, modulate the valve on the cooling coil and the valve on the hot water coil, in sequence, to maintain the desired discharge air temperature of 55°F. The air-handling unit shall be started and stopped from the BMCS System.
 2. Provide a temperature low limit switch located on the discharge side of the hot water preheat coil or the entering side of the cooling coil to de-energize the air handling unit, close the outside air damper, open the hot water valve 100%, start the boiler and hot water pump, signal an alarm to the BMCS when the temperature drops below 32°F. Device shall be manual reset.
 3. Open OA damper before starting unit. Provide end switch to ensure damper is in

the open position in either the manual (hand) or auto position of the motor starter.

POINT DESCRIPTION	TYPES	DEVICE
Start/Stop	DO	Control Relay
AHU Status	DI	Current Sensitive Relay
Discharge Air Temperature	AI	Duct Thermistor
CHW Valve	AO	Electronic Operator
Outside Air Damper	DO	Electronic Operator
Freeze Status	DI	Temperature Low Limit Switch
HW Pre Heat Valve	AO	Electronic Operator

3.17 VARIABLE VOLUME AIR HANDLING UNITS (AHU-1,2,3,4,5,7)

- A. Units consist of a chilled water coil, a fan, and a variable speed drive.
- B. The unit shall be started and stopped from the BMCS system.
- C. Discharge air temperature control:
 - 1. A sensor far enough from the fan discharge to be truly representative of the average temperature shall modulate the valve on the cooling coil to maintain setpoint. Reference drawing schedule for discharge temperature.
- D. Variable air volume control:
 - 1. Duct static pressure sensor shall be located in the duct at a position approximately 2/3 the distance from the fan in the longest duct run. Location is to be approved by Engineer and coordinated with Section 23 05 93.
 - 2. The static pressure sensors shall, through the DDC panel, accept the signal from the operating control sensor to:
 - a. Transmit a signal to the supply fan motor speed controller.
 - b. Modulate the fan speed to maintain the desired static pressure.
 - c. Coordinate signal with the fan motor speed controller.
 - 3. Install a static pressure high limit safety device to de-energize the system.
 - a. Manual reset.
 - 4. Outside air for these units are being provided pretreated from a separate Outside Air Unit or via an Outside Air Variable Air Volume Terminal Unit.

POINT DESCRIPTION	TYPES	DEVICE
Start/Stop	DO	Control Relay
AHU Status	DI	Current Sensitive Relay

POINT DESCRIPTION	TYPES	DEVICE
Discharge Air Temperature	AI	Space Thermistor
CHW Valve	AO	Electronic Operator
Duct Static Pressure	AI	Static Pressure Sensor
Variable Speed Fan	AO	Motor Controller

3.18 DX VARIABLE VOLUME AIR HANDLING UNITS (AHU-8/CU-1)

- A. These units are furnished with a direct expansion coil, VFD on the supply fan and outside air provided by an outside air supply fan. Units shall operate during emergency and after hours only. Control shall be as follows:
- B. The unit shall be started and stopped from the BMCS system.
- C. During activation of system, close motorized damper M-2 and open motorized damper M-1 as indicated in drawings.
- D. Discharge air temperature control:
 - 1. A sensor far enough from the fan discharge to be truly representative of the average temperature shall modulate the cooling capacity to maintain setpoint. Reference drawing schedule for discharge temperature.
- E. Variable air volume control:
 - 1. Duct static pressure sensor shall be located in the duct at a position approximately 2/3 the distance from the fan in the longest duct run. Location is to be approved by Engineer and coordinated with Section 23 05 93.
 - 2. The static pressure sensors shall, through the DDC panel, accept the signal from the operating control sensor to:
 - a. Transmit a signal to the supply fan motor speed controller.
 - b. Modulate the fan speed to maintain the desired static pressure.
 - c. Coordinate signal with the fan motor speed controller.
 - 3. Install a static pressure high limit safety device to de-energize the system.
 - a. Manual reset.
 - 4. The minimum unit airflow shall be determined by equipment manufacturer. BMCS shall maintain the minimum sum of the VAV terminals to match this minimum flow.
- F. Outside air Fan control:
 - 1. Each unit will be provided with an outside air supply fan. The supply fan will be activated with the air-handling unit.
 - 2. Provide a temperature low limit switch located on the discharge side of the supply fan to de-energize the air handling unit, close the outside air damper, signal an alarm to the BMCS when the temperature drops below 37°F. Device shall be manual reset.
- G. Fully integrate all available BACNET points into the graphics page associated with this unit.

POINT DESCRIPTION	TYPES	DEVICE
Start/Stop	DO	Control Relay
AHU Status	DI	Current Sensitive Relay
Discharge Air Temperature	AI	Space Thermistor

POINT DESCRIPTION	TYPES	DEVICE
Condensing Unit	DO	Control Relay(s)
Duct Static Pressure	AI	Static Pressure Sensor
Variable Speed Fan	AO	Motor Controller
Freeze Status	DI	Temperature Low Limit Switch
Outside Air Fan	DO	Control Relay
Outside Air Temperature	AI	Duct Thermistor

3.19 CONSTANT VOLUME / VARIABLE VOLUME TERMINAL UNITS (CVB-, VAV-)

- A. Each unit shall consist of a pressure independent variable volume damper, a constant volume fan, and a hot water heating coil or electric heating coil. The fans shall be interlocked with the AHU fan. Constant volume terminal shall start before AHU fan starts. Controls shall be as follows:
1. A space temperature sensor shall, through the direct digital control system, modulate the variable volume damper from full open to a minimum airflow rate to maintain room setpoint. If heating is required, the temperature sensor shall modulate the hot water control valve to maintain room setpoint with the variable volume damper in the minimum airflow position.
 2. Control valve, and control valve operator are specified in this section.
 3. The Controls Contractor shall furnish the terminal box manufacturer with a controller to be factory mounted. The controller shall display cfm, temperature, damper position, and hot water valve position.

POINT DESCRIPTION	TYPES	DEVICE
Space Temperature	AI	Space Thermistor
Primary Air	AO	Variable Volume Damper Operator
HW Valve	AO	Electronic Operator
Electric Heat	DO	Relays
Start/Stop	DO	Control Relay
Discharge Air Temperature	AI	Duct Thermistor

3.20 FAN COIL UNITS (CHFCU-1, CHFCU-2, CHFCU-3)

- A. Each fan coil unit is furnished with a chilled water coil and hot water coil. Control shall be as follows:
1. A space temperature sensor shall, acting through a terminal equipment controller, modulate the valves on the chilled water cooling coil and hot water reheat coil in sequence to maintain the desired space temperatures.
 2. Start/stop of fan coil unit shall be by terminal equipment controller.

3. The outside air units providing the outside air shall be activated when the fan coil units are operating during the occupied periods.

POINT DESCRIPTION	TYPES	DEVICE
Start/Stop	DO	Control Relay
CHW Valve	AO	Electronic Operator
Space Temperature	AI	Space Thermistor
HW valve	AO	Electronic Operator
Discharge Air Temperature	AI	Duct Thermistor

3.21 ELECTRIC UNIT HEATERS (EUH-1, EUH-2)

- A. An electric thermostat shall activate the unit and stage the electric coil to maintain room setpoint.

3.22 CHILLED WATER SYSTEM CONTROL

- A. The system consists of two air cooled chillers and two dedicated primary chilled water pumps.
- B. ACC-1 and ACC-2 are equal size chillers sized to handle the peak building load and shall operate as the primary chillers.
- C. Temperature sensors located in the building common chilled water supply and return piping and the turbine flow meter located in the building chilled water common supply piping shall, acting through the DDC system, be used to calculate the building BTUH requirements.
- D. During start-up, the one primary pump shall start. After flow has been indicated from the flow switch for an adjustable time period, the chiller shall be activated.
- E. When the load calculated from the temperature sensors and flow meter exceeds the capacity of one chiller for an adjustable time period, the second primary pump and chiller shall be activated.
- F. If the load drops to below half the capacity (adjustable) of one chiller, then the lag chiller will be deactivated. The primary pump serving the chiller will remain on for 3 minutes (adjustable) and then be deactivated.
- G. A temperature sensor located in the chiller by-pass piping shall send an alarm to the host computer and shall start the lag chiller after an adjustable time delay, if the temperature in the by-pass is above 3 degrees (adjustable) higher than the temperature in the common supply from the chillers. This indicates the flow is moving from the primary loop to the secondary loop.
- H. Provide time delays between pump starts and stops to allow system to stabilize.
- H. Change lead/lag rotation on a weekly basis.

POINT DESCRIPTION	TYPES	DEVICE
Chiller Start/Stop	DO	Control Relay
Chilled Water Supply Temperature	AI	Pipe RTD (1 each)
Status (Chiller)	DI	Safety Alarm Relay
Pump Status	DI	Current Sensitive Relay
Building Flow	AI	Turbine Flow Meter
Building Supply/Return Water Temp.	AI	Temperature Sensors
Bypass Temperature	AI	Temperature Sensor

3.23 SECONDARY CHILLED WATER PUMPING SYSTEM CONTROL

- A. The system consists of two variable speed secondary chilled water pumps controlled as follows:
1. The chilled water pumping system will be energized whenever there is a call for cooling in the building system.
 2. Two-system differential pressure sensors shall modulate the energized pump(s) speed controller to maintain the required system pressure in the building.
 - a. Location of the building differential pressure system sensors shall be approved by the engineer and contractor specified in Section 23 05 93.
 - b. Modulate the pump speed controllers to maintain desired system differential pressure.
 - c. Coordinate with the pump motor speed controller specified in another section.
 3. Alternate the lead pump on a daily basis.

POINT DESCRIPTION	TYPES	DEVICE
Pump Start/Stop	DO	Control Relay
Pump Status	DI	Current Sensitive Relay
System Differential Pressure (2)	AI	Differential Pressure Sensor
Pump VFD (Each of two pumps)	AO	Motor Controller

3.24 HYDRONIC HOT WATER HEATING SYSTEM

- A. This system consists of two condensing hot water boilers with constant flow primary boiler pumps and variable flow hot water secondary pumps. Control of the hydronic hot water heating system is as follows:
1. Energize the hydronic hot water heating system whenever there is a call for heating in the building.
 - a. Monitor all control valves to determine if a heating requirement exists.
 2. Energize the hybrid sequence controller specified elsewhere.

- a. The hybrid sequence controller shall control all functions and sequencing of the hot water heating boilers.
- b. Connect all boilers to the master boiler controller specified elsewhere with communication cable as required.
- 3. Hydronic hot water heating system supply temperature reset.
 - a. A temperature sensor sensing outdoor temperature shall provide an input to the hybrid sequence controller to reset the hot water supply temperature.
 - 1) Maintain 130°F supply water temperature whenever the ambient temperature is 20°F and below.
 - 2) Maintain 110°F supply water temperature whenever the ambient temperature is 60°F and above.
 - 3) All reset temperatures shall be adjustable through the BMCS.
- 4. Secondary hot water pump control:
 - a. A system differential pressure sensor shall modulate the hot water pump variable frequency drives and stage pumps A and B to maintain system differential pressure.
 - b. This system shall be completely adjustable in the field.

POINT DESCRIPTION	TYPES	DEVICE
Hybrid Sequence Controller	DO	Control Relay
Boiler Alarm Status	DI	Safety Relay (Each Boiler)
Secondary Hot Water Pump Start/Stop/Modulation	AO	Variable Frequency Drive (Each Pump)
Pump Status	DI	Current Sensitive Relay
Building Hot Water Supply/Return Temperature	AI	Pipe RTD
Boiler Discharge Water Temperature	AI	Pipe RTD (Each Boiler)
Ambient Temperature	AI	Thermistor
Boiler Supply Water Reset	AO	Hybrid Sequence Controller

3.25 EMERGENCY POWER HVAC

- A. The BMCS shall interface with the Generator Automatic Transfer Switch associated with equipment branch to monitor status of transfer switch. Coordinate with Division 26 and refer to specification section 26 32 13 Natural Gas Standby Gen Sets for additional requirements.
- B. Refer to section 26 32 13 Natural Gas Standby Gen Sets for additional sequencing requirements.
- C. The Emergency Power HVAC sequence shall only run when the transfer switch is in emergency power mode AND the Emergency Power HVAC Switch is pressed or commanded via BMCS web portal.
- D. The transfer switch for optional HVAC comfort loads will send a pre-transfer

signal/warning to the BMCS when a manual generator load test is preparing to commence. This will allow the BMCS to begin and complete an orderly shutdown prior to transfer to the emergency source or transfer back to the normal source upon completion. The BMCS will initiate its normal start-up sequence upon restoration of power.

- E. The Emergency Power HVAC system consists of allowing certain HVAC equipment to operate during a building power outage when the building is functioning under Emergency Power.
- F. The BMCS shall monitor the fire pump controller and fire pump transfer switch. Upon activation of the fire pump system the Emergency Power HVAC sequence shall be suspended and all equipment shall be shut down in an orderly manner as to not damage equipment.
- G. The following equipment is intended to operate when BMCS is signaled as described above. Select equipment are connected to emergency power.

Superintendents Suite

- 1. AHU-8
 - 2. CU-1
 - 3. SF-2
 - 4. VAV-4-21
 - 5. VAV-4-22
 - 6. VAV-4-22
 - 7. EF-6
 - 8. EF-7
- H. The systems operating during an Emergency Power event shall function as outlined elsewhere in this specification.
 - I. Provide a single graphics page to display the Emergency Power HVAC system and all mechanical equipment associated with this operating state.
 - J. Provide two Emergency Power HVAC switches as indicated on the drawing and as instructed by the owner.
 - K. Provide a Emergency Power HVAC virtual button with the BMCS system. Coordinate final location of virtual button within the BMCS graphics with the owner. This virtual button shall be capable of being secured with additional password or user level restrictions.
 - L. BMCS shall provide additional 8 hours of technician support during the commissioning and initial testing of the Emergency Operations Center HVAC operation.

3.26 START-UP AND POINT VERIFICATION

- A. Final startup and point verification shall include the following information.
 - 1. Field panel checkout:
 - a. Verify enclosure is not mounted on vibrating surface.
 - b. Verify class I and class II wiring is separated within enclosure.
 - c. Check for shorts/grounds/induced voltages/proper voltages.
 - d. Verify proper point terminations in accordance with as-builts.
 - e. Verify that all modules are in proper place and addressed.
 - f. Verify proper power voltage.
 - g. Load database and programming.
 - h. Startup the panel.

- i. Point and device checkout.
2. Analog input point checkout:
 - a. Verify the correct wiring terminations per the design documentation package, at the field panel. Verify that all wiring and terminations are neat and dressed.
 - b. Verify the point address by checking that the analog input instrument is wired to the correct piece of field equipment. Do this by altering the environment at the sensing element or by disconnecting one of the wires at the sensor, and verifying that the reading at the field panel has reacted to this change.
 - c. Verify the point database to be correct, (i.e., alarmability, alarm limits, slope/intercept, engineering units, etc.). Verify that the correct change of value (COV) limit has been defined.
 - d. Verify the sensor has the correct range and input signal. (i.e., 20-120°F, 4 - 20 ma). Verify that the device is mounted in the correct location and is wired and installed correctly per the design documentation package.
 - e. Set-up and/or calibrate any associated equipment (i.e., panel LCD meters, loop isolators, etc.). Verify that these auxiliary devices are mounted in the correct location and are wired and installed correctly per the design documentation package.
 - f. Verify the correct reading at the field panel using appropriate MMI devices. Verify that any associated LCD panel meters indicate the correct measured value.
3. Digital input point checkout:
 - a. Verify the device is correctly wired and terminated as shown in the design documentation package. Verify that all wiring and terminations are neat and properly secured.
 - b. Verify the point address by verifying that the digital input is correctly terminated at the controlled piece of equipment.
 - c. Verify the point database is correct (i.e., point name, address, alarmability, etc.).
 - d. Set-up and/or calibrate the associated equipment, i.e. smoke detector, high/low temp detector, high/low static switch, flow switch, end switch, current relay, pressure switch, etc. is mounted in the correct location, and is wired and installed correctly per the control system installation drawings.
 - e. With the controlled equipment running or energized as described in the digital output checkout procedures, verify the correct operation of the digital input point and associated equipment by putting the digital input monitored equipment into its two states. Verify that the proof or status point indicates the correct value at the operator's terminal and that the status led is giving the proper indication in each mode of operation (on/off).
4. Digital output point checkout:
 - a. Verify that device is correctly wired and terminated as shown in the design documentation package.
 - b. Verify that the correct voltage is utilized in the circuit.
 - c. Verify the point database to be correct (i.e. point name, address, etc.).
 - d. Check and verify that the end device responds appropriately to the digital output(s).
 - e. After verifying the set-up and operation of any associated digital input/proof points, check and verify correct operation of the logical point and associated equipment by commanding the point to all possible states (i.e. off, on, fast, slow, auto, etc.). Verify that the defined proof delay is adequate for all modes of operation.

- f. If any interlocked equipment exists that has independent hand-off-auto or auxiliary control wiring, verify correct operation of same. Also check that any interlocked equipment such as EP switches for damper operation or exhaust and return fans are wired correctly and operate correctly.
 - g. Verify that the controlled piece or pieces of equipment cannot be caused to change state via the digital output if an associated hand-off-auto switch is in the hand/on or hand/off mode of operation, unless specified as a fireman's override point etc.
 - 5. Analog output point checkout:
 - a. Verify the correct wiring or piping terminations per the design documentation package, at the field panel. Verify that all wiring and piping terminations are neat and dressed.
 - b. Insure that the correct output device(s) are installed per the Control System Installation Drawings. (i.e., I/P or P/I transducers, transformers, power supply, etc.). Verify that these devices are installed, wired and piped correctly. Verify that any configuration jumpers are in the proper settings for the required application. Verify related transformers are fused in accordance with installation drawings.
 - c. Verify the point database to be correct. Verify that the correct COV limit has been defined.
 - d. Verify the point address by checking that the analog output is wired and/or piped to the correct output transducer and/or equipment.
 - e. Verify that the controlled device is calibrated (i.e., 3-8PSI valve, 8-13 PSI damper motor, 4-20 ma variable frequency drive, etc.) and is in the correct location, and is wired or piped and installed correctly per the design documentation package. If the controlled device is not calibrated, then a three-point (high, low and mid-point) calibration procedure must take place. Verify proper operation of the end device. When calibration has been verified, ensure that installation drawings, point database, and PPCL have been updated.
 - f. Set-up and or calibrate any associated equipment, (i.e., panel LCD meters, loop isolators, pneumatic gauges, etc.). Also verify that these auxiliary devices are mounted in the correct location, and are wired or piped and installed correctly per the design documentation package.
 - g. After verifying the set-up and operation of any associated equipment check for the correct operation of the logical point and associated equipment by commanding the analog output to the top and bottom of its range. Verify that the control device(s) responded appropriately as indicated by the design documentation package. Check to insure that all network terminals, host console devices, etc. can also command these outputs.
 - h. Check that all pneumatic gauges, pilot positioners and LCD panel meters indicate the correct values.
 - 6. Terminal equipment controller checkout:
 - a. Load program database
 - b. Enable programs
 - c. Verify sequence of operations
 - 7. Programming checkout:
 - a. Provide checkout for each system and sequence of operation.
 - b. The following are sample sequence of operations tests. The intent of these procedures is to provide a plan of action to verify system operations via block checks of the project specific sequence of operations. The procedures may be used in this format, or one procedure to a page should more detail be required. The procedures

outlined below should be verified for accuracy, and may be modified to meet your specific requirements.

- c. Description of Test: AHU Alarm Checkout. Verify AHU-1 discharge air temperature alarming is operational and is received at the designated terminal.
 - d. Input to Trigger Test: Change discharge temperature high alarm limit through software to a value below the current discharge temperature (discharge temperature - 10°F).
 - e. Expected Outcome: A high temperature alarm will be received per the Alarm Definition Report at its designated terminal.
 - f. Provide signoff sheet with indication for test Pass, Fail, Date of test and Initials for signoff.
8. Workstation checkout:
- a. Verify the operation of all trunk interface equipment.
 - b. Verify all workstation software, including options, based upon the installation instructions for the PC.
 - c. Perform software backup (site, options, etc.)
 - d. Complete workstation configuration report for owner signoff.
 - e. Provide verification that all graphics have been created, as required by project bid documents.

3.27 TESTING AND ACCEPTANCE

- A. General:
- 1. After completion of installation and start-up procedures, commence the specified 3-phase verification and testing sequence leading to final acceptance.
 - a. Follow in the order specified.
 - b. Each testing phase shall be satisfactorily completed before entering the next phase.
 - 2. Prior to entering each phase of the sequence, submit for approval, a written agenda describing in detail the procedure to be followed to meet the requirements for each specified verification, test or demonstration.
 - 3. Submit for approval, a sample of the form on which the test will be reported.
 - a. Identify project.
 - b. Provide a list of all points, arrange in numerical order of point addresses.
 - 1) Show point descriptor and location of each.
 - 2) Indicate DDC panel that processes each point.
 - 3) Use the list as a basis for the specified report form.
 - c. Signatures of participants and observers.
 - d. Results.
 - e. Description of adjustment or corrections of points in error.
 - f. Date.
 - 4. Provide schedule of tests. Estimate dates of significant events.
 - 5. Test, calibrate and adjust each point in the system as specified.
 - 6. Provide documentation of all tests and verifications as specified.
 - 7. Provide trend reports indicating proper control of all points for an extended period of time.
- B. Phase 1 - Testing, Calibrating, and Adjusting:
- 1. Operate each analog point in the entire system.
 - a. At a point in the upper quarter of its range.
 - b. At a point in the lower quarter of its range.
 - c. At its operating point.
 - 2. Provide personnel and diagnostic instruments at both the central and remote locations.

3. Provide testing stimulants for alarms.
 4. Use digital meters of double the accuracy of the instruments being calibrated.
 5. Provide an approved test device for simulating high and low temperatures.
 6. When the function is performed, read values at the central control and observe the actual function at the field instrument.
 7. Exercise each binary point and observe indication at console and simultaneously observe operation in the field.
 8. Submit an operation report for each point in the system, in approved format, and describe any corrective or adjusting action taken.
 9. Test all power transducers with a Dranetz Power Analyzer.
- C. Phase 2 - Equipment and Point Verification:
1. Verify calibration or function of each point.
 - a. Verify analog points at operating value.
 - b. Record on specified form.
 - c. Make approved adjustments to out of tolerance points.
 - 1) Identify these points for ready reference.
 2. After verification procedure is completed:
 - a. Verify corrected points.
 - b. Record on specified form.
 - c. Points requiring correction.
 - 1) Replace sensor or actuator if electrical measurements indicated components are out of specified tolerance.
- D. Phase 3 - Software Verification:
1. Submit agenda and report format for software demonstrations.
 2. Demonstrate to the Owner and the Engineer that all software programs and automatic control sequences function as specified.
 3. Demonstrate compliance with response time specifications.
 - a. Simulate normal heavy load conditions.
 - b. Initiate at least ten successive occurrences on normal heavy load conditions as specified, and measure response time of typical alarms and status changes.
 04. Provide written documentation of demonstration, signed by representatives of the Contractor and Engineer.
- E. Provide the following reports to Engineer at final completion of all Testing:
1. List of all points.
 2. List of all points currently in alarm.
 3. List of all disabled points.
 4. List of all points in over-ride status.
 5. List of all points currently locked out.
 6. List of user accounts and access levels.
 7. List all weekly schedules.
 8. List of holiday programming schedules.
 9. List of limits and deadbands.
 10. System diagnostics reports including, list of DDC panels on line and communicating, status of all DDC terminal units device points.
 11. List of programs.
 12. Provide trend data reports to ensure proper operation and sequence control of BMCS.
- F. Substantial Completion of the BMCS will not occur until completion and acceptance of all testing and acceptance procedures.

3.28 TRAINING

- A. The contractor shall provide factory-trained instructor to give full instruction to designated personnel in the operation of the system installed. Instructors shall be thoroughly familiar with all aspects of the subject matter they are to teach. The contractor shall provide all students with a student binder containing product specific training modules for the system installed. All training shall be held during normal working hours of 8:00 am to 4:30 PM weekdays.
- B. Provide 40 hours of training for Owner's designated operating personnel. Training shall include:
 - Explanation of drawings, operations and maintenance manuals
 - Walk-through of the job to locate control components
 - Operator workstation and peripherals
 - DDC controller and ASC operation/function
 - Operator control functions including graphic generation and field panel programming
 - Operation of portable operator's terminal
 - Explanation of adjustment, calibration and replacement procedures
 - Student binder with training modules
- C. Since the Owner may require personnel to have more comprehensive understanding of the hardware and software, additional training must be available from the Contractor.

3.29 PROJECT MANAGEMENT

- A. Provide a designated project manager who will be responsible for the following:
 - 1. Construct and maintain project schedule.
 - 2. Authorized to accept and execute orders or instructions from General Contractor, Owner / Architect & Engineer.
 - 3. Attend project meetings as necessary to avoid conflict and delays.
 - 4. Make necessary field decisions relating to this section.
 - 5. Coordination / Single point contact.
 - 6. Have Internet access for project management.

END OF SECTION 23 09 33

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SECTION 23 09 34

COORDINATION OF BUILDING MANAGEMENT AND CONTROL SYSTEM

1 GENERAL

1.1 SECTION INCLUDES

- A. The items listed below are provided for contractor coordination and shall be furnished and/or installed by this contractor.

2 PRODUCTS

- A. Products provided by the Building Management and Control System (BMCS) Contractor.
 - 1. Control Valves
 - 2. Dampers
 - 3. Wells for sensors installed in piping system
 - 4. Flow Meters

3 EXECUTION

3.1 COORDINATION

- A. Coordinate with the Building Management and Control System (BMCS) Contractor.
 - 1. Provide project-scheduling information to the BMCS Contractor to allow ample time for purchase of equipment and devices.
 - 2. Schedule periodic project meetings to review progress and coordination issues.
 - 3. Submit a written report, to the Architect/Engineer, on a monthly basis stating status of coordination effort.
- B. The BMCS contractor will submit shop drawings to this contractor for review and coordination processing.

3.2 INSTALLATION

- A. This Contractor will be responsible for the following:
 - 1. Installation of control valves for HVAC equipment.
 - 2. Installation of dampers for HVAC equipment.
 - 3. Installation of temperature sensor wells in piping.
 - 4. Installation of pressure taps in piping system.
 - 5. Installation of flow meter taps in piping system.
- B. Install the above material under the direction of the Building Management and Control System (BMCS) Contractor.

END OF SECTION 23 09 34

SECTION 23 20 00

HVAC PIPE AND PIPE FITTINGS - GENERAL

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

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.

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 manufacturer, 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. Pipe cleaning shall be performed at velocities above maximum design flow rates to ensure solids are suspended in the fluid and removed from the pipe system. Contractor shall ensure no piping components or devices are damaged by elevated fluid velocities by bypassing or removing from system prior to pipe cleaning process.
- 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 23 20 00

SECTION 23 21 13

HOT WATER AND CHILLED WATER PIPING, VALVES AND APPURTENANCES

1 GENERAL

1.1 WORK INCLUDED

- A. Furnish and install heating water and chilled water piping, valves and appurtenances, including fittings and strainers. Domestic hot water piping is specified in the Domestic Water Piping and Appurtenances section.

1.2 RELATED WORK

- A. Division 23 Mechanical:
 - 1. Pipe and Pipe Fittings - General
 - 2. Valves, Strainers and Vents
 - 3. Vibration Isolation
 - 4. Insulation

2 PRODUCTS

2.1 PIPE AND FITTINGS

- A. For pipe 2" and less in diameter, provide pipe conforming to ASTM A 53, Grade A or B, or ASTM A106 standard weight seamless, or electric-resistance welded black steel pipe. Furnish 150 lb. screwed malleable iron fittings conforming to ANSI B 16.3 for chilled water. Provide fittings conforming to ANSI B 16.4 for hot water.
- B. For pipe 2-1/2" in diameter and larger, provide pipe meeting the requirements of ASTM A 53, Grade A or B, or ASTM A 106 standard weight seamless, or electric-resistance welded black steel pipe with standard weight seamless steel welded fittings, satisfying ASTM A 234, Grade WPA or WPB, ANSI B16.9.

2.2 VALVES

- A. Refer to Section 23 05 23.
- B. Refer to Building Management and Control System.

2.3 WATER SPECIALTIES

- A. Pressurized Expansion Tanks shall be precharged steel tank with a replaceable heavy duty Butyl rubber bladder. The tank shall have a 1-1/2" system connection, drain, and a standard tire valve to facilitate on-site charging of the tank. The tank shall be fitted with lifting rings and a floor mounting skirt for vertical installation. The tank must be constructed in accordance with Section VIII of ASME Boiler and Pressure Vessel Code and stamped 125 PSI working pressure.
 - 1. Acceptable manufacturers: Bell & Gossett, Taco, Wessels, John Wood Company, and Wheatley.
- B. Air Separators shall be centrifugal type. The inlet and outlet connections shall be the same as adjoining pipe. Vessel shell diameter is to be three times the nominal inlet/outlet pipe diameter. The unit shall have an internal stainless steel air collector tube with perforations and 63% open area designed to direct accumulated air to the compression tank via a vent connection at top of unit. The air separator must be designed,

constructed and stamped for 125 psig @ 350°F in accordance with Section VIII, Division 1 of the ASME Boiler and Pressure Vessel Code, and registered with the National Board of Boiler and Pressure Vessel Inspectors. The air separator(s) shall be painted with one shop coat of light gray air dry enamel. A Manufacturer's Data Report for Pressure Vessels, Form U-1 as required by the provisions of the ASME Boiler and Pressure Vessel Code shall be furnished for each air separator upon request.

1. Acceptable manufacturers: Bell & Gossett, Armstrong, Taco, John Wood Company, and Wheatley.
- C. Automatic Air vents shall be float actuated high capacity air vent designed to purge free air from the system and provide shutoff at pressures up to 150 psig at a maximum temperature of 250 degrees F. The design of the high capacity air vent shall prevent air from entering the system if system pressure should drop below atmospheric pressure. The high capacity air vent shall purge free air at pressures up to 150 psig during normal system operation. The high capacity air vent shall be constructed of cast iron and fitted with components of stainless steel, brass, and EPDM.
1. Acceptable Manufacturers: Bell & Gossett, Armstrong, Taco, and Wheatley.
- D. Pressure Reducing Valves shall be diaphragm operated with brass body, low inlet pressure check valve and inlet strainer. The strainer shall be easily removed without system shutdown. The valve seat, strainer, and stem must be removable and of non-corrosive material.
1. Acceptable Manufacturers: Bell & Gossett, Armstrong, Taco, and Wheatley.

3 EXECUTION

3.1 TESTING

- A. Test all piping systems to assure they are absolutely leak free.
- B. Apply a hydraulic pressure 1-1/2 times the operating pressure, 150 psig minimum, and check for leaks. Maintain test for a minimum of 24 hours. The piping system must remain absolutely tight during this period. The satisfactory completion of any test or series of tests will not relieve the contractor of responsibility for ultimate proper and satisfactory operation of piping systems and their accessories. The test should be observed by the Architect / Engineer before pressure is removed and water drained.

3.2 AIR HANDLING UNIT PIPING

- A. Provide a minimum of 12" of straight pipe at all coil piping connections.

3.3 AIR SEPARATOR

- A. Install full size drain to nearest floor drain.

END OF SECTION 23 21 13

SECTION 23 21 23

HVAC PUMPS

1 GENERAL

1.1 WORK INCLUDED

- A. General characteristics for pumps specified in Division 23 - Mechanical.

1.2 RELATED WORK

Requirements for pumps are specified in other sections of Division 23 - Mechanical, including the following:

- A. Division 23 Mechanical - Electrical Provisions of Mechanical Work.

1.3 PUMP SELECTION

- A. Select pumps conservatively for scheduled conditions. Furnish pumps that have reasonably high efficiencies, with peak efficiency at or near rated conditions. Select pumps that will operate stably at 15' suction lift despite substantial reduction in head or substantial increase in delivery.
- B. If the pumps proposed are not considered suitable, submit manufacturer's data on other pumps, for review.
- C. Scheduled design flow, design head, pump efficiency, and motor horsepower are the minimum acceptable.
- D. The pump curve shall rise continuously from maximum flow to cut-off.
- E. Shut-off head approximately 10 percent greater than design head, unless otherwise indicated in pump schedules.
- F. Pump brake horsepower shall not exceed the motor horsepower rating over the entire operating range from shut-off to run-out.
- G. Select the pump for operation at or near peak efficiency.
- H. Cavitation-free at all points on the curve.
- I. Impeller diameter shall not exceed 90 percent of the maximum published diameter.
- J. Pumps shall be suitable for parallel operation. Where pumps are operated in parallel, individual pumps shall be capable of stable operation with only one pump operating in the system. Submit pump curves with single and multiple pumps operating on system curve for approval.

1.4 PUMP SIZE AND TYPE

- A. Provide motor-driven pumps of the type and speed scheduled. Select pumps that are not overloaded throughout the entire range of pump operation. Provide pump connection sizes as indicated.

- B. The head capacities indicated in the schedules are listed for bidding purposes only. Calculate the operating head at each pump; take into consideration the actual routing of the various lines, pressure drops in heat exchangers and coils, exact lengths of pipe, fittings, etc. Submit these calculations, together with copies of manufacturer's performance curves, as shop drawings on each pump. Clearly mark the curves for each pump to indicate the diameter of the impeller and the selection point.

1.5 CERTIFIED DATA

- A. Submit factory certified pump curves showing pump performance characteristics with pump and system operating points plotted. Curves shall include as a minimum, flow (gallons per minute), head (feet of water), all available impeller diameters (inches), efficiency (percent), net positive suction head required (feet of water), brake horsepower, pump size and pump model. When multiple pumps are operating in parallel, show pump curves for one pump running, two pumps running, and so on. Show pump curves with system curve plotted.

2 PRODUCTS

2.1 VERTICAL IN-LINE (VIL) PUMPS

- A. Pump Construction:
1. Pump casing, cast iron with 125 psig ANSI/PN16 flanges for working pressure below 175 psig at 150°F and ductile iron with 250 psig ANSI / PN25 flanges for working pressure to 375 psig at 150°F.
 2. Suction and discharge connections shall be flanged and the same size and shall be drilled and tapped for seal flush and gauge connections.
 3. Impeller: Bronze, fully enclosed type; dynamically balanced, two-plan balancing is required where installed impeller diameter is less than 6 times the impeller width.
 4. Shaft: Provide stainless steel pump shaft.
 5. Coupling: Rigid spacer type of high tensile aluminum alloy. Coupling is to be designed to be easily removed on site to reveal a space between the pump and motor shafts sufficient to remove all mechanical seal components for servicing and to be replaced without disturbing the pump or motor.
 6. Mechanical seals shall be stainless steel multi-spring inside or outside balanced type with Viton secondary seal, carbon rotating face and silicon carbide stationary seat. Provide 316 stainless steel glad plate. Provide factory installed flush line with manual vent.
 7. Split coupled pumps shall be provided with a lower seal chamber throttle bushing to ensure seals maintain positive cooling and lubrication.
 8. Provide seal flush supply line to the mechanical seal with a 50 micron cartridge filter and sight flow indicator to suit the working pressure encountered. Filters shall be changed by the installing contractor after system is flushed and on a regular basis until turned over to the Owner.
 9. Supply in the flush line to the mechanical seal a maintenance free sediment separator with sight flow indicator.
- B. Single stage, single or double suction type, with pump characteristics which provide rising heads to shut off. Refer to pump schedule for pump flows and heads and motor speed, enclosure, efficiency and power requirements and other system conditions.
- C. Pump Motor:
1. Premium efficiency
 2. Totally enclosed fan cooled

3. Cast iron frame and end plate
4. Forge steel lifting eye
5. Over sized conduit box with ground lug
6. So sized with relation to the pump impeller that the brake horsepower requirements will not overload the motor at any point on the pump curve
7. Designed for Variable Frequency Drive Application
8. Minimum Efficiency

3 hp	1800 rpm	89.5%
5 hp	1800 rpm	90.2%
7.5 hp	1800 rpm	91.7%
10 hp	1800 rpm	91.7%
15 hp	1800 rpm	92.4%
20 hp	1800 rpm	93%
25 hp	1800 rpm	93.6%
30 hp	1800 rpm	94.1%
40 hp	1800 rpm	94.5%
50 hp	1800 rpm	94.5%
60 hp	1800 rpm	95%
75 hp+	1800 rpm	95.4%

D. Data plates:

1. Provide the pump with a nameplate constructed of 300 series stainless steel securely fastened to pump casing with stainless steel pins.
2. Locate the nameplate for easy visibility.
3. Clearly stamp the rating conditions and other data below, as a minimum, on the nameplate.
 - a. Manufacturer, address, telephone number
 - b. Pump model number
 - c. Pump serial number
 - d. Size (including impeller diameter scheduled in inches)
 - e. Type
 - f. Equipment designation as listed on the pump schedule.
 - g. Flow scheduled (gallons per minute)
 - h. Dynamic head scheduled (feet of water)
 - i. Efficiency (percent)
 - j. Shut-off head (feet of water)
 - k. Speed (rpm)
 - l. Brake horsepower
 - m. Maximum brake horsepower with rated impeller
 - n. Rotation
 - o. Maximum allowable pressure (psig)

E. The schedule on the drawing sets forth the type of pump and GPM required.

1. The head capacities and horsepower are for bidding purposes only.
2. Make pump selection based on actual system calculations.

F. Acceptable manufacturers:

1. Armstrong Series 4300
2. Aurora
3. Bell & Gossett
4. Grundfos
5. Patterson
6. TACO

3 EXECUTION

3.1 INSTALLATION

- A. Install the pumps in accordance with Manufacturer's "Installation, Start-up and Service Instructions".
 - 1. Provide access space around pumps for service.
 - 2. Install pumps on concrete housekeeping base, with anchor bolts, set and level, and grout in place. Install stainless steel drain pan with trough under chilled water pumps only.
 - 3. Provide air cock and drain connection piped to floor drain.
 - 4. Lubricate pumps prior to start-up.
 - 5. Install condenser water pumps to ensure a full flooded suction.
 - 6. Paint entire unit with two coats of machinery enamel after completion of installation.
 - 7. Provide a spool piece between the suction diffuser and the suction side of the pump minimum length 8" face to face.
 - 8. Provide pressure taps with valves on each side of the pump.
 - 9. Install hot water circulator horizontally, properly supported to wall, in an accessible location for testing and maintenance at a height not to exceed 60" above finished floor. Install line size Ernst bronze rotating wheel, flow indicator with double window, downstream of circulator.
- B. Provide a line size isolation valve and strainer on the pump suction and a line size silent check valve and balancing valve on the pump discharge. Provide an automatic air vent off the pump casing. For base mounted pumps, provide a drain line the full size of the base connection and extend it to and terminate it over the nearest floor drain.
- C. Support piping adjacent to the pump such that no weight is carried on the pump casing. Decrease from pipe size with eccentric reducer on suction side and concentric increaser on discharge side.
- D. Ensure pumps:
 - 1. Operate at specified system fluid temperatures without vapor binding and cavitation.
 - 2. Are non-overloading in parallel and individual operation.
 - 3. Operate within 25 percent of midpoint of published maximum efficiency curve.
- E. Refer to pump detail on the Contract Drawings for piping accessories to be provided.

3.2 ALIGNMENT FOR BASE MOUNTED PUMPS

- A. Set the pump on a concrete inertia base or concrete housekeeping pad as specified; anchor, level and grout.
- B. Align the pump and driver in accordance with Hydraulic Institute Standards for centrifugal, rotary and reciprocating pumps.
- C. Realign the pump and driver after initial leveling of pump base before placing the grout and again after the grout has set and the foundation bolts are tightened. Recheck the alignment after the piping has been connected.

3.3 MANUFACTURER START-UP SERVICE ALIGNMENT

- A. After installation, the pumps and motors are to be aligned by the manufacturer or their representative utilizing a dial indicator. After completion, a formal report must be

submitted by the Manufacturer to the Engineer prior to final acceptance. This report must include pump serial number, location, beginning and final alignment at a minimum.

1. Technicians, as required, shall be trained and experienced in the work they perform (contractor start-up / alignment is unacceptable).
- B. Before starting pumps, but after connecting piping:
 1. Align shafts and coupling with a precision dial indicator alignment instrument to the minimum tolerances .004 (TIR) per inch of coupling radius or as recommended by the manufacturer, whichever is the greater.
 2. Tabulate the actual pump alignment reading with manufacturer's minimum tolerances.
 3. Submit readings for approval.
 4. Include the approved readings in the Owner's Maintenance Manual.

3.4 FINAL PUMP FLOW CALIBRATION

- A. Based on the results of the final phases of the test and balance sequences, if the flow of the unthrottled pump is more than 10% above the scheduled values:
 1. Request detailed instructions from the pump manufacturer for the correct impeller diameter.
 2. Trim the impeller to the diameter recommended by the manufacturer, employing precision machinery.
- B. Enter the information on the final configuration of the pump in the Owner's Manual.
 1. Modify the pump nameplate to reflect the correct head and flow data and the impeller diameter.

3.5 SPARE PARTS

- A. Provide the following spare parts and material to the Owner for his use after the warranty period.
 1. A mechanical seal for each pump
 2. A set of bearings for each pump

END OF SECTION 23 21 23

SECTION 23 23 00

REFRIGERANT PIPING AND APPURTENANCES

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

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.

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.

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.

END OF SECTION 23 23 00

SECTION 23 25 12

FLUSHING AND CLEANING OF STEEL PIPING SYSTEM

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01, apply to this Section.
- B. Addenda issued during the bidding period that affect this section of the specifications.

1.2 WORK INCLUDED

- A. Flushing and cleaning of the complete closed loop chilled water system and heating hot water system. This work shall be performed prior to replacing the air separator with new air dirt separator.

1.3 SERVICE AND SUPPLIES

- A. All work shall be performed by a qualified, full-time, Flushing Contractor.
 - 1. Specialist in the field of industrial system flushing and cleaning.
- B. After the mechanical contractor has tested the piping, it shall be flushed and cleaned for service. Provide a complete water flushing and cleaning of the closed loop chilled and hot water systems as specified herein. Systems must be commissioned as clean and meet water treatment specifications.
- C. All closed loop chilled water, and hot water piping and related equipment shall be thoroughly flushed out with precleaning chemicals designed to remove deposits such as pipe dope, oils, loose rust, mill scale and other extraneous materials. Recommended dosages of pre-cleaner chemical products shall be furnished by water treatment supplier, added and circulated throughout the water systems. The water system shall then be diluted and final flushed thoroughly until no foreign matter is observed and total alkalinity of the water is equal to or better than that of the make-up water.
- D. All temporary connections required for flushing, cleaning, purging, and circulating shall be provided by mechanical contractor. Provide suitable pipe bypasses at each coil and heat exchanger during the flushing and cleaning operation.
- E. Self-contained flush unit requirements shall contain a pump or pumps connected that will meet or exceed the volume required to flush and purge the system at the required velocity rate through the largest pipe. Pump curve shall be submitted along with other important documentation for the related equipment on the unit. This will include, at minimum, filtration, flow meter(s), pressure gauges, and unit description or picture. All operators shall comply with all safety regulations of the project-site. The flushing operation shall be manned continuously during the flushing process.

2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. PurgeRite
- B. Owner or Engineer approved equivalent. Substitution request must be received as outlined elsewhere in specifications.

3 EXECUTION

3.1 FLUSHING PROCEDURE

- A. PRE-FLUSH
 1. Bypass loops should be installed in front of any strainers and control valves at all equipment components. Coordinate with flushing and cleaning contractor for proper sizing and placement of bypasses and flush ports.
 2. Install temporary strainer elements in front of pumps, tanks, solenoid valves, control valves, and other equipment where permanent strainers are not indicated that are not bypassed. Keep these 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-off valve. Strainers should be removed when a self-contained flush unit is used in conjunction with on board filtration.
 3. Flush ports should be identified along with the type of high pressure hose or piping that will be used to connect to the system.
 4. The water source shall be provided and identified to the flushing and cleaning contractor by the mechanical contractor and must be adequate to fill and make up water in a timely manner to the system during the flush process.
 5. A water dump location source shall be provided and identified to the flushing and cleaning contractor by the mechanical contractor which is usually the sanitary.
- B. CLEAR WATER FLUSH
 1. Fill the piping system with clean potable water. The first flush is a clear- water flush intended to circulate water through the system and force loose debris to low point drains and flush cart filtration system. This flush should be at minimum velocity throughout the system of 5 -7 ft./sec throughout. Filtration should be at minimum, 50 microns. This flush shall continue until the system water is comparable to the make-up water. Iron content should be under 2.0 ppm.
- C. CLEANING AND PASSIVATION
 1. The second flush cycle is a combined flushing cycle where cleaning and passivation chemicals are introduced into the system to clean the oils and treat the inside wall of the piping system. This process will be monitored by the chemical treatment company to meet the chemical specifications of the water. The cleaning velocity should be between 3 to 5 ft./sec throughout, and the circulation time will be based on the chemical testing, but will be at minimum, 24 hours.
- D. FINAL CLEAR WATER FLUSH
 1. The system will be continuously flushed while discharging chemicals into the sanitary system as approved locally. As the existing treated water is being discharged, a fresh water make-up source will be utilized to ensure air is not introduced into the system. Continue to drain the system while adding domestic water to dilute the treated water. The chemical treatment company will monitor the outgoing water composition and compare the composition with the incoming water. Flush with fresh water until the conductivity is reduced to that of the make-up water and iron meets specifications. The final system water should be approved by the chemical treatment company. Filtration should be 5 microns.

- E. FINAL CHEMICAL FILL
1. Once the chemical treatment company has determined the system has been brought back to the correct composition, the chemical treatment company will inject the final chemicals into the system. Once the system is filled with the final chemicals it is important the water not be left stagnant.
 2. Verify satisfactory completion of clean piping and a final flushing and chemical treatment report should be submitted by field personnel. The report should include at minimum, project name, date, location, parties involved, type of pipes treated, scope summary, flows, durations, and other relevant information.
 3. Cleaning chemicals, procedure, water testing, reporting, and consultation must be provided by a qualified water treatment company specializing in this type of work.

END OF SECTION 23 25 12

SECTION 23 25 13

CIRCULATING WATER SYSTEM CHEMICAL TREATMENT

1 GENERAL

1.1 WORK INCLUDED

- A. Provide equipment, chemicals and treatment materials for the complete water treatment system.
- B. Determine which chemicals to use from the results of a water sample analysis taken from the building domestic water supply.
- C. Provide water treatment products, holding reservoirs, equipment and labor for testing, cleaning, flushing and dispensing products to achieve the required water quality for each system specified.
 - 1. Closed chilled and hot water systems

1.2 SERVICE AND SUPPLIES

- A. All work shall be performed by a qualified, full-time, Water Program Manager.
 - 1. Specialist in the field of industrial water treatment.
 - 2. Facilities include water analysis laboratory, development facilities and service department.
- B. Provide a water treatment test set for each system (pH, alkalinity, hardness, chloride) for field use including test equipment and reagents as required for specific use with the treatment products employed.
- C. Where specialized supplementary testing or control equipment is required, provide appropriate items.
- D. Provide a water management and service program for a period of one year beginning at substantial completion. Make routine visits bi-weekly during first two months of operation and monthly during the remainder of the specified period.
- E. Routing Services
 - 1. Check and adjust water treatment system operation.
 - 2. Instruct, train and advise operating personnel.
 - 3. Check efficiency of chemicals and chemical applications.
 - 4. Replenish chemicals and replace expendables.
 - 5. Clean or replace filter in feeder.
- F. Chemically clean the piping system.
- G. Provide a complete laboratory analysis of water samples. Insert in the Owner's manuals.
- H. Provide review of report figures in the field water testing.

1.3 QUALITY ASSURANCE

- A. Acceptable program manager shall have:
 - 1. Research and development facilities.

2. Regional laboratories capable of making water analysis.
 3. A service department and qualified technical service representatives located within a reasonable distance of the project site.
 4. Service representatives who are registered Engineers or factory-certified technicians with not less than 5 years of water treatment experience with the water treatment system manufacturer.
- B. Ensure that all products, packaging, blow-down or other effluents do not violate local, state, or federal laws or regulations. Use only chemicals that are registered, when required, with the U.S. Department of Agriculture or the U.S. Environmental Protection Agency and that are labeled as required by law.
- C. Provide electrical products that have been tested, listed and labeled by Underwriters Laboratories and comply with the National Electrical Manufacturers Association Standards.

1.4 WARRANTY

- A. The Chemical Treatment provider shall provide a full system warranty throughout construction and for a period of one year after substantial completion. One year extended warranty shall start the date of the substantial completion certificate.

2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Worth Hydrochem of Houston (Brad Kym 713-896-0087)

2.2 CLOSED CHILLED AND HOT WATER SYSTEM

- A. By-pass filter feeders in the hot water and chilled water systems:
1. Rated at 40-gpm capacity.
 2. Operating conditions: 150 psig and 250°F.
 3. Quick opening cap with a Buna N-O ring seal; or 1-1/2" valve and funnel.
 4. 5 micron polypropylene filter bag mounted in a perforated stainless steel holder. Filter bag shall be supported from top of feeder.
 - a. Filter bag and holder shall extend full length of feeder tank.
 - b. Bottom feed tanks are not acceptable.
 5. Fabricated hot dipped galvanized steel support legs and frame. Refer to detail drawing for requirements.
 6. Provide sufficient quantity of filter bags for warranty period. Minimum of six additional bags provided to owner.
- B. Acceptable Manufacturers
1. Neptune Model FTS-5
 2. Efficiency Dynamics FF-100.
 3. J.L. Wingert Model FHC-5HD.
 4. Hydro-systems HS-800
 5. Vector Industries, Inc. FA-900
- C. Treatment chemicals:
1. Furnished as a concentrated liquid in 5 gallon pails
 2. A corrosion inhibitor of the nitrite-borate type.
 3. Maintained at a nitrite residual of 600 – 800 ppm in chilled loops and 1000-1500

- in hot loops.
 - 4. With effective copper, black iron, stainless steel and aluminum corrosion inhibitors.
 - 5. Form a protective film to prevent corrosion and scale formation.
 - 6. Have colored dye to indicate presence.
- D. Multiple chemicals used in a common system shall be compatible.
- E. Flow Indicator:
 - 1. Bronze Construction
 - 2. Rotating Wheel
 - 3. Line Size
 - 4. Double Window
 - 5. Ernst Flow Industries Model EFIE-57-3

3 EXECUTION

3.1 INSTALLATION/START-UP

- A. In accordance with manufacturer's recommendations.
- B. Anchor the chemical filter feeder to a concrete housekeeping pad using wedge type expansion anchors.
- D. Clean and flush closed loops systems.
 - 1. Clear water flush systems before introducing chemical cleaners.
 - 2. Chemical cleaner shall be introduced into the systems to remove construction related oils, greases, threading compounds, and silt.
 - 3. Chemical Cleaner shall passivate and pre-film pipe system.

3.2 WATER ANALYSIS

- A. The chemical treatment agency shall provide the services of a testing laboratory to perform a site water analysis. As a minimum, conduct the following tests in accordance with ASTM standards and to the satisfaction of the Owner/Architect/Engineer.
 - 1. Silica in water and wastewater.
 - 2. Acidity or alkalinity of water.
 - 3. Iron in water.
 - 4. Hardness of water.
 - 5. Ph of water.
 - 6. Particulate and Dissolved Matter, Solids or Residue in Water.
 - 7. Turbidity in water.
 - 8. Corrosivity of water in absence of heat transfer.
 - 9. Standard practices for sampling water.
- B. Take water samples in accordance with ASTM.
- C. Prepare a test report in accordance with ASTM for each of the tests conducted.
- D. Submit the test reports to the Architect/Engineer.

3.3 CHEMICAL TREATMENT

- A. The chemical treatment agency shall provide complete services necessary for chemically cleaning and treatment the following systems:

1. Chilled water.
 2. Hot water.
 3. Condenser water.
- B. The chemical treatment agency shall provide, but not be limited to the following:
1. Equipment and installation.
 2. Chemicals.
 3. Analytical and testing work.
 4. Inspection.
 5. Calculations.
 6. Assistance to the trade installing the piping.
 7. Instruction to Owner.
- C. Determine which chemicals to use from the results of site water analysis. Provide the chemical necessary to achieve the desired water condition.
- D. Examine and supervise flushing and pipe cleaning operations and verify that the systems are clean, free of debris and rust and other construction materials before starting water treatment.
- E. After the piping has been flushed, cleaned, rinsed and charged with chemicals, then start-up and operate the chemical treatment equipment to provide steady, stable characteristics for the systems treated.
- F. During construction, instruct the Contractor in the field piping and wiring of chemical feeding equipment. If such piping and wiring details are not shown on the Contract Drawings, then provide all equipment, piping, wiring, instrumentation and chemicals to provide a complete and operating system without additional cost.
- G. After the chemical treatment is functioning as intended, the chemical treatment agency shall demonstrate to the Architect/Engineer the chemical treatment operation.

3.4 OWNER TRAINING

- A. A chemical treatment agency, in conjunction with the chemical treatment equipment manufacturer's factory representative, shall train the Owner to operate and maintain the chemical treatment system as a whole and in part for each piece of equipment.
- B. Furnish to the Owner a chemical treatment administration manual covering the chemical treatment program for each of the systems treated. The manual shall include, but not be limited to:
1. Name, address and telephone number of the chemical treatment agency and each of the equipment manufacturers.
 2. Operation and maintenance manuals.
 3. Test reports.
 4. Chemical data sheets.
 5. A narrative describing the chemical treatment program for each of the systems being treated.

3.5 TESTING AND INSPECTION

- A. After the systems have been accepted, the chemical treatment agency shall visit the site every month during the warranty period.
- B. During each visit:

1. Check and adjust the chemical treatment equipment.
 2. Check the chemistry of the treated system to confirm the chemicals are maintaining the system as intended.
 3. Advise and instruct the Owner on operational changes made to the chemical treatment program.
 4. Take a water sample of each system being chemically treated and have the samples tested by a testing laboratory. Prepare a report for each water sample and submit it to the Owner. Include in the test report the changes that need to be made to the chemical treatment program.
 5. Maintain complete records of the treatment program for each system at the project site. Keep the records in a hardbound manual with the building manager. A second copy shall be maintained by the agency for the agency's records.
- C. Routine visits must be coordinated with the Owner.
- D. Send copy of monthly report to Engineer for Verification.

END OF SECTION 23 25 13

SECTION 23 31 13

DUCTWORK

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. 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 submit 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.

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
- H. Natatorium Ductwork: 304 Stainless Steel

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 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

2.9 FLUES FOR POWER EXHAUST AND HIGH EFFICIENCY BOILERS AND WATER HEATERS

- A. Double wall air insulated positive pressure chimney equal to Metalbestos, Van-Packer, Schebler or Metal-Fab. Chimney shall be rated for 550°F maximum flue gas temperature and with a UL tested pressure rating of 40 inches w.c. The interior pipe shall be constructed of AL 29-4C stainless steel and the exterior pipe shall be constructed of 304 stainless steel. Stack system shall be complete with a one inch air gap between inner liner and outer cover. Chimney shall be constructed and installed per UL-1738 and NFPA-211. All accessories shall be made by the same manufacturer and designed to be a part of a positive pressure chimney system.

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 Teflon end bushings / bearings.
 - 6. Provide the damper with a hand operated regulator with handle locked in place with heavy duty high torque stamped wing nut (Duro Dyne UESO).
 - 7. Provide a 2" sheet metal stand-off to extend the regulator (Duro Dyne UESO).
 - 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.

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. Where otherwise indicated or required for balancing coordinate location of additional dampers required by TAB Contractor.
 - 8. 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 FLUES

- A. Provide and install flues for all gas fired equipment.

- B. Refer to plans for all related locations.

- C. Contractor is responsible for coordinating stack sizing, stack drains, stack test ports, stack termination fittings and all other required fittings with the selected equipment manufacturers.

- D. All fittings and accessories shall be manufactured by the flue manufacturer. The flue shall be installed per manufacturer's instruction.

- E. Terminate flues at height above roof to prevent flue gas from entering the building.

3.9 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.

3.10 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.

3.11 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.

3.12 FUME HOOD EXHAUST SYSTEM

- A. All material and fittings shall be 304 stainless steel construction.

3.13 ACOUSTICAL DUCT

- A. Install in the following locations:
 - 1. Where indicated on the drawings

3.14 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.

3.15 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.

3.16 PLENUMS

- A. Construct plenums with galvanized steel framing members and galvanized sheet steel, cross braced 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.

3.17 AUXILIARY DRAIN PANS

- A. Where coils that have a condensate drain are located above ceiling.

3.18 TESTING OF LOW PRESSURE DUCTWORK

- A. Test ductwork for leaks before concealing. Maximum allowable leakage is 5% of total airflow.
- B. Pressure testing of ductwork shall be performed by mechanical contractor and witnessed by Owner/Architect/Engineer/Commissioning/TAB.
- C. 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.
- D. 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.
- E. Ductwork down stream of terminal boxes, return, exhaust, and outside air ducts are to be visually inspected.

3.19 TESTING OF MEDIUM AND HIGH PRESSURE DUCT

- A. As the project progresses, test the ductwork in sections.
- B. Pressure testing of ductwork shall be performed by mechanical contractor and witnessed by Owner/Architect/Engineer/Commissioning/TAB.
- C. 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.
- D. 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.
- E. Test method as set forth in SMACNA "HVAC Duct Construction Standards".

END OF SECTION 23 31 13

SECTION 23 33 19

DUCT SILENCERS

1 GENERAL

1.1 WORK INCLUDED

- A. Furnish and install duct silencers.

1.2 RELATED WORK

- A. Division 23 Mechanical.
 - 1. Ductwork.
 - 2. Air Balance.

1.4 SUBMITTALS

- A. Submittal to submittal drawings detailing all duct silencer data specified in the mechanical drawing schedule.
- 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.
- C. Silencer manufacturer shall submit certified laboratory performance obtained using ASTM E477-13. The laboratory must be NVLAP accredited for the ASTM E477-13 test standard and a copy of the accreditation certificate must be included with submittals. Data from non-NVLAP accredited test facilities is not acceptable.
- D. Submitted silencer pressure drops should not exceed those listed in the silencer schedule unless approved by project engineer. Silencer pressure drop measurements shall be made in accordance with ASTM E477-13. 4. Submitted silencer dynamic insertion loss and self-noise data should satisfy values listed in the silencer schedule at the project's air distribution system airflow requirements. ASTM E-477-13 tests to obtain this data shall be conducted in the same facility and utilize the same silencer.
- E. Silencer dynamic insertion loss shall not be less than that listed in the silencer schedule unless approved by the project engineer.
- F. Silencer generated noise shall not be greater than that listed in the silencer schedule unless approved by the project engineer.
- G. The silencer manufacturer shall provide, for approval, acoustic calculations for relevant duct systems with silencers to validate that the submitted silencers will satisfy occupied space design guidelines. Use sound power levels of actual equipment scheduled for installation on project. Acoustic Analysis shall include breakout noise calculations as required. In the absence of specified background noise level criteria, the guidelines outlined in the 2015 ASHRAE Applications Handbook Chapter 48, Table 1 shall apply.

1.4 SHIPPING PROTECTION

- A. Silencers shall be shipped with factory-installed end caps

2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Price
- B. Vibro-Acoustics
- C. Kinetic Noise Control
- D. IAC Acoustics
- E. Ruskin

2.2 GENERAL REQUIREMENTS

- A. Silencers shall be of the size, configuration, capacity and acoustic performance as scheduled on the drawings. Silencers shall be fabricated by the same manufacturer.
- B. Silencer inlet and outlet connection dimensions must be equal to the duct sizes shown on the drawings. Duct transitions at silencers are not permitted unless shown on the contract drawings or approved by the project engineer.

2.3 CONSTRUCTION

- A. Silencers shall be constructed in accordance with ASHRAE and SMACNA Standards for the pressure and velocity classification specified for the air distribution system in which it is installed.
- B. Casing seams and joints shall be lock-formed and sealed or stitch welded and sealed except as noted, to provide leakage-resistant construction.
- C. Airtight construction shall be achieved by use of a duct-sealing compound supplied and installed by the contractor at the jobsite.
- D. Perforated steel shall be adequately stiffened to insure flatness and form. Spot welds shall be painted as required.
- E. Fire-Performance Characteristics: Silencer assemblies, including acoustic media fill, natural cotton fiber, sealants and acoustical spacers shall have Class 1 flame spread index not exceeding 25 and smoke-developed index not exceeding 50 when tested according to ASTM E84, NFPA 255 or UL 723.
- F. Material gauge thickness:
 - 1. Material gauges noted in other sections are minimums and shall increase as required for the system pressure and velocity classification.
 - 2. The silencers shall not fail structurally when subjected to a differential air pressure of 8 inches water gauge.
- G. Outer casing shall be ASTM A 653/A 653M, G90 galvanized sheet steel, gauge as listed below:
 - 1. Rectangular Silencers, including STC-rated models: 22 gauge
 - 2. Rectangular Elbow Silencers: 22 gauge
 - 3. Circular Silencers:
 - a. For units up to 20 inches in diameter: 22 gauge
 - b. For units 21 through 44 inches in diameter: 18 gauge

- c. For units over 44 inches in Diameter: 16 gauge
 - d. Transitional Silencers: 22 gauge
- H. Rectangular Elbow Silencers: 1. Acoustical splitter/baffles shall be internally radiused and aerodynamically designed for efficient turning of the air.
- I. Transitional Silencers shall occur internal to the silencer such that the height of the gap or air passage is changing with the length of the splitters/baffles.
- J. Inner perforated metal liner shall be supplied in accordance with ASTM A 653/A 653M, G90 galvanized sheet steel in the following gauge thicknesses according to silencer type or connection size:
 - 1. Rectangular Silencers: 22 gauge
 - 2. Rectangular Elbow Silencers: 22 gauge
 - 3. Circular Silencers: 22 gauge
 - 4. Transitional Silencers: 22 gauge
- K. Principal Sound-Absorbing Mechanism:
 - 1. Packless (No-Media) Silencers:
 - a. Models shall not contain absorptive media. Attenuation shall be achieved with controlled impedance membranes and broadly tuned resonators.
 - 2. Absorptive (Dissipative) and Film Lined Silencers:
 - a. Standard Acoustic media:
 - 1) Media shall be of acoustic quality, shot-free glass fiber insulation with long, resilient fibers bonded with a thermosetting resin. Glass fiber density and compression shall be as required to insure conformance with laboratory test data.
 - 2) Media shall be packed with a minimum of 15% compression during silencer assembly.
 - 3) Media shall be resilient such that it will not pull apart during normal applications, and shall resist settling, breakdown, and sagging from vibration. Media shall not rot, mildew, or otherwise deteriorate, and shall have sufficient flexibility to readily form around corners and curved surfaces.
 - 4) Media shall not cause or accelerate corrosion of aluminum or steel.
 - b. Natural cotton and film lined natural cotton:
 - 1) Media shall be natural cotton fibers treated with an EPA registered, non-toxic borate solution, and "flash dried" to actively inhibit the growth of mold, mildew, bacteria, and fungi.
 - 2) Media shall not contain formaldehydes, phenolic resins or Volatile Organic Compounds (VOC's) that can off-gas and/or cause health concerns.
 - 3) Media shall be 100% recyclable and comply with UL181 and NFPA 90A. Insulation shall be packed with a minimum of 15% compression during silencer assembly.
 - 4) Media shall not cause or accelerate corrosion of aluminum or steel. Glass fiber, fiberglass and mineral wool are not permitted as a substitute for natural cotton.
- L. Media Protection:
 - 1. Dissipative silencers:
 - a. Where indicated on the silencer schedule, media shall be encapsulated in glass fiber cloth to help prevent shedding, erosion and impregnation of the glass fiber.

- b. Axial Fan silencers shall have a glass fiber cloth liner.
- 2. Film Lined silencers:
 - a. The acoustic media shall be completely wrapped with polymer film to help prevent shedding, erosion and impregnation.
 - b. The wrapped acoustic media shall be separated from the perforated metal by a factory-installed acoustically transparent spacer.
 - c. The spacer shall be flame retardant and erosion resistant.
 - d. Mesh, screen or corrugated perforated liner will not be acceptable as a substitute for the specified spacer.
 - e. Silencer manufacturer shall provide a written test report showing silencer assemblies have Class 1 flame-spread index not exceeding 25 and smoke-developed index not exceeding 50 when tested according to ASTM E 84, NFPA 255 or UL 723.
- 3. HTL Casings:
 - a. Where indicated on the silencer schedule, silencers shall have high transmission loss (HTL) walls externally applied and completely sealed to the silencer casing by the silencer manufacturer.
 - b. If requested by the project engineer, relevant breakout noise calculations shall be provided to ensure compliance with the relevant room noise criteria that are based on the sound power levels of the specified equipment.

3 EXECUTION

3.1 INSTALLATION

- A. Install silencer according to manufacturer's written installation instructions.

3.2 FIELD QUALITY CONTROL

- A. Ensure duct silencers are installed with airflow arrows in direction of airflow.

END OF SECTION 23 33 19

SECTION 23 34 16

FANS

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.

2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Cook
- B. Greenheck

- C. Penn Barry Ventilator
- 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. Dampers. Where automatic backdraft damper is scheduled:
 - 1. Multi-bladed.
 - 2. Heavy duty.
 - 3. Roll formed aluminum blades.
 - 4. Nylon bearings.
 - 5. Neoprene weather strip on blade edge.

- G. Where motorized damper is scheduled:
 - 1. The motor and damper are specified in the Building Management and Control System Specification.
- H. 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
- I. 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

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 23 34 16

SECTION 23 36 16

VARIABLE VOLUME TERMINAL UNITS

1 GENERAL

1.1 WORK INCLUDED

- A. Furnish and install variable volume terminal units, including hangers, controls and other required elements.
 - 1. Provide constant fan variable volume terminal units where indicated on the drawings.
 - 2. Provide variable volume terminal units where indicated on the drawings.

1.2 RELATED WORK

- A. Division 23 Mechanical.
 - 1. Ductwork.
 - 2. Air Balance.
 - 3. Electrical Requirements for Mechanical Work.
 - 4. Building Management and Control System.
 - 5. Vibration Isolation,

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.
- B. Coordinate the primary (input) voltage with the electrical power source. Refer to the Electrical Drawings for specific requirements.

1.4 SUBMITTALS

- A. Submit product data for control devices, terminal boxes, and similar equipment for review prior to placement of purchase order. Submit internal wiring diagrams, installation and operation manual as a complete submittal package.
- B. Submit certified sound power levels for both discharge sound and casing radiated sound in accordance with ARI 880-98 Certification Program. All NC levels shall be calculated using ARI 885-98, Appendix E attenuation factors for mineral ceiling.
- C. Submit for each box the following information:
 - 1. Box size
 - 2. Inlet size
 - 3. Box number
 - 4. Box designation
 - 5. Minimum / Maximum Fan CFM
 - 6. L / R Coil connection
 - 7. GPM
 - 8. Motor HP
 - 9. NC Level
 - 10. External Static Pressure
 - 11. Scheduled MBH
 - 12. Actual MBH

- 13. Heating Coil Pressure Drop (ft.)
- 14. Entering and Leaving Water Temperature
- 15. Entering and Leaving Air Temperature

1.5 QUALITY ASSURANCE.

- A. Make air flow tests and sound level measurements in accordance with applicable ASHRAE Standards 130-96 and ARI 880-98.
- B. Manufacturer shall certify cataloged performance and ensure correct application of terminal units.
- C. Sound power levels to occupied space shall not exceed NC-30 as calculated using ARI 885-98 Appendix E attenuation factors for mineral tile ceiling.

2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

- A. Titus.
- B. Krueger
- C. Price
- D. Nailor
- E. Metalaire

2.2 BOX CONSTRUCTION

- A. Galvanized 22-gauge steel casing with suspension lugs.
- B. Lined with minimum 1.5 PCF / 1" thick fiber free
 - 1. Flame spread not higher than 25.
 - 2. Smoke developed rating not higher than 50.
 - 3. Condensation on the exterior of the box is not approved.
 - 4. Coat all cut edges of liner with NFPA approved sealant.
 - 5. Lining shall pass UL 181, NFPA 90A and ASTM C 665.
- C. Provide access to controls, fan compartment, and unit servicing, without disturbing duct connections. Limit the size of access doors to 24 inches. Where required, provide multiple access doors. Gasket each door in the unit casing.
- D. Components shall be constructed of corrosion resistant materials.
- E. Bearings shall not require lubrication.
- F. Casing leakage shall not exceed 2.0% of scheduled design air flow at 3.0" WG interior casing pressure.
- G. Seal casing joints with approved adhesive if required to meet the maximum casing leakage rate.
- H. The maximum overall height of the variable air volume unit shall not exceed available

ceiling space.

- I. Maximum static pressure drop of air through terminal box shall be 0.2" w.g.
- J. Maximum velocity through duct inlet shall be 2,000 fpm.

2.3 COMPONENTS

- A. The entire terminal unit, including the heating coil, shall be designed and built as a single unit.
- B. Provide each unit with a primary variable air volume damper that controls the air quantity in response to a space sensor.
- C. Each unit shall contain:
 - 1. Fan and motor assembly. For Fan Powered Units Only
 - 2. Heating coil.
- D. Locate the heating coil in the discharge of the blower section.
- E. Provide single point electrical connections for the entire unit. Entire assembly shall be UL or ETL Certified, electrical components shall be UL listed and installed in accordance with the National Electrical Code.
- F. The variable air volume units provided by the manufacturer shall be the quietest design available from the manufacturer for the type specified.
- G. Induced air filter frame for 1" thick disposable filter.
- H. Sufficient power for the VAV unit DDC controller, electric actuator and other components necessary to satisfy the sequence of operation. Size each transformer for the total connected load plus an additional 25% of the connected load. Primary and secondary fuses housed in a fuse block.
- I. Inlet attenuator for induction airside of box with liner to lower radiated noise.

2.4 BLOWER FAN AND MOTOR

- A. Blower fan:
 - 1. Constructed of steel.
 - 2. Forward curved centrifugal wheel.
 - 3. Dynamically balanced wheels.
 - 4. Direct drive motors.
- B. Motor
 - 1. Ultra-high efficiency ECM motor technology
- C. Motor current characteristics as scheduled. Coordinate motor voltage with Division 26. Verify voltage with Electrical Plans.
 - 1. Thermal overload protection.
 - 2. Sleeve bearings.
- D. Provide isolation between fan motor assembly and unit casing.
- E. Provide a manual speed control system to allow continuously adjustable fan speed from

maximum to minimum.

1. Electronic speed control matched to operate with the motor.
 2. Speed controller shall incorporate a minimum voltage stop to ensure motor cannot operate in a stall mode.
- F. Fan disconnect switch. This is not to be used as a main disconnect switch.
- G. Provide electric heating models with the following items:
1. Single point electrical connection
 2. Line side disconnect switch
 3. Motor fuse
 4. Motor disconnect switch
 5. Fan SCR and relay
 6. Control transformer
 7. Air flow switch
 8. Heat contactors
 9. Thermal Hi-Limit Auto Reset switch

2.5 PRIMARY AIR DAMPER AND ACTUATOR

- A. The control actuator shall vary the primary air damper in response to the control signal.
1. Damper leakage at shutoff shall not exceed 2.0% at 1" WG pressure.
 2. Locate the damper inside the unit.
 3. Damper connection to the operating shaft shall be a positive mechanical connection.
 4. Damper shall have bearings at all penetrations of inlet tube and terminal housing. Penetration of damper shaft in terminal lining shall have seal at surface of lining to prevent fiber entrainment through rotation of damper shaft.
 5. Two damper stop pins shall be provided. One pin shall ensure damper cannot rotate beyond full closed position. One pin shall ensure damper cannot rotate beyond full open position.
 6. Inlet tube shall have rolled bead (outward position) prior to penetration point of flow sensor tubing to provide stop point for hard duct and anchor point for flex duct.
 7. Flow sensor tubing shall have gaskets at penetration point of inlet tube.
 8. Flow sensor shall be center averaging type. Non-center averaging flow sensors are not acceptable.

2.6 AIR FLOW CONTROL

- A. Provide a flow control device that will limit the maximum CFM of the unit to that scheduled on the drawings.
1. Air quantity shall be factory set.
 2. Thermostat signal shall reset the flow control device to reduce primary air quantity to match load requirements.
 3. Control shall be pressure independent.
 4. Each terminal shall incorporate a flow cross sensor with pick-up points connected to a center averaging chamber to ensure the following performance:
 - a. Controller fidelity shall be +/-5% of set volume with a flex inlet configuration and inlet static variation of 0.5" WG to 6.0" WG.
 5. Provide flow measuring taps and a flow chart with each unit for field balancing air flow.
- B. HOT WATER HEATING COILS
1. Provide hot water heating coils sized as scheduled.

- a. The hot water heating coil is specified to be provided and mounted under the work of this Section.
- b. Coil access door upstream of coil.
- c. Install coil with supply inlet at bottom and on leaving airside of coil.
- d. Maximum static pressure drop of water through heating coil shall not exceed 10' w.g.
- e. Maximum static pressure drop of air through heating coil shall not exceed 0.25" esp

3 EXECUTION

3.1 INSTALLATION

- A. Deliver and store products in a clean and dry place. Protect products from the weather, dirt, dust, construction debris and physical damage.
- B. Install each unit in accordance with the manufacturer's printed installation instructions.
- C. Suspend each unit from 1/4" electroplated zinc thread rods secured from structure.
 - 1. Provide sub-structure where required.
 - 2. Mount bottom of terminal unit no more than 18" above the finish ceiling height.
 - 3. Install units so that they are level and plumb.
- D. Install a straight length of rigid ductwork upstream of all boxes. Provide at least 3 primary air inlet diameters of straight ductwork upstream of the primary air inlet connections. Flexible duct connections at boxes are allowed but are not a substitute for the straight run of rigid duct. A maximum of 4' of flexible duct is allowed at each box. All changes in direction shall be made with rigid duct. Seal connection at box, as required to comply with system maximum allowable leakage.
- E. Coordinate the location of each variable air volume unit to ensure proper clearance so that all components are accessible and not blocked by other trades. Provide no less than the code required clearances to electrical components.
- F. Cover and seal the openings of the VAV inlets during construction to prevent the inside from getting dirty. Where VAV units are considered dirty, as determined by the Architect / Engineer / Owner, clean the VAV units with a vacuum machine, and then wipe all surfaces with a cleaning agent, using clean rags.
- G. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.
- H. All installation shall be in accordance with manufacturer's published recommendations.
- I. Provide clearance for inspection, repair, replacement and service. Ensure accessibility to all terminal unit electrical control panel doors, controllers and operators are located a minimum of 30 inches from all obstructions (walls, pipe, etc.).
- J. Provide ceiling access doors or locate units above easily removable ceiling components.
- K. Support units individually from structure. Do not support for adjacent ductwork. Terminal units shall be supported using unit's hanger brackets and threaded rods.

3.2 MISCELLANEOUS CONTROLS

- A. The following equipment items are to be furnished by Building Management and Control System and installed by Fan Powered Terminal Unit manufacturer:
 - 1. Automatic temperature control card (DDC).
 - 2. Damper actuator.
- B. The following equipment items are to be furnished and installed by the Fan Powered Terminal Unit manufacturer:
 - 1. Damper.
 - 2. Multi-point flow sensor.
 - 3. Controller enclosure.
 - 4. Power transformer.
- C. Coordinate the output voltage required by the Building Management and Control System.
- D. Coordinate location of controller enclosure.

3.3 ACOUSTICAL PERFORMANCE TEST

- A. Test each size for each type of variable air volume unit furnished on the project.
- B. Test for radiated noise and discharge noise in all operational modes from minimum to maximum primary air settings; at inlet air pressures of 1 and 2 inches water column, and at primary air settings of 20, 40, 60 and 100 percent.
- C. Testing shall be done by an independent testing laboratory. Sound values submitted shall be certified by the laboratory doing the testing. Testing laboratory must be approved by Engineer. Final testing and approval must be witnessed by Engineer.
- D. Testing procedures shall be in accordance with ASHRAE Standard 130-96 and rated in accordance with ARI 880.
- E. Test the unit complete with damper, coils and controls. The unit shall be operational and represent a final version of the units to be installed on the project.
- F. If the units do not meet sound criteria, modify the units and retest at no additional cost to the Owner until the sound criteria is in accordance with Contract Documents. The variable air volume unit manufacturer shall be held liable for the costs associated with construction delays resulting from failed test, not to exceed the purchase order cost.
- G. Sound Levels: Maximum sound power levels resulting from any box shall not exceed the following:

OCTAVE BAND CENTER FREQUENCY, Hz.						
	125	250	500	1000	2000	4000
Radiated SPL db	52	45	40	36	34	33
Discharge SPL db	44	37	31	27	24	22

- 1. Sound power levels are referenced to 10-12 watts.
 - 2. Box inlet static pressure = 1-1/2"
 - 3. No discounting for roof effect, ceiling attenuation, lined duct, division of flow and other similar effects.
- H. All terminal boxes shall be equipped with a sheetmetal elbow with liner connected to plenum air inlet.

3.4 SPARE PARTS

- A. Provide one spare motor for each size box.

END OF SECTION 23 36 16

SECTION 23 37 13

AIR DEVICES

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.

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.

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 23 37 13

SECTION 23 41 00

AIR FILTRATION

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.

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 and shall not exceed 375 fpm.
- E. Initial resistance to air flow:
 - 1. 300 fpm - 0.12" 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.

3 EXECUTION

3.1 INSTALLATION

- A. Install the filters and filter gauges in accordance with the manufacturer's instructions.

- B. Filter shall be maintained and replaced throughout construction and through substantial completion.
- C. It is the contractor's responsibility to ensure HVAC equipment used during construction to complete finishes are properly protected from dirt, dust and debris. If coils are dirty or show signs of negligence. It will be the contractor's responsibility to properly clean equipment and coils prior to owner acceptance.

END OF SECTION 23 41 00

SECTION 23 52 35

GAS-FIRED MODULATING HOT WATER BOILER (Condensing)

1 GENERAL

1.1 WORK INCLUDED

- A. This section specifies a packaged, gas-fired, fire tube power type condensing stainless steel boiler complete with all controls and trim for indoor installation.
- B. Each factory "packaged" boiler shall be complete with all components, accessories and appurtenances necessary for a complete and operable boiler as hereinafter specified. Each unit shall be furnished factory assembled with required wiring and piping as a self-contained unit. Each unit shall be readily transported and ready for installation.
- C. Each factory "packaged" boiler, including pressure vessel, trim, valve trains, burner, control system, and all related components, accessories and appurtenances as herein specified shall all be assembled and furnished by the boiler manufacturer. The boiler manufacturer shall provide unit responsibility for the engineering, coordination, workmanship, performance, warranties, and all field services for each factory "packaged" boiler as specified herein. The boiler manufacturer shall be fully responsible for all components assembled and furnished by him whether or not they are of his own manufacture.

1.2 RELATED WORK

- A. Division 23 - Mechanical
 - 1. Hot Water Piping
 - 2. Gas Piping
 - 3. Ductwork

1.3 PERFORMANCE

- A. Provide performance as scheduled on drawings. Boiler shall be certified for up to 99% efficiency.

1.4 WARRANTIES

- A. The Boiler Manufacturer shall provide a full machine parts and labor warranty for a period of five years. The boiler manufacturer shall provide a five-year parts and labor extended warranty for boiler heat exchanger for a total of ten years. Warranties shall start the date of the substantial completion certificate.

2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Hydrotherm - KN
- B. Lochinvar - Crest
- B. PK - Solis
- C. Raypak - Xvers

2.2 PERFORMANCE CRITERIA

- A. Each boiler shall be capable of operating continuously at rated capacity while maintaining a CSA certified efficiency of not less than 92% on 500 MBH input boilers and less and not less than 95% on larger than 500 MBH input boilers. Each boiler shall be capable of operating with a minimum outlet water temperature of 68 deg. F.
- B. Boiler shall comply with ASME Section IV for 80 psig, max 200 deg. F (100 psig on 1500 MBH and larger units).
- C. Fuel shall be natural gas with an assumed higher heating value of 1,030 Btu/Cu Ft and an assumed specific gravity of 0.60 (relative to air). Natural gas shall be supplied at a pressure of no less than 3.5-inch WC to the inlet gas valve. Maximum inlet gas pressure shall not exceed 14-inch WC.
- D. Boilers shall be certified for low NOx by the TCEQ. NOx emissions shall not exceed 30 PPM when referenced at 3% O2 at all firing rates.
- E. The burner, gas train and controls shall conform to the requirements of I.R.I. /G.E. Gap.

2.3 BOILER DESIGN

- A. Each hot water boiler shall consist of a horizontal, stainless steel heat exchanger complete with trim, valve trains, burner, and boiler control system. The boiler manufacturer shall fully coordinate the boiler as to the interaction of its elements with the burner and the boiler control system in order to provide the required capacities, efficiencies, and performance as specified.
- B. Each boiler heat exchanger shall be stainless steel, counter-flow design for maximum heat transfer with the multiple sections arranged in a reverse return configuration to assure balanced flow through each section
- C. Contractor must, when filling the system, verify that the pH level is maintained between 6.0 and 8.5.
- D. All boiler pressure parts shall be constructed in accordance with the latest revision of the ASME Boiler and Pressure Vessel Code, Section IV, and shall be so stamped.
- F. Boiler heat exchanger headers shall be fabricated steel and be completely removable for inspection. Seals shall be EPDM, rated for 400 deg F service. Push nipples or gaskets between the sections are not permitted.
- G. Boiler shall be enclosed with a single wall outer casing. It shall be fabricated from minimum 16-gauge carbon steel. The front and top wall shall be secured in place with 1/4 -20 NC bolts (sheet metal screws are not acceptable). The complete outer casing shall be finished, inside and out, with a powder coat finish. The composite structure of the boiler combustion chamber, insulating air gap and outer casing shall be of such thickness and materials to assure an outer casing temperature of not more than 50°F above ambient temperature when the boiler is operated at full rated load.
- H. An observation port shall be located on the boiler to allow for observation of the burner flame.
- I. Boiler shall have a single condensing heat exchanger. A boiler that utilizes a secondary condensing heat exchanger is unacceptable.

2.4 BOILER TRIM

- A. Each boiler shall be provided with all necessary trim. Boiler trim shall be as follows:
 - 1. Safety relief valve shall be provided in compliance with the ASME code. Contractor is to pipe to acceptable drain.
 - 2. Water pressure-temperature gauge.
 - 3. Primary low water flow fuel cutoff (probe type with manual reset).
 - 4. Manual reset high limit water temperature controller.
 - 5. Operating temperature control to control the sequential operation of the burner.
 - 6. Separate inlet and outlet water temperature sensors capable of monitoring flow
 - 7. Exhaust temperature sensor
 - 8. Provide condensate neutralization kit (shipped loose).

2.5 BOILER FUEL BURNING SYSTEM

- A. The boiler manufacturer shall furnish each boiler with an integral, power type, straight gas, fully automatic fuel burner. The fuel burner shall be an assembly of gas burner, combustion air blower, valve train, and ignition system. The burner manufacturer shall fully coordinate the burner as to the interaction of its elements with the boiler heat exchanger and the boiler control system in order to provide the required capacities, efficiencies, and performance as specified.
- B. Each burner shall be provided with an integral gas firing combustion head.
- C. Each burner shall provide adequate turbulence and mixing to achieve proper combustion without producing smoke or producing combustibles in the flue gases.
- E. Each boiler shall be provided with an integral variable speed power blower to premix combustion air and fuel within the blower. The combustion air blower shall have sufficient capacity at the rated firing rate to provide air for stoichiometric combustion plus the necessary excess air. Static and total pressure capability shall comply with the requirements of the boiler. The blower shall operate at 6000 RPM maximum without undue vibration and noise and shall be designed and constructed for exposure to temperatures normal to its location on the boiler. The operating fan speed will be tachometer sensed and be capable of being displayed at the text based display.
- F. Each burner shall of the radial-fired (down-fired) type and constructed of steel with a stainless steel inner and stainless steel mesh outer screen.
- G. Each boiler shall be provided with a "Full Modulating" firing control system whereby the firing rate is infinitely proportional at any firing rate between 20% and 100% as determined by the pulse width modulation input control signal. Both fuel input and air input must be sequenced in unison to the appropriate firing rate without the use of mechanical linkage.
- H. The Micro Processor shall use a Proportional Integral Algorithm to determine the firing rate. The control must have the following capabilities:
 - 1. Maintain single set point
 - 2. Reset the set point based on outdoor air temperature.
 - 3. Boiler shutdown based on outdoor air temperature
 - 4. Internal dual set point program with an external switchover. (e.g. - night setback w/external clock, supplied by others)
 - 5. Alarm relay for any for any manual reset alarm function.
 - 6. Programmable Low Fire Delay to prevent short cycling based on a time and temperature factor for release to modulation.

7. Text Based Display showing current supply and return temperatures, current set points as well as differential set points. It must also display any fault codes whether automatically reset or manually reset.
8. Local Manual Operation.
9. Remote Control System (Building Management / Sequencer Control) - The boiler control shall be capable of accepting a 0 -10vdc remote external analog signal to control the firing rate
10. Computer (PC) interface for programming and monitoring all functions

2.6 MAIN GAS VALVE TRAIN

- A. Each boiler shall be provided with an integral main gas valve train. The main gas valve trains shall be factory assembled, piped, and wired. Each gas valve train shall include at least the following:
 1. Two (2) safety shutoff valves. Valves equipped with dual solenoids that can independently energized for leak testing.
 2. Air – Gas ratio control (maximum inlet pressure 14-inch WC)
 3. One (1) low gas pressure switch (manual reset).
 4. One (1) high gas pressure switch (manual reset).
 5. Two (2) pressure test ports

2.7 IGNITION SYSTEM

- A. Each boiler shall be equipped for direct spark ignition

2.8 COMBUSTION AIR CONTROL SYSTEM

- A. Each boiler shall be provided with an integral combustion air control system. The combustion air system shall be factory assembled. Each combustion air control system shall include at least the following:
 1. The primary control shall vary the speed of the blower based on load demand. The blower shall apply a varying negative pressure on the gas valve which will open or close to maintain zero pressure at the valve orifice, thereby increasing or decreasing the firing rate. Both the air and gas shall be premixed in the blower.
 2. One (1) low airflow differential pressure switch to insure that combustion air is supplied.
 3. High exhaust back pressure switch

2.9 BURNER CONTROL SYSTEM

- A. The control system shall be supplied with a 24 VAC transformer (120 VAC, single phase, 60 hertz primary). The 120/1/60 power supply to each boiler shall be protected by a 15 Amp circuit breaker located in the MCC (supplied by contractor).
- B. The boiler shall include an electric spark ignition system. Main flame shall be monitored and controlled by flame rod (rectification) system.
- C. Each boiler shall be provided with all necessary controls, all necessary programming sequences, and all safety interlocks. Each boiler control system shall be properly interlocked with all safeties.
- D. Each boiler control system shall provide timed sequence pre-ignition air purge of boiler combustion chamber. The combustion airflow sensor shall monitor and prove the airflow purge.

2.10 BOILER CONTROL PANEL

- A. The boiler manufacturer shall provide each boiler with an integral factory prewired control panel. The control panel shall contain at least the following components, all prewired to a numbered terminal strip:
1. One (1) burner "on-off" switch.
 2. One (1) electronic combination temperature control, flame safeguard and system control.
 3. Control circuit breaker, 5 amp
 4. All necessary control switches, pushbuttons, relays, timers, terminal strips, etc.
 5. Text Based Display Panel to adjust set points and control operating parameters. Text Based Display is to indicate burner sequence, all service codes (0-65), fan speed, boiler set point, and sensor values such as inlet, outlet, flue gas and outdoor air.

2.11 FACTORY TESTING - HYDROSTATIC

- A. Each factory "packaged" boiler shall be hydrostatically tested and bear the ASME "H" stamp.

2.12 FACTORY TESTING - FIRE TESTING

- A. Each factory "packaged" boiler shall be fire tested. The boiler manufacturer shall perform this fire test under simulated operating conditions, with the boiler attached to a working chimney system and with water circulating through the boiler. The manufacturer shall provide a fire test report, including fuel and air settings and combustion test results permanently affixed to the boiler.

2.13 SEQUENCE CONTROLLER

- A. Boiler shall be provided with a boiler sequence controller that is capable of controlling a) one or multiple boilers, b) all condensing or all non-condensing boilers, c) combination of condensing and non-condensing boilers (hybrid system). When controlling hybrid systems, sequence controller shall sequence the lead boiler based on its condensing capabilities to provide the most efficient operation. Controller shall be capable of communicating via MODBUS protocol. Controller shall allow boiler or boilers to operate off of a remote header sensor (header sensor provided by boiler manufacturer, installed by contractor). Controller shall be capable of allowing boiler or boilers to operate based on outdoor reset, see specification Section 23 09 33 for reset schedule. This shall be achieved by either, a) programming the controller with an outdoor air reset curve in conjunction with a separate outdoor air sensor (outdoor sensor shall be provided by boiler manufacturer, installed by contractor), b) setpoint control via 0-10 VDC analog communication with building automation system, c) setpoint control via MODBUS communication. Controller shall visually display relay status, firing rate of each boiler, header temperature, outdoor air temperature. Coordinate wiring of this controller with mechanical and control's contractor.

2.14 CARBON MONOXIDE MONITORING SYSTEM

- A. Provide and install a manual reset Carbon Monoxide Detector located within the boiler room. The Carbon Monoxide Detector and the boilers shall be interlocked so that the burners will not operate when the level of CO in the room rises above 50ppm. The Carbon Monoxide detector shall disable the boiler's burner upon loss of power to the detector.
- B. Carbon Monoxide Sensor with two year warranty by U.S. Draft Co. Model CGM-605 with model XB expansion module or equivalent by International Gas Detectors (IGD)
1. Provided with pre-programmed dry contacts to shut down equipment during unsafe

- operation.
- 2. NEMA 1 Enclosure
- 3. Complies with Texas State Boiler Code 65.603-2015
- 4. Additional features shall include 0-10 VDC control signal out, visual alarm and audible alarm.
- 5. Provide expansion board for additional equipment interlocks.

3 EXECUTION

3.1 INSTALLATION

- A. Install isolation valves and unions on supply and return water lines to boiler.
- B. Install strainer, drain with valve, pressure and temperature gauge on return water line to boiler.
- C. Install main gas cock, drip leg and union close to boiler.
- D. Install on 4" concrete pad and place into operation in accordance with manufacturer's instructions. Pipe as detailed on drawings.
- F. Provide Category IV vent stack material. Mechanical contractor shall coordinate draft requirements and other venting requirements between stack supplier and boiler supplier.
- G. Install boilers, piping and accessories in accordance with the manufacturer's installation instructions and state boiler code.
- H. Pipe each gas relief vent to the outdoors, in accordance with the manufacturer's recommendations and the local codes.
- I. Contractor must, when filling the system, verify that the pH level is maintained between 6.0 and 8.5.
- J. Contractor to route condensate connection off of boiler and stack to acid neutralization kit and then to appropriate drain. Trap as required by boiler manufacturer.

3.2 BOILER MANUFACTURER STARTUP SERVICE

- A. Provide factory authorized startup services to assure its proper operation.
- B. Set the boiler operating and safety controls.
- C. Perform a flue gas analysis at the boiler outlet. Record the following results of the analysis:
 - 1. Carbon dioxide percent volume.
 - 2. Oxygen percent volume.
 - 3. Stack temperature.
 - 4. Calculated combustion efficiency.
- D. Do not operate the boiler for any reason until the factory startup service has been completed.
- E. Startup procedure shall include a functional test of Carbon Monoxide Detector. Simulate an alarm condition and demonstrate the functionality of the detector shutting down the appliances. Owner/Engineer shall be present to witness test.

END OF SECTION 23 52 35

SECTION 23 63 00

AIR-COOLED CONDENSING UNITS

1 GENERAL

1.1 WORK INCLUDED

- A. Furnish and install 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.

2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Daikin
- B. York/JCI

2.2 COMPRESSOR

- A. This unit is utilized for variable air volume systems shall include a variable capacity scroll compressor on a minimum of one refrigeration circuits, which shall be capable of modulation from 10-100% of its capacity as required to maintain discharge air temperature throughout the full range of evaporator airflows.
- B. Provide unit with a refrigerant monitoring sensor option that detects refrigerant leaks throughout the refrigeration system to shut down the unit when a leak is detected. In addition, an alarm contact shall be provided within unit controller for connection to the building management system.

2.3 CONDENSER COILS

- A. Provide copper tubes with mechanically bonded aluminum fins. Protect condenser coils with a heavy gauge, corrosion resistant wire guard.
- B. Provide condenser coil coated with corrosion resistant epoxy utilizing a dip and bake process. Coating shall be flexible and uniformly bonded to all condenser coil surfaces.

2.4 FANS AND MOTORS

- A. All fans on the unit shall have variable speed fan motors to provide higher part load efficiency and reduced acoustic levels. Each fan circuit shall have a factory-installed,

independent variable speed drive with display. Variable speed drives are rated IP-55 enclosures and UL Listed. The use of this option, with the addition of wind baffles, shall allow running with outdoor ambient temperatures down to -20°F.

- B. Protect fan with a heavy-gauge, corrosion resistant wire guard. Provide inherently protected, permanently lubricated, and weatherproof motors.

2.5 CASING

- A. Furnish a unit designed for outdoor mounting. Fabricate the casing of heavy gauge steel, zinc coated and finished with enamel. Provide removable access panels.

2.6 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.
- B. Unit manufacturer shall provide software, hardware, interface module, cables and all other required devices to enable a laptop computer to communicate directly with unit for programming, troubleshooting and unit status.
- C. The unit be provided with discharge temperature controls and shall be capable of stable cooling operation to a minimum a cooling coil discharge temperature as scheduled down to 55°F outdoor temperature.

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 removable core refrigerant filter dryer and sight indicating glass.

3.2 CONTROL WIRING

- A. Furnish and install control wiring as required. Install control wiring in conduit.

3.3 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.

END OF SECTION 23 63 00

SECTION 23 65 28

AIR-COOLED VARIABLE SPEED ROTARY SCREW CHILLER

1 GENERAL

1.1 WORK INCLUDED

- A. Furnish and Install a packaged, electric-driven, air-cooled, water chilling unit with variable speed rotary screw compressors complete with controls.

1.2 RELATED WORK

- A. Division 23 – Mechanical:
 - 1. Chilled Water Piping
 - 2. Insulation
 - 3. Building Management Control System
 - 4. Vibration Isolation.
 - 5. Electrical Provisions of Mechanical Work.

1.3 REFERENCES

- A. ANSI/ARI 550/590 - Water Chilling Packages using the Vapor Compression Cycle.
- B. ANSI/ASHRAE 15 - Safety Code for Mechanical Refrigeration.
- C. ANSI/ASHRAE ASHRAE 90.1-1999 Minimum Chiller Efficiency Requirements
- D. ANSI/ASME SEC 8 - Boiler and Pressure Vessel Code
- E. ANSI/NEMA MG 1 - Motors and Generators.
- F. ANSI/UL 465 - Central Cooling Air Conditioners.
- G. ANSI/AFBMA 9-1978 - Load Ratings and Fatigue Life for Ball Bearings. Bearings must have life of not less than 200,000 hours.
- H. ASTM B117 - Standard Method of Salt Spray (Fog) Testing
- I. ASTM A123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
- J. ASTM A525 - Zinc (Hot-Dip Galvanized) Coatings on Sheet Steel Products
- K. ASTM D1654 - Evaluation of Painted or Coated Specimens, Subjected to Corrosive Environments

1.4 PERFORMANCE

- A. Provide performance as scheduled on drawings.

1.5 WARRANTY

- A. The Chiller 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.

1.6 SUBMITTALS

- A. Submit manufacturer's certified computer generated performance and capacity data in accordance with specification requirements.
- B. Submit the following information:
 - 1. Manufacturer's installation instructions.
 - 2. Minimum Circuit Ampacity.

3. Maximum Overcurrent Protection size.
 4. Maximum conductor / Terminal Lug size.
 5. Minimum flow thru evaporator.
 6. Electrical interlocks.
- C. Submit recommended clearance dimensions for air flow and service.
- D. Submit coordination drawings as specified.
1. Give consideration to adjacent structures as they affect air flow patterns.
- E. Submit internal wiring diagram of Control Center.
- F. Submit sequence of operation in narrative form.
- G. Submit a letter stating chiller being proposed meets the efficiency requirements of Centerpoint Energy's Score Program listed in Centerpoint Energy's Design Guide: HVAC Recommendations document.
- H. Mark-up a copy of the specifications, indicating in the margin of each paragraph, the following: COMPLY, DO NOT COMPLY, NOT APPLICABLE.

1.7 STORAGE/HANDLING/SHIPPING

- A. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.
- B. Protect units from physical damage. Factory coil shipping covers shall be kept in place until installation.
- C. Unit controls shall be capable of withstanding 203°F (95°C) storage temperatures in the control compartment for an indefinite period of time.

2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Daikin
- B. York/JCI

2.2 COMPRESSORS

- A. Provide a minimum of two independently circuited semi-hermetic direct drive, variable speed rotary screw compressors with the following:
1. Rubber isolation pads.
 2. Crankcase heaters.
 3. Semi-hermetic motor.
 4. Oil sight glass.
 5. Load and unload solenoid valves.
 6. Discharge oil separator.
- B. Provide compressor with automatic capacity reduction equipment consisting of a capacity control variable speed drive. The controls system logic must start the compressor at minimum speed for a soft start.
1. Control to be based upon leaving chilled water.

- C. Ultra-Low Sound Compressor Control: Chiller manufacturer shall provide the following attenuation package and meet scheduled maximum A-weighted sound pressure level rating of 70dBA at 30' from the condenser coil side of chiller per AHRI. Complete sound attenuation package shall be provided regardless if scheduled dBA is met without.
1. Provide ultra-low sound blanket on a minimum of 100% coverage of each compressor, suction line, discharge line and oil separator.
 2. Removable Sound Covers shall be constructed with a Silicone-fiberglass cloth outer jacket, a loaded vinyl barrier septum, fiberglass needle mat (11 lbs./ft.3 density), and a Silicone-fiberglass cloth inner jacket. The covers shall be connected together by means of a cloth straps with "D" rings and Velcro fasteners. The inner and outer jackets shall protect against UV rays, oil and water. Finished Surface Mass – 3 lbs. per sq. ft., to cover compressors and extended components for the specified chiller. Stainless steel wire tie fastening assemblies are not acceptable.
 3. Provide detailed ultra-low sound acoustical data with submittal. Data shall include sound pressure rating across each octave band and A-weighted average for chiller as built with attenuation package.

2.3 CONDENSER COILS

- A. 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.
- B. Protect all vertical or angled coil sections from hail or physical damage with corrosion resistant hail guard.
- C. Chiller shall be capable of stable operation in ambient temperatures down to 15°F and temperatures up to 130°F.
- D. Protect condenser coils during shipping.
- 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.

2.4 FANS AND MOTORS

- A. Direct Drive Ultra Low Sound propeller type fans.
1. Vertical discharge with sound reduction without performance reduction.
 2. Protect fan blades with a heavy-gauge wire guard.
 3. Statically and dynamically balanced.
 4. Sound reduction engineered heavy-duty molded plastic blades designed to reduce airflow turbulence.
- B. Motors with built in thermal overload protection
1. Permanently lubricated ball bearings.
 2. Weatherproof (TEAO or TEFC) motors.

2.5 EVAPORATOR

- A. Provide shell and tube direct expansion cooler with:
1. Copper tube and steel shell construction

2. 150 psig water side working pressure
 3. ASME coded 200 psig refrigerant side working pressure
 4. Fully independent refrigerant circuit for each compressor.
 5. Serviceable construction including removable heads and field replaceable tubes.
- B. Protect cooler with ambient controlled heater cable and minimum 1-1/4" thick flexible elastomeric rubber closed cell insulation. Heater cable to protect evaporator to -20°F (-29°C). Heater cable shall be wrapped helically around the shell under the insulation.
- C. Protect insulation and equipment from abrasion by unit enclosure.
- D. After completion of successful start-up, installing contractor shall seal all openings and apply a protective aluminum sheet metal cover.
- E. Provide water drain connection, vent and fittings for factory installed leaving water temperature control and low temperature cutout sensors.
- F. Water connections shall be grooved or flanged.
- G. Proof of flow shall be provided by the equipment manufacturer factory installed.

2.6 CASING/ENCLOSURES

- A. House components in minimum 12 gauge galvanized steel frame and mounted on welded structural steel base. Hot-dip galvanized steel frame coating shall be Underwriters Laboratories Inc. (UL) recognized as G90-U, UL guide number DTHW2.
- B. Unit panels, and control panels shall be finished with a baked on powder paint. Control panel doors shall have door stays.
- C. Mount starters and disconnects in weatherproof panel provided with full opening access doors. Provide lockable disconnect operating handle external to panel and clearly visible from outside of unit indicating if power is on or off.
- D. Casings fabricated from steel that do not have a Zinc coating conforming to ASTM A 123 or ASTM A525 shall be treated for the prevention of corrosion with a factory coating or paint system. The coating or paint system shall withstand 500 hours in a salt-spray fog test in accordance with ASTM B 117. Each specimen shall have a standard scribe mark as defined in ASTM D 1654. Upon completion of exposure, the coating or paint system shall be evaluated and rated in accordance with procedures A and B of ASTM D 1654. The rating of failure at the scribe mark shall be not less than six (average creepage not greater than 1/8"). The rating of the unscribed area shall not be less than ten (no failure). Thickness of coating or paint system on the actual equipment shall be identical to that on the test specimens with respect to materials, conditions of application, and dry-film thickness.
- E. Coated wire mesh to limit access beneath the condenser coils, cooler, and compressor section area.
- F. Convenience outlet (GFI) at control panel connected to 120-vac circuit provided for heat tracing on cooler.
- G. A control power transformer shall be factory installed to provide unit control power.

2.7 REFRIGERANT CIRCUIT

- A. All units shall have a separate independent refrigerant circuit for each compressor.
- B. Provide for each refrigerant circuit:
 - 1. Liquid line isolation valve.
 - 2. Filter dryer (replaceable core type).
 - 3. Liquid line sight glass and moisture indicator.
 - 4. Electronic expansion valve sized for maximum operating pressure. Expansion valves with less than five years of proven field operation are not acceptable.
 - 5. Charging valve.
 - 6. Discharge and oil line check valves.
 - 7. Compressor suction and discharge service valves.
 - 8. Relief valve.
 - 9. Full operating charge of refrigerant and oil.

2.8 CONTROL PANEL

- A. The Control Center.
 - 1. NEMA 3R weatherproof cabinet with hinged lockable outer door.
 - 2. Control system.
 - 3. Solid-state compressor three phase motor protection.
 - 4. Single point field power connection points.
 - 5. Control interlock terminals.
 - 6. Fan motor and control circuit fuses.
 - 7. Individual contactors for each fan motor.
 - 8. Unit power terminal blocks for connection to remove disconnect switch.
 - 9. Power supply terminals for evaporator heater circuit.
 - 10. Dead front panels over line voltage.
 - 11. Control power / circuit transformer.
 - 12. Provide incoming power terminals, sized to accept the feeder conductors.
 - 13. Pump output relay for chilled water pump control
 - 14. Freeze protection and low limit control of pumps
 - 15. Chiller run and alarm status relay cards.
- B. Microprocessor control system.
 - 1. Stage unit based on leaving water temperature control.
 - 2. Oil differential pressure setpoints.
 - 3. Motor protection.
 - 4. High pressure alarm.
 - 5. Loss of refrigerant alarm.
 - 6. Loss of water flow alarm.
 - 7. Freeze protection alarm.
 - 8. Low refrigerant pressure alarm.
 - 9. Auto start/stop switch.
 - 10. Chilled water setpoint adjustment.
 - 11. Anti-recycle timer.
 - 12. Compressor run status.
 - 13. Password protection.
 - 14. Low water temperature safety (freeze protection).
 - 15. Automatic pump down cycle.
 - 16. Limit supply water temperature pull down on start up to 1° per minute.
 - 17. Automatic lead-lag sequence change of compressors.
 - 18. Unload the compressors if the return water is too high.
 - 19. Compressor starts with the controlled cylinders unloaded.
 - 20. Reset of the chilled water temperature.
 - 21. Indicate status of safeties.

22. Non-volatile memory (EPROM) with setpoints retained with battery backup.
 23. Automatic high pressure unloader to unload compressor at pressures above 375 psig.
 24. Auto restart after power failure.
 25. BacNET Interface
 26. Alarm Relay
 27. Percent of Running Load Amperage
- C. Display the following information with Alphanumeric Liquid Crystal Display for outdoor viewing.
1. Supply and Return water temperature.
 2. Low water temperature cutout setting.
 3. Low ambient temperature cutout setting.
 4. Outdoor air temperature.
 5. English and Metric data.
 6. Suction pressure cutout setting.
 7. Each system suction pressure.
 8. Each system discharge pressure.
 9. Each system oil pressure.
 10. Percent of full load motor current.
 11. Liquid control range. (2.0 - 20°F above setpoint)
 12. Liquid pull down rate sensitivity adjustment.
 13. Anti-recycle timer status for each compressor.
 12. Compressor starts & operating run hours.
 13. Safety shutdown shall be date and time stamped.
 14. Compressor run status.
 15. Display data in English or metric units.
- D. All control functions and information shall be available at the unit control panel or via RS 232 cable and phone modem to personal computer.
- E. Chiller shall include a relay board with dry contacts for alarms to notify a Building Automation System of certain events or statuses of the chiller.
- F. Chiller shall include input for leaving chilled water temperature setpoint based upon a 2-10VDS or 4-20mA signal from a Building Automation System.
- G. Chiller shall include input for chiller current limit setpoint based upon a 2-10VDC or 4-20mA signal from a Building Automation System.

2.9 LOW VOLTAGE VARIABLE SPEED DRIVE, UNIT MOUNTED

- A. The water chiller shall be furnished with an air cooled variable speed drive (VSD) as shown on the drawings.
- B. The VSD will be specifically designed to interface with the water chiller controls and allow for the operating ranges and specific characteristics of the chiller.
- C. The VSD efficiency shall be 97% or better at full speed and full load. Fundamental displacement power factor shall be a minimum of 0.96 at all loads.
- D. The VSD shall be solid state, microprocessor based pulse-width modulated (PWM) design. The VSD shall be voltage and current regulated. Output power devices shall be IGBTs.

- E. Power semi-conductor and capacitor cooling shall be from a liquid or air cooled heatsink.

3 EXECUTION

3.1 INSTALLATION

- A. Install system in accordance with manufacturer's instructions.
- B. Where the chiller unit is mounted on a grade, a concrete pad shall be provided that is a minimum of 4" high and extends 6" all around the chiller.
- C. Align chiller package on steel or concrete foundations.
- D. Locate away from overhead restrictions. Maintain side clearances according to manufacturer's recommendations and maintain overhead clearance to allow full elimination of hot air discharge.
- E. Install units on vibration isolation pads.
- F. Arrange piping for easy dismantling to permit tube cleaning, removing and or repair.
- G. Level chiller.
- H. Provide flexible elastomeric rubber closed cell insulation to prevent condensation from occurring at cooler and 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.

3.2 CHILLER MANUFACTURER START-UP/ FIELD SERVICES

- A. Provide the services of a factory trained service technician employed full time by the chiller manufacturer to start-up the system. Technicians, as required, shall be factory trained and experienced in the work they perform. (Contractor startup is unacceptable.)
- B. The technicians shall utilize comprehensive report forms to document results. Sample forms shall be submitted for review prior to commencing work.
- C. Upon completion of the work, the report forms shall be signed by the technicians and their supervisor and included in the final report and Owner's manual.
- D. Submit four copies of the final report to the Architect/Engineer for approval within 10 working days of start-up.
- E. Follow the manufacturer's start-up procedures.
 - 1. Verify interlocks.
 - 2. Test and verify operation of safety controls.
 - 3. Calibrate controls.
 - 4. Verify microprocessor based control operation.
 - 5. Test, calibrate, and set the chilled water temperature controls.
 - 6. Verify chilled water temperature reset sequence.
 - 7. Verify operation of the integrated control panel.
- F. Measure and record the following data:
 - 1. Chilled water entering/leaving temperature.
 - 2. Chilled water flow through the chiller.

3. Suction pressure/condensing pressure.
 4. Suction pressure/unloading steps.
 5. Air entering/leaving condenser; dry bulb temperature.
 6. Outdoor ambient; dry bulb.
 7. Motor nameplate voltage; phase and full load amperes.
 8. Heater coil in starter (as applicable)
 - a. Rating in amperes.
 - b. Manufacturer's recommendation.
 9. Power reading (voltage and amperes of legs at motor terminals).
- G. Test and calibrate the operation of the electronic ground current sensing devices.
- H. If the system has been shipped with a holding charge, provide the following:
1. Leak test.
 2. Refrigerant pressure test.
 3. Evacuate, dehydrate and charge.
- I. Verify that accessories are installed and performing the specified functions. Insert certification in Owner's manual.
- J. Instruct the Owner's operating personnel. Provide Owner with 8 hours of training prior to substantial completion.
- K. Do not operate the equipment for any reason until the factory start-up service has been completed.
- L. Provide a printout from the unit microcomputer control system showing the correct operation of all system controls and components.
- M. Provide minimum 24-hour history log displaying accuracy of temperature control system in 15-minute intervals and documented number of compressor cycles during the 24-hour period.

END OF SECTION 23 65 28

SECTION 23 73 13

AIR HANDLING UNITS

1 GENERAL

1.1 WORK INCLUDED

- A. Furnish and install air handling units with casing, fans, coils, filters, and special items.

1.2 RELATED WORK

- A. Division 23 Mechanical
 - 1. Air Balance
 - 2. Ductwork
 - 3. Controls
 - 4. Electrical Provisions of Mechanical Work
 - 5. Air Filtration
 - 6. Heating and Cooling Coils
 - 7. Other applicable sections

1.3 PERFORMANCE

- A. Unit capacities and characteristics as indicated.
 - 1. Units must be certified in accordance with ARI Standard 430-66.
 - 2. UL 1995 certification for safety including electric heat.
 - 3. ARI 430 listed and meet NFPA 90A requirements.

1.4 SHOP DRAWINGS

- A. Indicate assembly, unit dimensions, weight loading required clearances, construction details, field connection details, and electrical characteristics and connection requirements.
- B. Submit fan performance curve for each unit:
 - 1. Plot fan volume against static pressure, horsepower, and efficiency.
 - 2. Show point of rating based on static requirements of the system.
 - 3. Chart of specific sound power level at each octave band center frequency.
 - 4. For variable volume units, plot fan volume over entire range.
- C. Submit for review a unit internal static pressure loss calculation.
 - 1. Provide an itemized list of static pressure loss at the scheduled CFM for each unit component including and not limited to:
 - a. Coils
 - b. Dirty filters
 - c. Fan and unit system effect
 - d. Cabinet and cabinet inlet and outlet
 - e. Unit mounted dampers
 - 2. If a unit mounted outside air pretreatment section without supply fan, "piggyback" is specified:
 - a. Provide an itemized static pressure loss as indicated above.
 - b. Determine losses for unit configuration, i.e. parallel or series.
 - c. Include losses in the primary unit internal static pressure required by

- configuration.
3. The air handling unit schedule indicates static pressure external to the unit and does not include any losses associated with the air handling equipment.

1.5 ENVIRONMENTAL REQUIREMENTS

- A. Do not operate units until ductwork is clean, filters are in place, bearings lubricated, condensate properly tapped, piping connections verified and leak tested, belts aligned and tensioned, all shipping braces have been removed, and fan has been tested under observation.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Inspect for transportation damage and store in a clean, dry location. Protect from weather and construction traffic.

2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Daikin
- B. York/JCI

2.2 MISCELLANEOUS REQUIREMENTS

- A. Provide factory assembled units. Large units may be shipped in sections, at contractor's option, to enable entrance to building, or for oversize shipping reasons only.
- B. Furnish units with sealing and fastening hardware supplied by the manufacturer. Include written instructions needed to complete field assembly of the components.
- C. Provide units designed and constructed so that coils, panels, fan housing and fans can be removed without affecting the structural integrity of the unit.
- D. Unit casing panels shall be a minimum of 2" double wall construction with solid galvanized exterior and solid galvanized interior. Panels shall have a minimum thermal resistance of R-13. The casing shall not exceed 0.0042-inch deflection per inch of panel span at 1.5 times the design static pressure up to a maximum of +8 inches in all positive pressure sections and -8 inches in all negative pressure sections.
- E. Provide full perimeter base rail channel under units constructed of heavy gauge galvanized steel (minimum 10 gauge) and intermediate cross members to assure unit integrity. Provide minimum size base rail to ensure proper trapping and slope of condensate drain (minimum 6 inch from bottom of drain opening).
- F. Fan assembly shall be provided with 1" deflection internally mounted spring vibration isolation under the fan and motor base on units with coils less than 8 sq. ft. and 2" deflection internally mounted spring vibration isolation under the fan and motor base with coils greater than 8 sq. Ft. Units with coils over 35 sq. ft. shall have spring thrust restraints securing the fan housing to the discharge opening panel on units. Fan motor shall be internally mounted. Provide internal flex connection of fan discharge. Maximum acceptable RPM of fan shall not exceed 1000.

- G. Provide factory installed removable hinged access doors in the following locations:
 - 1. Entering side of all coils to allow for cleaning of coils on both sides of unit.
 - 2. Each side of filter compartment to allow changing of filters from either side.
 - 3. Each side of motor compartment to allow motor and isolation access.
 - 4. Each side of condensate drain pan to allow for cleaning and inspection.
 - 5. Swing the doors against the casing static pressure.
- H. Provide all coil modules, including heating coil modules, with stainless steel drain pans to facilitate cleaning and maintenance of the coils. Drain pan to extend 10" minimum downstream of cooling coil.
- I. Provide coils with stainless steel casings, end plates, tube supports and top & bottom plates.
- J. Units shall meet ASHRAE III Class 6 Low Leakage Standard. Casing shall have less than a 1% leakage rate at plus or minus 8 inches W.G.
- K. Provide units with a low velocity angled filter section unless otherwise specified.

2.3 DRAW THROUGH AIR HANDLING UNITS CONSTANT VOLUME

- A. Provided with:
 - 1. Non-Overloading direct drive plenum fans. Provide minimum number of fans as indicated on drawings.
 - 2. Insulated sheet metal cabinet with removable panels for access to the interior.
 - 3. Hinged double wall doors with two-step safety handles.
- B. Drive assembly:
 - 1. Sized for 50% overload.
- C. Motors and Control:
 - 1. Totally enclosed, fan cooled, Variable speed, 1750 rpm.
 - 2. Maximum operating point of 70 Hz.
 - 3. Minimum 90% nominal efficiency at loads of 70%-100%.
 - 4. Premium efficiency inverter duty
 - 5. NEMA B design, with Class B insulation, capable to operate continuously at 104 deg F without tripping overloads.
 - 6. +/- 10% voltage utilization range to protect against voltage variation.
 - 5. Cast iron frame and end plate
 - 6. Forged steel lifting eye
 - 7. Oversized conduit box with ground lug
 - 8. Provide with factory installed shaft grounding rings by Aegis
 - 9. Motor selected so that the brake horsepower required to deliver the design air quantity at the system static pressure will not exceed the motor nameplate rating.
- D. Supply Fans:
 - 1. Single width, single inlet, backward curved welded aluminum plenum fan.
 - 2. Statically and dynamically balanced to a BV-3 per AMCA 204 test standard.
 - 3. Tested after being installed in the fan sections.
 - 4. Selected for the design air quantities and pressure of the system.
 - 5. Mounted on a common shaft if multiple wheels.

6. The fan shall be rated in accordance with AMCA 210 for performance and AMCA 260 for sound.
 7. Minimum of Class II fan.
- E. Fans selected with isolation shall be internally isolated with spring isolators. A flexible connection shall be installed between fan and unit casing to ensure complete isolation. Flexible connection shall comply with NFPA 90A and UL 181 requirements. If fans and motors are not internally isolated, then the entire unit shall be externally isolated from the building, including supply and return duct work, piping, and electrical connections. External isolation shall be furnished by the installing contractor to avoid transmission of noise and vibration through the ductwork and building structure.
- F. Each direct drive fan in a multiple-fan array shall be provided with integral back flow prevention: a backdraft damper that prohibits recirculation of air in the event a fan or multiple fans become disabled. Dampers are tested and rated based on AMCA Standard 500. Dampers to be heavy duty type capable of a maximum back pressure that exceeds the design total static pressure with minimal leakage. The dampers should have a minimal total effect on airflow performance; both pressure drop when open and system effect on the fan. The damper blades and frame shall be extruded aluminum with blade edge seals locked into the blade edge. Adhesive type seals are unacceptable. AHU manufacturer responsible for providing proper spacing upstream of dampers to ensure full, uniform airflow through upstream components. For units where the damper(s) are supplied at the jobsite, the installing contractor shall contract a certified TAB contractor to verify uniform airflow thru upstream components.
- G. Select fan to operate at or near its maximum efficiency point when handling the required air quantity and static pressure.
- H. Stainless steel condensate pan with positive slope in all directions to outlet. Line the condensate drain pan with minimum 1-1/2" waterproof insulation.
- I. Insulation, vapor barriers, facings and adhesives shall have:
1. Flame spread not higher than 25.
 2. Smoke developed rating not higher than 50.
- J. Double wall casing construction. Construct interior casing panels with 3 lb. minimum density insulation for acoustical and condensation control.
1. Condensation on the exterior of the air handling units is not acceptable.
- K. Filter section:
1. Constructed with substantial hinges.
 2. Neoprene gasketing.
 3. Permanent quick release latching devices.
 4. Arranged to accommodate the 2" thick filters as specified.
- L. Cooling coils as specified. Extend drain and vent piping through cabinets. Provide grommets at all pipe penetrations through cabinets.
- M. Heating coils as specified. Extend drain and vent piping through cabinets. Provide grommets at all pipe penetrations through cabinets.
- N. Provide units with factory fabricated mixing box section that include an additional 2" thick metal perforated inner liner which utilizes fiberglass insulation. Liner shall be installed on

all walls and top surface.

- O. Provide each fan section with an additional 2" thick perforated metal inner liner which utilizes fiberglass insulation. Liner shall be installed on all walls and top surface.
- P. Factory dynamic fan balancing shall be conducted from 16Hz to 60Hz to identify and eliminate critical speeds to ensure stable operation through the entire operating range of the fan and drive assembly. Field fan balancing is not acceptable. Forward factory balancing test report to Engineer upon request.

2.4 DRAW THROUGH AIR HANDLING UNITS – VARIABLE AIR VOLUME

- A. Provided with:
 - 1. Non-Overloading direct drive plenum fans. Provide minimum number of fans as indicated on drawings.
 - 2. Insulated sheet metal cabinet with removable panels for access to the interior.
 - 3. Hinged double wall doors with two-step safety handles.
- B. Drive assembly:
 - 1. Sized for 50% overload.
- C. Motors and Control:
 - 1. Totally enclosed, fan cooled, Variable speed, 1750 rpm.
 - 2. Maximum operating point of 70 Hz.
 - 3. Minimum 90% nominal efficiency at loads of 70%-100%.
 - 4. Premium efficiency inverter duty
 - 5. NEMA B design, with Class B insulation, capable to operate continuously at 104 deg F without tripping overloads.
 - 6. +/- 10% voltage utilization range to protect against voltage variation.
 - 5. Cast iron frame and end plate
 - 6. Forged steel lifting eye
 - 7. Oversized conduit box with ground lug
 - 8. Provide with factory installed shaft grounding rings by Aegis
 - 9. Motor selected so that the brake horsepower required to deliver the design air quantity at the system static pressure will not exceed the motor nameplate rating.
- D. Supply Fans:
 - 1. Single width, single inlet, backward curved welded aluminum plenum fan.
 - 2. Statically and dynamically balanced to a BV-3 per AMCA 204 test standard.
 - 3. Tested after being installed in the fan sections.
 - 4. Selected for the design air quantities and pressure of the system.
 - 5. Mounted on a common shaft if multiple wheels.
 - 6. The fan shall be rated in accordance with AMCA 210 for performance and AMCA 260 for sound.
 - 7. Minimum of Class II fan.
- E. Fans selected with isolation shall be internally isolated with spring isolators. A flexible connection shall be installed between fan and unit casing to ensure complete isolation. Flexible connection shall comply with NFPA 90A and UL 181 requirements. If fans and motors are not internally isolated, then the entire unit shall be externally isolated from the building, including supply and return duct work, piping, and electrical connections.

External isolation shall be furnished by the installing contractor to avoid transmission of noise and vibration through the ductwork and building structure.

- F. Each direct drive fan in a multiple-fan array shall be provided with integral back flow prevention: a backdraft damper that prohibits recirculation of air in the event a fan or multiple fans become disabled. Dampers are tested and rated based on AMCA Standard 500. Dampers to be heavy duty type capable of a maximum back pressure that exceeds the design total static pressure with minimal leakage. The dampers should have a minimal total effect on airflow performance; both pressure drop when open and system effect on the fan. The damper blades and frame shall be extruded aluminum with blade edge seals locked into the blade edge. Adhesive type seals are unacceptable. AHU manufacturer responsible for providing proper spacing upstream of dampers to ensure full, uniform airflow through upstream components. For units where the damper(s) are supplied at the jobsite, the installing contractor shall contract a certified TAB contractor to verify uniform airflow thru upstream components.
- G. Select fan to operate at or near its maximum efficiency point when handling the required air quantity and static pressure.
- H. Stainless steel condensate pan with positive slope in all directions to outlet. Line the condensate drain pan with minimum 1-1/2" waterproof insulation.
- I. Insulation, vapor barriers, facings and adhesives shall have:
 - 1. Flame spread not higher than 25.
 - 2. Smoke developed rating not higher than 50.
- J. Double wall casing construction. Construct interior casing panels with 3 lb. minimum density insulation for acoustical and condensation control.
 - 1. Condensation on the exterior of the air handling units is not acceptable.
- K. Filter section:
 - 1. Constructed with substantial hinges.
 - 2. Neoprene gasketing.
 - 3. Permanent quick release latching devices.
 - 4. Arranged to accommodate the 2" thick filters as specified.
- L. Cooling coils as specified. Extend drain and vent piping through cabinets. Provide grommets at all pipe penetrations through cabinets.
- M. Heating coils as specified. Extend drain and vent piping through cabinets. Provide grommets at all pipe penetrations through cabinets.
- N. Provide units with factory fabricated mixing box section that include an additional 2" thick metal perforated inner liner which utilizes fiberglass insulation. Liner shall be installed on all walls and top surface.
- O. Provide each fan section with an additional 2" thick perforated metal inner liner which utilizes fiberglass insulation. Liner shall be installed on all walls and top surface.
- P. Factory dynamic fan balancing shall be conducted from 16Hz to 60Hz to identify and eliminate critical speeds to ensure stable operation through the entire operating range of the fan and drive assembly. Field fan balancing is not acceptable. Forward factory balancing test report to Engineer upon request.

3 EXECUTION**3.1 INSTALLATION**

- A. Install air handling units according to manufacturer's instructions.
- B. Provide additional drive packages as required by the Testing and Balancing firm.
- C. Air leaks detectable by sound or touch are to be corrected.
- D. Air handling units are to be properly supported to prevent flexing, bending, or distorting base rails.
- E. All coils are to be cleaned prior to substantial completion if units are used during construction.
- F. Clean all air handling units and return to original manufacturer's condition prior to substantial completion. Vacuum clean all debris from inside air handling equipment.
- G. Install piping to unit with full size 6-inch-long dirt leg with 1/2" valve at bottom for cleaning.
- H. Provide for positive gravity drainage of coil condensate. Pipe full size of unit connection.
- I. Adjust fan drives as required to obtain scheduled capacities as directed by the Test and Balance Firm to include sheave and belt replacement.
- J. Align belts to eliminate wear and vibration of belts.
- K. Verify correct drainage of condensate from condensate pan.
- L. Verify correct rotation of fan and wiring of motor.
- M. Lubricate all greaseable ball bearings with manufacturer's suggested lubricant.
- N. Replace filters as required if units are used during construction.
- O. Provide piping installation so that after piping is completed and insulated there is full access to service unit and remove fan housing. Piping to coils shall not block fan section access or cause damage to piping insulation during access.

3.2 IDENTIFICATION

- A. Furnish each unit with a durable, deep etched, .025" thick, factory installed aluminum identification plate, permanently mounted with the following information:
 - 1. Unit identification as indicated on Contract Drawings.
 - 2. Serial Number.
 - 3. Model Number.
 - 4. Capacity (CFM) and static pressure.
 - 5. Motor HP.
 - 6. Unit power supply: Volts / PH / Amps.
 - 7. Supply Fan Type.

AIR HANDLING UNITS

SECTION 23 73 13

8. Coil GPM and pressure drop.
9. Sales Order #.
10. Date unit manufactured.

END OF SECTION 23 73 13

SECTION 23 82 16

HEATING AND COOLING COILS

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.

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 CHILLED WATER COILS

- A. Chilled water coils:
 - 1. Constructed of copper tubes and aluminum fins
 - 2. Designed and circuited for chilled water

- 3. Minimum of six rows
- B. Non-trapping circuit design:
 - 1. Working pressure 200 psi.
 - 2. Tappings for drain and air vent.
- C. Provide a Peterson Pete's Plug with retainer strap on the inlet and outlet of each coil. Position to permit accurate pressure readings.
- 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 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.

2.4 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.

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 23 82 16

SECTION 23 82 18

DUCTLESS MINI SPLIT DX UNITS

1 GENERAL

1.1 WORK INCLUDED

- A. Furnish and install mini split system. Complete with a slim silhouette, compact, high wall mounted indoor fan coil section with wireless remote controller and a slim silhouette horizontal discharge outdoor condensing unit. Unit shall be provided with constant speed compressor, pre-charged with R410A or R32 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 R410A or R32 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. System efficiency shall meet or exceed 13.0 SEER.

2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Mitsubishi Electric

- B. Daikin
- C. York/JCI

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 UNIT CABINET

- A. The casing shall have a smooth front, top return, in a Munsell No. 1.0Y 9.2/0.2 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 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 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 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 grooves 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 with extension hose shall be provided under the coil. Drain connections shall be provided at each end of the drain pan. (Option: A condensate mini-pump shall be provided to provide a means of condensate disposal when a gravity drain is not available.)

2.7 ELECTRICAL

- A. The unit shall be equipped with a micro-processor control system directing indoor and outdoor unit coordinated operation.
- B. The indoor unit shall not have any supplemental electrical heat elements.

2.8 CONTROL

- A. This system shall have a wired wall mounted thermostat/controller to perform input functions necessary to operate the system. The controller shall consist of a Power On / Off switch, Mode Selector, Temperature Setting, Timer Control, Fan Speed Select and Auto Vane Selector.
- 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 unit shall have an emergency operation mode to allow operation without the remote controller.
- E. 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 wireless remote controller, providing emergency operation and controlling the outdoor unit.
- F. The control voltage between the indoor unit and the outdoor unit shall be 115 volts, AC.
- G. The system shall be capable of automatic restart when power is restored after power interruption.
- H. 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 MS series indoor units. These units are equipped with a circuit board that interfaces to the MS indoor unit circuit board. 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 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 MS-A09WA 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 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 COMPRESSOR

- A. The compressor shall be a high performance, hermetic, rolling piston, 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 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 ELECTRICAL

- A. The electrical power of the system shall be 115 volts, 1 phase, 60 hertz. The unit shall be capable of satisfactory operation within voltage limits of 103 volts to 127 volts.
- 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.

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.

3.2 CONTROL WIRING

- A. Furnish and install control wiring as required. Install control wiring in conduit.

3.3 DELIVERY, STORAGE AND HANDLING

- A. Unit shall be stored and handled according to the manufacturer's recommendations.
- B. The wireless 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 WARRANTY

- A. The units 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. If, during this period, any part should fail to function properly due to defects in workmanship or material, it shall be replaced or repaired at the discretion of the manufacturer. This warranty does not include labor.

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 on 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 23 82 18

SECTION 23 82 19

FAN COIL UNITS

1 GENERAL

1.1 WORK INCLUDED

- A. Floor mounted decorative cabinet fan/coil units, horizontal fan/coil units for concealed installation and horizontal exposed ceiling mounted fan/coil units with decorative cabinet.

1.2 RELATED WORK

- A. Division 23 Mechanical
 - 1. Air Balance
 - 2. Controls
 - 3. Electrical Provisions of Mechanical Work
 - 4. Ductwork
 - 5. Air filtration

1.3 REFERENCES

- A. ANSI/AHRI 410 - force circulation air cooling and air heating coils
- B. National Electrical Code

1.4 SUBMITTALS

- A. Submit manufacturer's dimensioned product data sheets.
 - 1. Show location of filter access doors.
- B. Submit fan performance curve for each unit:
 - 1. Plot fan volume against static pressure, horsepower and efficiency.
 - 2. Show point of rating based on static requirements of the system.
- C. Submit the fan performance plot at each motor speed position with consideration for the reduced internal static.
- D. Submit a chart of specific sound power level at each octave band center frequency.
- E. Submit manufacturer's certified heating and cooling coil capacity data.
- F. Submit filter manufacturer's product data sheets and capacity information.
- G. Submit manufacturer's data on housing insulation material.

1.5 CAPACITY

- A. Refer to equipment schedule.

2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Daikin
- B. York/JCI
- C. Oxygen8

2.2 COMPONENTS

- A. Fan section
- B. V-belt drive assembly, or,
- C. Multi-speed direct connected motor
- D. Filter section
- E. Coil section
- F. Insulated sheet metal cabinet with removable panels for access to the interior
- G. Motor and drive inside the cabinet

2.3 FAN SECTION

- A. Locate the motor and drive assembly inside the cabinet.
- B. Size each v-belt drive for 50% overload.
 - 1. Adjustable pitch motor pulley
 - 2. Provide built-in motor protection
 - 3. Belt adjustment means
- C. Provide multi-speed direct connected fan motor with built-in motor protection.
 - 1. Three-speed windings
 - 2. Factory wired to a junction box with provisions for motor speed change, mounted on the box
 - 3. Resiliently mounted
- D. Select the fan motor so that the brake horsepower required to deliver the design air quantity at the system static pressure will not exceed the motor nameplate amperage rating.
- E. Supply Fans:
 - 1. Double width, double inlet, forward curve blade
 - 2. Statically and dynamically balanced
 - 3. Tested after being installed in the fan section
 - 4. Selected for the design air quantities and static pressure of the system
 - 5. Mounted on a common shaft if multiple wheels
- F. Select fan to operate at or near its maximum efficiency point when handling the required air quantity and static pressure.
- G. Fan Bearings:
 - 1. Permanently lubricated
 - 2. Self-aligning

2.4 DECORATIVE HOUSING AND PLENUM

- A. Where units are exposed to view in occupied spaces and where scheduled, construct cabinets of cold rolled steel, bonderized and coated with baked enamel finish.
- B. Access panels shall have position locking fasteners for easy removal.
 - 1. Plated screws with captive nuts
 - 2. Hinged if too large for one man operation

2.5 UNIT HOUSING

- A. Unit will be supplied with 1-inch, double-wall panels. The cabinet is to be thermally isolated through injected foam insulation inside each cabinet. Single wall cabinets with fiberglass insulation exposed in the airstream are not acceptable. Frame channels which allow heat conductance between the inside and outside of the cabinet are not acceptable. Base rails used for unit mounting/hanging are acceptable. Panel shall have a minimum thermal insulation of R6.
- B. Internally insulate the entire unit with neoprene coated, 1-1/2 lb. density glass fiber insulation, applied to internal surfaces with adhesive and weld pins. Coat exposed edges of insulation with adhesive.
- C. Insulation, vapor barriers, facings and adhesives:
 - 1. Flame spread not higher than 25
 - 2. Smoke developed rating not higher than 50
- D. Condensation on the exterior of the unit is not approved.
- E. Provide a duct flange on four sides of the return air inlet and supply air outlet of the unit.
 - 1. Sized to permit connection of the flexible connection to the ductwork
 - 2. Extend beyond the primary drain pan
 - 3. Minimum dimension 2"
- F. Provide insulated, removable panels for access to the interior.
 - 1. Plated captive screws and nuts
 - 2. Neoprene gaskets

2.6 CONDENSATE DRAIN PANS

- A. IAQ style drain pans shall be provided under all coils.
 - 1. Pitch to drain connection
 - 2. Fabricated from 16 gauge 304 stainless steel
 - 3. Triple pitched for complete drainage with no standing water
 - 4. Insulated to prevent condensation
 - 5. Welded corners
 - 6. Stainless drain connection

2.7 COILS

- A. Reference Schedule and Specification Section 23 82 16.

2.8 FILTER SECTION

- A. Locate behind access doors.
 - 1. Construct with substantial hinges

- 2. Neoprene gaskets
 - 3. Permanent quick-release latching devices
- B. Arranged to accommodate the 1" thick filters as specified.
 - 1. Single section filter
- C. Provide full length tracks to support the filter.

2.9 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.

3 EXECUTION

3.1 SPARE PARTS

- A. Provide the following spare parts and material to the Owner for use after the warranty period.
 - 1. One spare fan motor for each size of fan motor on the project
 - 2. One spare set of filters or filter media for each fan coil unit on the project

3.2 ELECTRICAL REQUIREMENTS

- A. Bring electrical connections to a common junction box.

3.3 STORAGE

- A. Storage and shipping in accordance with manufacturer's recommendations.

3.4 INSTALLATION

- A. Install unit so motor connections and filters are accessible.

END OF SECTION 23 82 19

SECTION 23 82 39

ELECTRIC UNIT HEATERS

1 GENERAL

1.1 WORK INCLUDED

- A. Provide and install electric unit heaters complete with heating element, propeller mounting brackets and other options as specified.

1.2 RELATED WORK

- A. Division 23 - Mechanical.
 - 1. Electrical Provisions of Mechanical Work.
 - 2. Ductwork.

2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Modine
- B. Reznor
- C. Chromalox
- D. Trane
- E. Markel

2.2 COMPONENTS

- A. Casing:
 - 1. Construct casing of sheetmetal with a structural frame.
 - 2. Enamel or lacquer finish to manufacturers standard.
- B. Electric Heating Elements:
 - 1. Shall bear the UL label.
 - 2. Corrosion resistant materials.
 - 3. Heating coil of 80-20 nickel-chrome wire.
- C. Components:
 - 1. Fused control circuits
 - 2. Contactors in accordance with the staging requirements
 - 3. Control power transformer
 - 4. Control voltage 120
- D. Louvers:
 - 1. Adjustable vertical and horizontal louvers for air discharge.
- E. Mounting brackets:
 - 1. As indicated

2.3 CONTROLS

- A. Automatic controls:
 - 1. Factory mounted
 - 2. Prewired to the junction box
 - 3. Unit mounted thermostats 24-volt low voltage
- B. Safety Controls:
 - 1. A primary and secondary thermal cut-off to de-energize each circuit.
 - 2. Manual reset high limit
 - 3. Automatic reset thermal protection

2.4 FAN

- A. Propeller blade fan:
 - 1. Construct the fan of aluminum or other corrosion-resistant material.
 - 2. Statically and dynamically balanced
 - 3. Substantial fan guard

2.5 MOTOR

- A. Totally enclosed ball bearing motor:
 - 1. Permanently lubricated bearings
 - 2. 120 volt, single phase, 60 cycle motor
 - 3. Sized to operate the fan at the required capacity

2.6 ELECTRICAL

- A. Single point connection:
 - 1. Factory wiring
 - 2. Only direct line supply and thermostat field connections
 - 3. Terminal blocks for line voltage wiring
 - 4. Wiring diagram permanently attached
 - 5. Balance phases

3 EXECUTION**3.1 INSTALLATION**

- A. Furnish units with suitable connections for mounting as shown or as otherwise approved.
- B. Provide start-up to ensure correct operation of unit.
- C. Adjust discharge louvers to control direction of air flow.

END OF SECTION 23 82 39

SECTION 26 01 00

COMMISSIONING OF ELECTRICAL SYSTEMS

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.

2 PRODUCTS (Not Used)**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 26 01 00

SECTION 26 01 05

ELECTRICAL OPERATING AND MAINTENANCE MANUALS

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.

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.

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 26 01 05

SECTION 26 05 00

ELECTRICAL GENERAL PROVISIONS

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 Plants* ("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. IEEE 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 1100™, *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.

2 PRODUCTS – NOT USED

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 devices 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 1/4-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 1/4-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 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	Receptacle Contactor C2 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.
- | | |
|---------------------------|-----------------------------------|
| Main Service ATS Example | Wall Mounted Lighting ATS Example |
| ATS-1 | ATS |
| Emer Power-Emer Generator | Exterior Wall Packs/Soffit Lights |
| Located Chiller Yard | North/West Metal Canopy Lights |
| Normal Power-MSB | Fed from EHA-2 |
| Located-Mech Rm 100 | Located Mech Rm 200 |
| Serves Panel EHA | Fed From HB-4 |
| Located-Mech Rm 100 | 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 20 hours dedicated instructor time.
 - 2. 4 hours on each of 5 days
 - 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 TM
 3. Working distance calculated in accordance with IEEE Std 1584a TM
 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 TM, 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
 - g. Building Lightning protection 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_unbalance_motor-systems7.pdf

END OF SECTION 26 05 00

SECTION 26 05 09

ELECTRIC UTILITY COORDINATION AND SERVICE ENTRANCE

1 GENERAL

1.1 WORK INCLUDED

- A. General: Electrical service shall be provided by local utility company.
- B. Power Company Data: Obtain from utility company information and installation standards for electrical service installation.
- C. Responsibilities: Determine what equipment and labor is provided by utility company and what equipment and labor is required of this Contractor.

2 PRODUCTS

2.1 GENERAL

- A. Service Data: Ensure that utility company service data is accurate and verified.

2.2 PRIMARY SERVICE

- A. General: Division 26 shall provide primary service conduit, concrete transformer pads, concrete duct bank, utility service and metering equipment enclosures, manholes, and pull boxes as required and as specified.
- B. Utility company shall provide primary cables, splices, utility metering instruments, terminations, and primary underground and overhead service conductors.

2.3 TRANSFORMERS AND SWITCHGEAR

- A. General: Division 26 shall make provisions for service as required by utility company, including, but not limited to permanent or removable/lockable vehicular barriers, grounding rods, grounding conductors, and sleeves.
- B. The utility company shall provide service transformers, primary switchgear, primary protective relaying, and connections to the customer service.

2.4 SECONDARY SERVICE CONDUCTORS

- A. General: Division 26 shall provide secondary service entrance conductors, conduit and concrete duct bank.

2.5 SECONDARY SERVICE BUS WEATHERHEAD AND UTILITY METERING CURRENT TRANSFORMER ENCLOSURES

- A. General: Division 26 shall provide secondary service bus weatherhead and utility metering current transformer enclosures as specified and as approved by the utility company. Where required or specified, enclosure shall be constructed of aluminum or stainless steel NEMA 3RX construction.
- B. Rack mounted bus weatherhead and current transformer metering enclosure shall be

installed on W6x20 hot dipped galvanized vertical support structures with baseplates to a minimum 20-inch diameter by eight-feet-deep steel reinforced concrete pier foundation with anchor bolts. Hot dipped tubular steel cross members as required for equipment support. Support structure shall support approximately 1,200 pounds of equipment and minimum 150 MPH wind loading.

2.5 SECONDARY SERVICE CABLE TAP BOXES

- A. General: Division 26 shall provide secondary service cable tap boxes only if required or specified and as approved by the utility company. Where required or specified, enclosure shall be constructed of aluminum or stainless steel NEMA 3RX construction.

3 EXECUTION**3.1 INSTALLATION**

- A. Standards: The installation of the service entrance provisions shall comply with the published standards and requirements of the utility company, the utility company's specific construction requirements for this project, and with requirements of this Division.
- B. Correction: Any failure to meet the standards and requirements shall be corrected to the satisfaction of the utility company and Owner without any additional cost to the Owner.
- C. Contractor shall provide all construction materials and labor that the utility company determines to be the responsibility of the customer, at no additional cost to the Owner.
- D. The materials and labor required by the for a complete installation shall be provided by the contractor and includes, but is not limited to permanent or removable / lockable vehicular barriers, grounding rods, grounding conductors, sleeves, concrete pads, concrete reinforced ductbanks, conduits, metering racks and metering enclosures.
- E. Utility distribution poles and service entrance ductbank locations shall be staked and surveyed prior to pole installation by the Contractor to verify their proper placement is within the Owner's property and respective utility easements. Contractor shall verify by survey that the pole and service entrance ductbank location and easements do not interfere with existing easements, right-of-ways, or other restricted properties. Conflicts with existing easements and restrictions shall be brought to the attention of the Architect prior to construction.
- F. Contractor shall initiate contact with the power provider (retail seller), utility (transmission and distribution), and Owner within 14 days of Notice to Proceed to ensure permanent power will be available to the site. Any delays resulting from lack of this coordination shall be the responsibility of the Contractor.

END OF SECTION 26 05 09

SECTION 26 05 10

CONTRACT QUALITY CONTROL

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.

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.

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. Mockup the light fixture fireproofing for each type of light fixture to be located in fire rated ceilings. Demonstrate that the fireproofing material does not interfere with the mechanical operation of light fixture doors, hinges, or latches.
- B. Mockup a typical office 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. Mockup a typical panelboard backbox with Surge Protective Device (SPD) panelboard extension backbox or SPD device.
- D. Mockup ten feet of cable tray including all supports, hardware and bonding.
- E. Mockup canopy light fixtures that are attached to aluminum canopies. Refer to light fixture specifications and drawings for additional information. Mock-up and all installations shall be reviewed and approved by Owner.

END OF SECTION 26 05 10

SECTION 26 05 12

ELECTRICAL SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA

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.

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.

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 product or 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. Substitutions 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 required 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 manufacturer'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. Modular metering equipment for multi-tenant utility electrical services
 - 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
 - 27. Surface Raceways

- 28. Electrical controls and time switches
- 29. Motor control centers, including renewal components for existing motor control centers
- 30. Busway
- 31. Uninterrupted Power Supply systems
- 32. Power quality improvement filters or capacitors
- 33. Lightning protection system
- 34. Fire Rated Cables and Connectors

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 26 05 12

SECTION 26 05 16

EXCAVATING, BACKFILLING AND COMPACTING FOR ELECTRICAL

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 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 electrical underground, and all related appurtenances. Provide concrete duct banks as specified in other related Division 26 specification sections.
- B. The extent of raceways, excavation, and backfill shall be in conformance with the locations, raceways, elevations and grades shown on the drawings.

1.3 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/ft³)
 - 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. Local Authority Having Jurisdiction Standards
- C. Local Governing Agencies or Utilities

1.4 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.

2 PRODUCTS

2.1 MATERIALS

- A. Concrete: Refer to other Division 26 specification section where concrete encasement is required or specified.
- B. 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.

- C. Sand: Clean, local sand
- D. Earth Backfill: Clean local material consistent with the surrounding earth material and free of large clods, roots, organic materials, rocks or other debris.

3 EXECUTION

3.1 EXCAVATION

- A. General:
 - 1. All utility trenches shall be constructed in conformance with OSHA trench safety standards.
 - 2. Refer to project Geotechnical Report for additional requirements for excavating and backfilling of utility trenches.
 - 3. Sheet piling 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.
 - 4. 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 raceway placing operation to ensure a dry, firm bed on which to place the raceway.
- B. Appurtenances:
 - 1. Any overdepth excavation below appurtenances shall be refilled with cement-stabilized sand.
- C. Electrical Trenches:
 - 1. Electrical underground raceways must be the minimum depth required by the local governing authority and Power Company.
 - 2. Trench width for the electrical raceway shall be a minimum of the outside raceway encasement plus 12 inches.
 - 3. Trenches shall be excavated to a depth of at least 6 inches below the conduit raceway. The conduit raceway bedding or concrete encasement shall then be placed in accordance with the specifications, local governing authority, and Power Company standard details.

3.2 BEDDING AND BACKFILL

- A. Electrical Trenches:
 - 1. Place backfill, consisting of sand or cement stabilized sand, to a depth of one foot above top of raceway or concrete duct bank and compact to 90% maximum density.
 - 2. Backfill the remainder of the trench in 6 inch lifts with select excavated material and compact as required to achieve density of soil of surrounding area.
- B. Utility Locators:
 - 1. Provide metallic locators for utility company raceways as required by respective utility.
 - 2. Refer to other specification sections for additional requirements for underground raceway locators and markers.

END OF SECTION 26 05 16

SECTION 26 05 19

CONDUCTORS AND CONNECTORS – 600 VOLT

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
 - 3. 600V 2-hour fire rated power cable
- 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.

2 PRODUCTS

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. 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.

3. Where authorized in writing by the Owner and Architect and not prohibited by local codes or the Authority Having Jurisdiction (AHJ), aluminum alloy compact stranded conductors may be substituted at Contractor's discretion in AWG sizes 3/0 through 750 kcmil (150-358 Amps) for service entrance conductors and feeders exceeding 25-feet in length. Aluminum alloy conductors shall not be used for grounding or for branch circuits or any equipment terminations. Aluminum alloy conductor size shall meet or exceed the equivalent ampacity for the specified copper conductor using 75 C ampacities for both types of conductors.
- C. 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.
 3. Insulation for aluminum conductors shall be UL Type XHHW-2, 90 degrees C.
- D. Insulation for 2-hour fire rated power cables: Insulation shall meet or exceed the requirements of UL 2196 Fire Test for Electrical Circuit Protection Systems, and UL 44, Standards for Fire Resistive Cable. Conductor ampacity shall be based on 75C. Combination UL Type insulation types are permissible where the required UL Type is part of the combination UL listing.
1. Conductors installed underground: Insulation for underground fire rated conductors shall be wet location, UL Type RHW 75 degrees C, or UL RHW-2 90 degrees C.
 2. Conductors installed above ground: Insulation for above ground fire rated conductors shall be UL Type RHH 90C or RHW 75C or UL RHW-2 90C.
 3. Electrical Circuit Protective Systems (FHIT) – System 27 of the UL Fire Resistance Directory
- E. 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.

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.

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 from 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.
 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. Two-hour fire rated cable:
1. Two-hour fire rated power cable shall be installed per manufacturer's installation instructions in compliance with UL Fire Resistance Directory, Electrical Circuit Protective Systems (FHIT), and System 27.
 2. Two-hour fire rated power cable shall be installed in rigid steel EMT or rigid steel galvanized conduit (RGC) with steel fittings. Provide fire rated sealant to the end of the raceway to prevent gases from migrating from the fire rated cable into the equipment.
 3. Provide two-hour rated cable where conduit or cables enters or passes through the building envelope at areas or rooms that are not two-hour rated equipment rooms for the following:
 - a. Fire Pump feeders.
 - b. Emergency Feeders (Life Safety) as defined by NFPA Article 700.
 - c. Legally required level one standby systems as defined by NFPA 110 and NFPA Article 701. These systems include but are not limited to those used to aid firefighting and rescue operations, smoke removal systems, and elevators designated for ADA and/or fire rescue operations.
 4. Alternate two hour rated feeder conductor sizes may be substituted for the required conductor ampacity, voltage drop, or equipment lug terminations based on two-hour fire rated conductor standard size availability or provided equipment manufacturer's cable terminations. Substituted conductor ampacity shall meet or exceed the specified cable ampacity and exceed the required equipment minimum circuit ampacity. Provide substitutions and the required conduit sets and sizes as required for the substitutions at no additional cost to the Owner.
- E. Identification: Label each phase conductor in each junction box with corresponding

circuit number, using self-adhesive wire markers.

- F. 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.
- G. 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.
- H. 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 26 05 19

SECTION 26 05 26

ELECTRICAL GROUNDING

1 GENERAL

1.1 WORK INCLUDED

- A. Grounding shall conform to the requirements of:
 - 1. National Electrical Code.
 - 2. Governing local codes.
 - 3. All Local Utility Companies
- B. Ground effectively and permanently.
 - 1. Neutral conductor at the main service disconnect and other separately derived systems.
 - 2. All conduit systems.
 - 3. All electrical equipment and related current carrying supports or structures.
 - 4. All metal piping systems.
 - 5. All building structural metal frames.
 - 6. All telephone/voice/video/CATV/data utilities

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

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.
 2. UL listed.
 3. Approved thermal fusion connector methods (exothermic).
- B. Metal frame of building or enclosure.
- C. Foundation concrete encased rebar.

2.3 DATA / VOICE COMMUNICATIONS CLOSET GROUND BAR

- A. MDF closets/head end rooms: Erico Cadweld #B544A028 ground bar with 7/16-inch holes.
- B. IDF closets, Erico Cadweld #B542A004 ground bar with 7/16-inch holes.
- C. Heavy-duty, two bolt type, copper alloy or bronze for grounding and bonding applications, in configurations required for particular installation.

2.4 EXOTHERMIC CONNECTIONS

- A. Exothermic type for underground and structural steel; Cadweld
- B. Exothermic materials, accessories, and tools for preparing and making permanent field connections between grounding system components.

2.5 WIRE

- A. Stranded, copper cable
- B. Foundation Electrodes: 4/0 AWG
- C. Grounding Electrode Conductor: Size to meet NFPA 70 requirements

3 EXECUTION**3.1 GROUNDING AND BONDING**

- A. In the service equipment, provide a separate (dedicated) ground bus.
 1. Bond the ground bus with copper bus bar or cable, of equal or greater current carrying capacity of the service grounding conductor, to the neutral bar.
 2. Resistance of neutral to ground shall not exceed 10 Ohms.
 3. Connect the electric service grounding electrode conductors to the incoming metal water pipe system (when available, using a suitable ground clamp) and to a supplemental electrode such as a ground rod or ground .ring.
 4. Provide grounding and bonding at the power company's metering equipment.
 5. Provide access and cover for access to the ground grid and removable connections for testing the system.
- 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 required. 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 25 Ohms 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.
- C. Provide an insulated equipment grounding conductor inside all conduits, raceways, surface raceways, gutters and wireways. The ground wire shall be bonded to each box to suitable lug, bus, or bushing. All bonding jumpers shall be routed inside conduit or raceway.
- D. Provide an insulated isolated equipment grounding conductor in addition to the insulated equipment grounding conductor for all isolated grounding feeders, branch circuits, outlets and isolated grounding receptacles.
- E. Provide all conduit terminating in switchgear, transformers, switchboards, panelboards and voice/data outlets with grounding bushings, where required, and ground wire extended to ground bus in equipment. Install grounding bushings where reducing washers are used and concentric and eccentric knock-outs are used.
- F. Main bus and building grounding electrode conductor installation shall be witnessed by the Architect / Engineer.
- G. Provide bonding to meet Regulatory Requirements.
- 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.
- O. Do not use sheetmetal or self-drilling screws for bonding connections. Provide listed or approved connectors.
- P. 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.

3.2 METAL FRAME OF BUILDING OR STRUCTURE

- A. Effectively ground the building steel or structure per NEC 250-52 (2).

3.3 UFER GROUND

- A. Provide a UFER ground at bottom of building slab per NEC 250.52 (3), bond to building steel.

3.4 GROUND RING

- A. Provide an electrically continuous ground system consisting of minimum of #4/0 copper main ground ring and ground rod stations with the bare copper conductors connected to the ground rod stations. Verify that the resistance to ground between any points on the system does not exceed 3 Ohms. Provide ground rod stations at each corner of the building.
- B. Install the ground conductors in contact with the earth below the frost line or a minimum of 30 inches, whichever is deeper.
- C. Bond ground ring to building steel at every other building perimeter steel column.

3.5 MISCELLANEOUS REQUIREMENTS

- A. Continuity of the equipment grounding system shall be maintained throughout the project. Equipment grounding jumpers shall be installed across conduit expansion fittings, liquid-tight flexible metal and flexible metal conduit, and other non-electrically continuous raceway fittings.
- B. Equipment grounding conductors and grounding electrode conductor shall be stranded copper conductors and run in a suitable 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. Exterior Electrical Equipment Racks:
 1. Provide driven ground electrode.
- E. 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. Grounding shall conform to ANSI/TIA/EIA 607(A) – Commercial Building Grounding and Bonding Requirements for Telecommunications, National Electrical Code®, ANSI/NECA/BICSI-568 and manufacturer's grounding requirements as minimum. Bonding shall be of low impedance to assure electrical continuity between bonded elements.
 1. MDF Closets Telecommunications Main Ground Bar (TMGB): Provide Erico #EGBA14424MM ground bar, 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 nearest electrical switchboard or panelboard.

2. IDF Closets Telecommunications Ground Bar (TGB): Provide Erico #EGBA14410FF ground bar mounted to the telecommunications plywood backboard. Provide one #6 AWG insulated ground conductor from ground bar to building steel and to ground bus of nearest electrical panelboard or switchboard.
 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, cabinets, frames, together and with #6 AWG insulated ground conductor to the local TMGB / TGB. Bond and ground equipment racks, housings, messenger cables, raceways, and rack-mounted conduit.
 6. Route TMGB – TGB ground conductor using the shortest, straightest, route practical with long radius curves.
 7. All conduits terminating to cable trays, wireways, and racks shall be mechanically fastened. When connected to a cable tray or rack, it must be connected with ground bushings, wire bonded to the tray or rack, and grounded to the main building grounding system or IDF room grounding bar using #6 AWG copper.
- F. Ground lighting fixture bodies to the conduit grounding system.
- G. Bond receptacle ground to the box and conduit ground system, except where and insulated/isolated grounding receptacle or outlet is specified.
- H. Ground connections to building steel, grounding electrodes and all underground connections shall be by thermal fusion (exothermic).
- I. Provide OZ Type "BJ" bonding jumper at all expansion joints, points of electrical discontinuity or connections in conduit where firm mechanical bond is not possible, such as flexible connections, insulating couplings, etc.
- J. Ground each lighting and power panelboard by connecting the grounding conductors to the grounding stud.
- K. Ground each secondary dry-type transformer to the ground bus of the primary side panelboard. Provide a bonding jumper between the ground stud and the neutral. Ground transformer ground stud to ground ring if a ground ring is installed or the nearest structural steel member.
- L. Bond every item of equipment served by the electrical system to the building equipment ground system. This includes, but is not limited to, switchboards, panelboards, disconnect switches, receptacles, cable trays, controls, fans, air handling units, pumps and flexible duct connections.
- M. Ground each light pole, power distribution poles, and metal conduit stub-ups at each light pole base.
- N. Ground all metal conduit including metal conduit used for bends and penetrations through concrete.
- O. Bond hot water and cold water piping together at each domestic water heater.

3.6 MANHOLE AND/OR PULL BOX GROUNDING

- A. Provide a driven ground rod and ground bond ring in each power and telephone manhole

or pull box. Bond cable racks and medium voltage cable shields at splices and terminations, ductbank conduit ground bushings and all other metal components in manholes or pull box to the ground ring.

3.7 COORDINATION

- A. General: Coordinate installation of grounding connections for equipment with equipment installation work.

3.8 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. True 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 should 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.
- E. Notify Owner's Commissioning Authority (CxA) prior to performing any tests to the CxA may witness tests at his/her discretion. Refer to Section 26 01 00 Commissioning of Electrical Systems.

END OF SECTION 26 05 26

SECTION 26 05 27

EXPANSION OF EXISTING ELECTRICAL GROUNDING SYSTEM

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

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.

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.

3.3 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 26 05 27

SECTION 26 05 33

CONDUIT SYSTEMS

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

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 $\frac{3}{4}$ -inch unless indicated otherwise in Divisions 26, 27 or 28.
 - 1. Branch Circuits: Minimum conduit size shall be $\frac{3}{4}$ -inch.
 - 2. Feeder Circuits: Minimum conduit size shall be $\frac{3}{4}$ -inches.
 - 3. Technology, telecommunications, and low voltage systems: The minimum conduit size shall be $\frac{3}{4}$ -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 $\frac{1}{2}$ 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 H₂O 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 conduit 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 conduit 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 knock 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.

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 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. Underground conduits:

- a. Concrete encasement for utility installed conductors shall be as specified by the utility and comply with their standards and specifications.
- b. Conduits either specified or approved in writing to be routed under building slab 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 conduit 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 conduits 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 $\frac{1}{4}$ -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, when required, 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: $\frac{1}{2}$ -inch flexible steel conduit or steel MC cable, length not to exceed 6-feet.
 2. Non-accessible ceilings: $\frac{1}{2}$ -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

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 conduits. 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. When required by utilities, conduit type and encasement shall be as specified and required by the respective utility.
- 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 26 05 33

SECTION 26 05 35

ELECTRICAL CONNECTIONS FOR EQUIPMENT

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.

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.

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 conduit, 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. Provide dedicated feeder and branch circuit conduit, cable, and 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" conduit below the enclosure's bottom elevation. Provide conduit from the conduit 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 26 05 35

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 1/2 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. Orange: - 480/277 VAC systems
 2. Light Blue: - 240 VAC three phase delta systems.
 3. Red – All Emergency circuits, regardless of voltage, and fire alarm system.
 4. Light Green - 120/208 VAC 3 phase and 120/240 VAC single-phase systems
 5. Yellow – Building Management and Control System - BMCS
 6. White - 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 26 05 37

SECTION 26 05 38

ELECTRICAL FLOOR BOXES AND FITTINGS

1 GENERAL

1.1 WORK INCLUDED

- A. Provide electrical floor box and fitting work as required, scheduled, indicated, and specified.
- B. All floor boxes and all poke-throughs for line voltage wiring devices or telecommunication outlets shall be the concealed service type.

1.2 QUALITY ASSURANCE

- A. UL Label: Electrical boxes, covers, and fittings shall be UL listed.

2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS – Provide products that are Buy American Act Compliance

- A. Wiremold-No exceptions

2.2 CONCEALED SERVICE - FLOOR BOXES

- A. Wiremold Evolution EFBS 6/8 Series
- B. Floor box shall be electro-galvanized sheet steel with fusion-bonded epoxy suitable for direct contact with concrete on grade (EFBS-OG).
- C. Cover assembly shall die-cast aluminum, finish as selected by Architect.
- D. Shall deliver electric power and telecommunications from non-proprietary building standard wiring devices and non-proprietary building standard telecommunications ports installed below the surface of the floor.
- E. Shall deliver telecommunications without interference from the electric power delivery.
- F. Hinged cover shall accept carpet or tile to match floor covering and be 180 degrees reversible.
- G. Shall accept conduit sizes up to 2-inches.
- H. When hinged cover is closed and no services in place, device shall have no obstructions above surface of floor.

2.3 CONCEALED SERVICE, FIRE RATED, POKE-THROUGH DEVICE

- A. Wiremold Evolution Series - 6AT (3-gang) / 8AT (5-gang) /10AT (8-gang)
- B. Shall be UL classified two-hour fire rating. Where floor fire rating is three-hour, provide only the 6AT series with a 3-hour fire rating.

- C. Shall be UL listed for use with power and low voltage in a single service fitting and shall protect against ingress of water or foreign materials.
- D. Shall deliver electric power and telecommunications from non-proprietary building standard wiring devices and non-proprietary building standard telecommunications ports installed below the surface of the floor.
- D. Center data channel for six-inch 6AT poke throughs shall accept a minimum of (22) Category 6a cables, center data channel shall accept a minimum of (5) Category 6a cables.
- E. Shall be installed in a single core drilled hole.
- F. Shall permit use with "H" cut opening in carpet so carpet can be restored if position is vacated
- G. Shall have interchangeable service fitting accessories including hinged guard and low voltage communication inserts
- H. Service fitting cover shall be aluminum, finish as selected by Architect.

2.4 RECESSED FURNITURE FEED POKE-THROUGH DEVICES

- A. Wiremold Evolution 6ATCFF Series.
- B. Shall be UL classified for use in up to two-hour fire rated floors.
- C. Shall be UL listed for use with power and low voltage in a single service fitting and shall protect against ingress of water or foreign materials.
- D. Shall be installed in a single core drilled hole
- E. Die-cast aluminum covers, finish as selected by Architect.

2.5 SERVICE FITTING HEADS

- A. Shall be brushed aluminum or stainless steel.
- B. Shall deliver electrical power from receptacles as designated on the plans.
- C. Shall deliver telephone/data through precut bushed opening
- D. Provide non-proprietary building standard line voltage wiring devices
- E. Shall be furnished standard with conduit nipple for direct screw threading into cover assembly

3 EXECUTION**3.1 GENERAL**

- A. Locate position for floor boxes and runs of conduit as shown on the plans, or as required. Coordinate with the Structural Engineer and Architect for dimensional locations of floor boxes prior to cutting or pouring slab.

- B. Select appropriate size of floor boxes, poke-through, or multiple services floor boxes for quantity of wiring devices or cables indicated and as recommended by manufacturer.

3.2 INSTALLATION

- A. Position floor boxes and install conduits at locations approved by the Architect.
- B. After concrete pour, pull wires and install devices according to manufacturer's recommendations.
- C. Activate in accordance with the National Electrical Code.
- D. Coordinate with floor covering contractor to complete installation.
- E. Core drill openings for poke-through service fitting and installation in accordance with manufacturer's instructions and where approved by the Structural Engineer and Architect.
 - 1. Minimum spacing of 2-feet on center and not more than one unit per each 65-square feet of floor area in each span as required by Fire Resistance Directory.

END OF SECTION 26 05 38

SECTION 26 05 40

ELECTRICAL GUTTERS AND WIREWAYS

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.

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.

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 26 05 40

SECTION 26 05 50

FIRESTOPS

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.

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.

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 26 05 50

SECTION 26 08 00

ELECTRICAL COMMISSIONING COORDINATION

1 GENERAL

1.1 SUMMARY

- A. Section outlines commissioning requirements and activities of the Contractor, Owner, CxA and Design Professionals as related to the Division 26 Electrical.
- 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
 - 5. Division 27 – Communications
 - 6. Division 28 – Safety and Security

1.2 DEFINITIONS

- A. Refer to Specification Section 01 91 13, General Commissioning for definitions.

1.3 CONTRACT INFORMATION

- A. The Owner will contract directly for commissioning services.
 - 1. Commissioning Agent fee will be paid for directly by the Owner.
 - 2. Contractor shall provide coordination with the CxA including but not limited to labor, materials, and testing equipment as required for the CxA as specified in this section.

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 and other items required for Functional Performance Testing includes but not limited to those listed below. Data logging and software required for testing and corrective measures as required by the contract documents 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. 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 and the CxA.

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 26 specifications, including specific contractor provided or furnished items indicated by this Section, shall be provided by the Contractor.

3.2 SUBMITTALS

- A. Electrical:
 - 1. Lighting controls and lighting equipment submittals conforming to the contract documents.

3.3 EQUIPMENT START-UP

- A. Notification:
 - 1. Contractor shall provide ten Owner business day notice to CxA, Owner and Design Team of start-up dates. Owner business days are defined as the Owner's Construction and Maintenance Operations department's normally scheduled work days, typically Monday through Friday, excluding Federal, State, Local, and Owner scheduled Holidays.
- B. Prior to start-up, Contractor shall:
 - 1. Verify that equipment and systems are complete, accessible, correctly connected and ready for operation. Perform all pre-start inspections and tests as called for in Division 26 and as recommended by the equipment manufacturer.
 - 2. Pre-start requirements of the manufacturer shall include but not limited to the Contractor's completed applicable documentation and completed inspection and check-list.
 - 3. Complete applicable sections of Pre-functional Checklists (PFCs).
 - 4. Coordinate start-up attendance by manufacturer or their authorized representative as required by the specifications and the manufacturer.
- C. At start-up, Contractor shall:
 - 1. Supervise the activities of the manufacturer's authorized start-up technician and/or authorized manufacturer's representative.
 - 2. Verify proper voltage, overcurrent protection, phase, phase sequence, and any other conditions that may cause damage if not correct.
 - 3. Execute start-up under supervision of contractor personnel familiar with the installation and operation of equipment being commissioned and the equipment manufacturer's personnel 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 and noted during start-up to CxA, Owner and Design Team. Outline recommendations for corrective action to comply with the Contract Documents and equipment manufacture's installation and operation requirements.

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. If approved by the Cx as an alternate, contractor may submit alternate versions of the PFC's to the CxA for review and comment.
- B. Contractor shall complete PFC for each of the following equipment:
 - 1. Electrical.

- a. Lighting and lighting controls.

3.5 FUNCTIONAL TESTING

- A. General:
 - 1. Contractor shall organize and schedule Contractor Team members to execute the functional testing , which will be directed by CxA.
 - a. Lighting and lighting controls.

END OF SECTION 26 08 00

SECTION 26 09 21

MOTOR CONTROL CENTERS

1 GENERAL

1.1 WORK INCLUDED

- A. Motor control center work is as required, scheduled, and as specified.
- B. Types: Motor control centers required for the project include 600V motor control centers.

2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Schneider Electric - Square D
- B. General Electric Co.
- C. Siemens
- D. Eaton

2.2 MATERIALS AND COMPONENTS

- A. General: Except as otherwise indicated, provide motor control center manufacturer's standard materials and components as indicated by published product information, designed and constructed as recommended by the manufacturer, and as required for a complete installation.

2.3 600 VOLT MOTOR CONTROL CENTERS

- A. General: Provide a factory-assembled, dead-front construction, metal-enclosed, self-supporting motor control center of the voltage, phase, ampacity, and short circuit bracing required.
 - 1. Motor control centers shall consist of the required number of vertical sections bolted together to form one metal enclosed rigid structure.
 - 2. Motor control centers shall include starters, protective devices, and equipment as required with interconnections, instrumentation, and control wiring. Small wiring, fuse blocks, and terminal blocks within the motor control center shall be included within the motor control center. Groups of control wires leaving the motor control center shall be furnished with terminal blocks with suitable numbering strips. Wiring shall be NEMA Class I, Type B, unless shown otherwise. Size buckets to enable field servicing of components without removing entire bucket.
 - 3. A power monitor shall be included for each motor starter. Monitor relay shall drop out upon loss of any phase, undervoltage on any or all phases, or phase reversal from A-B-C sequence. Relay shall be adjustable for trip range and shall reset automatically when phase voltage and sequence is corrected. Motor starters shall open when monitor relay drops out, and automatically reset. Where solid state overload relays provide this specified requirement, separate overload relays may be omitted.
 - 4. A single-phase control power transformer shall be included with each motor starter for 120V control power. The primary shall be connected to the line side of

the motor starters; the secondary shall have one leg fused and one leg grounded. Arrange transformer terminals so that wiring to terminals will not be located above the transformer.

- B. Enclosure Construction: The motor control center framework shall be fabricated on a die-formed steel base or base assembly consisting of formed steel and commercial channel welded or bolted together to support the entire shipping unit for moving on rollers and floor mounting. The framework shall be formed code gauge steel, welded and bolted together to support cover plates, busing, and component devices during shipment and installation.
1. Each motor control center section shall have an open bottom and individually removable top plate for installation and termination of conduit. Top and bottom conduit area shall be shown and dimensioned on the shop drawings. Front plates used for mounting meters, selector switches, or other front-mounted devices shall be hinged, with wiring installed and laced, and at the flexible hinged side. Closure plates shall be small enough for easy handling by one man and held in place with slotted quarter turn fasteners. Door shall be held closed with captive textured thumb screws.
 2. An isolated horizontal wiring trough shall be arranged so that when bolted with adjacent vertical sections, the wiring trough will form a convenient pull box arrangement running the entire length of the motor control center. Each section shall also have a full height, isolated, non-obstructed, completely accessible, vertical wiring trough between the side and the starter units. Wire straps shall be furnished in the vertical wireway to group and tie wires in place for a neat, orderly installation. End sections shall have end closing plates that can be removed for the addition of future sections. Removable blank doors shall cover unused unit spaces.
 3. Unit space of a section shall be divided into six 12-inch space modules or other sizes in multiples of 6-inches for unit arrangements. Size 1 and Size 2 across the line, non-reversing, combination starter units, except those with 100 ampere fuse clips, shall fit into one space to permit rearrangement in the field.
 4. A main lug compartment shall be included complete with main lugs to accommodate incoming cables. The compartment shall be located in the topmost or bottom-most unit space of the section as required.
 5. Steel surfaces shall be chemically cleaned and treated to provide a bond between paint and metal surfaces to help prevent the entrance of moisture and formation of rust under the paint film. The paint finish shall be gray enamel over a rust-inhibiting phosphate primer.
 6. Enclosure shall be of NEMA 1 construction unless otherwise indicated.
- C. Busing: The motor control center busing shall be copper and of sufficient cross-section area to continuously conduct rated full load current with a maximum temperature rise of 65°C above an ambient temperature of 40°C.
1. The bus bars shall be braced to comply with the integrated equipment rating of the motor control center. The main horizontal bus bars between sections shall be located near the top of the motor control center. The horizontal main bus bar supports, connections, and joints shall be bolted or welded, as required, not to require periodic maintenance. Bolted joint connections shall have at least two bolts per joint per connection and have at least two bolts per joint per phase. Half-lapped bus joint construction is not acceptable. Horizontal bus shall be extended in each direction to allow for future motor control sections.
 2. Buses shall be arranged A-B-C, left-to-right, top-to-bottom, and front-to-rear throughout. A ground bus shall be secured to each vertical section structure and extend the entire length of the motor control center.

3. Insulated horizontal and vertical bus barriers shall reduce the hazard of accidental contact. Vertical bus barriers shall have plugs to close off unused openings. Bottom bus covers shall be included below the vertical bus to protect the ends of bus from contact with fish tapes or items entering the bottom of the enclosure. Draw out units shall be retained in the operating position by two conveniently positive latching mechanisms. Units shall be capable of being withdrawn to a test position (disengaged from bus) and padlocked.
 4. Sections shall include full length main busing of the ampacity rating indicated on the drawings. Each section shall contain full length sub-busing for future installations.
- D. Motor Control Devices: Each motor control device shall be a combination motor control unit consisting of a magnetic starter in combination with a circuit breaker. Each unit shall be rated as shown, and as required by equipment served.
1. Provide full-voltage, non-reversing, single-speed (FVNR), full-voltage, non-reversing, two-speed, two-winding (2S-2W), and reduced-voltage, non-reversing auto-transformer-type, closed transition (RVNR) starters sized as required. Starters shall be constructed and tested in accordance with the latest NEMA standards.
 2. Provide circuit breakers as specified below.
 3. Magnetic starter contacts shall be solid silver alloy, and shall not require filing, dressing, or cleaning throughout the life of the starter.
 4. Operating coils shall be 120V, and shall be pressure molded, and designed so that accidental exposure to excessive voltage up to 480V will not damage the coil. The starter shall also be designed so that when a coil fails due to an overvoltage condition, the starter shall definitely open, and shall not freeze in the closed position.
 5. Starters shall have manual reset, solid state, trip-free overload relays in each phase conductor. 3 phase FVNR starters shall have three overload relays. Single-phase FVNR starter shall have an overload relay in each ungrounded conductor. Two speed, full-voltage magnetic starters shall have overload relays for all 6 control legs. Overload relays shall not be field-convertible from manual to automatic reset. Provide button in front cover to reset all overload relays.
 6. Starters shall have 30.5mm RUN and STOP LED pilot lights. Furnish additional pilot lights for motor starters as shown. Provide FAST and SLOW pilot lights for two-starters. Pilot lights shall be mounted in the starter enclosure cover. Pilot lights shall be operated from an interlock on the motor starter, and shall not be wired across the operating coil.
Green – Stop
Red - Run
Yellow - Slow
Blue - Fast
 7. Starters shall have 30.5mm HAND-OFF-AUTOMATIC switches. Provide for FAST-SLOW, REMOTE-LOCAL speed selection from HVAC control system for two-speed starters. Two-speed starters shall have deceleration relays between fast and slow speeds. Coordinate motor starter controls with the requirements of Division 23. Motor starter controls shall be mounted in the starter enclosure cover.
 8. Each motor starter 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. In addition, it shall be possible to field install one or more additional auxiliary contacts without removing existing wiring, or removing the starter from the enclosure.
 9. Make provision for the units to be removed from the vertical bus without disturbing the wiring of the individual motor starter unit and permit starter door to be closed and fastened when removed. Include means to prevent incorrect

operation of the stab-in mechanism. Each individual removable unit shall be held in place with a positive-acting center toggle mechanism. Motor starter units up through NEMA Size 4 shall be provided with the stab-in mechanism.

- E. Integrated Equipment Rating: Each motor control center, as a unit, shall be given an integrated equipment rating by the manufacturer. The integrated equipment short-circuit rating shall certify that equipment is capable of withstanding the stresses of a fault available at the motor control center. The ratings shall have been established from tests by the manufacturer on similar equipment as the motor control center. This test data shall be available and submitted, if requested, with or before the submittal of shop drawings.
- F. Molded case circuit breakers:
 - 1. 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.
 - 2. 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.
 - 3. 1,200 Amp and larger frame circuit breakers regardless of trip shall have Energy Reducing Maintenance System switch with local status indicator (ERMS).
- G. Fusible switches:
 - 1. 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.
 - 2. 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.
 - 3. 600 Amps and below equipped for Class J fuses.
 - 4. 601 Amps and above shall be equipped for Class R or L fuses.
 - 5.. 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).

3 EXECUTION

3.1 INSTALLATION OF MOTOR CONTROL CENTERS

- A. General: Install motor control centers where shown, in accordance with the manufacturer's written instructions and industry practices to ensure that the motor control centers comply with the specified requirements.
- B. Concrete Pads: Install each motor control center on a 4-inch reinforced concrete housekeeping pad. The housekeeping pad shall extend 3-inches beyond the housing of the motor control center, unless shown otherwise. Furnish the position of any block outs, dimensions, and location of the housekeeping pads to prevent delay of the concrete work.
- C. Standards: Comply with requirements of NEMA and NEC standards, and NECA Standard of Installation, for installation of motor control centers.
- D. Tightness: Torque bus connections and tighten mechanical fasteners.

- E. Fuses: Install fuses, as required, in each motor starter.
- F. 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.
- G. Coordination: Motor controllers shall be provided to coordinate with motors furnished by Divisions 22 and 23. Motor controller controls shall be provided to coordinate with controls specified in Division 23.
- H. 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.
- I. Where motor controllers are indicated to be installed as part of a Motor Control Center, refer to the Motor Control Center specification.
- J. Adjustment: Adjust operating mechanisms for free mechanical movement.
- K. Coordination: Motor starter supplier shall coordinate with motors furnished by Divisions 22 and 23. Motor starter supplier shall coordinate with the Building Management Control System, Division 23.
- L. Identity each motor control center and each individual motor starter or branch circuit protective device as specified in Section 26 05 00.

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 Checks: Before energizing, check motor control center for continuous circuits and short circuits.
- C. Motor Control Center Insulation Resistance Test: Each motor control center bus shall have the insulation resistance tested after installation is complete, except for line and load side connections. Tests shall be made using a Biddle Megger or equivalent test instrument at voltage not less than 1000VDC. Resistance shall be measured from phase-to-phase and from phase-to-ground.
- D. Provide thermal infrared scan of motor control center under full load as directed and witnessed by Owner. Provide digital video documentation with test results 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.

- E. Submittals: Furnish instruments and personnel required for tests. Submit 4 copies of certified test results to Architect/Engineer for review. Test reports shall include motor control center tested, date and time of test, relative humidity, temperature, and weather conditions.

END OF SECTION 26 09 21

SECTION 26 09 25

ELECTRICAL CONTACTORS

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
 - Eaton

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.

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 the specified building lighting control system.
- 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.

END OF SECTION 26 09 25

SECTION 26 09 45

NETWORKED LIGHTING CONTROLS

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

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.
- 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.

2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers:
 - 1. Cooper ILC – Intelligent Lighting Controls, no exceptions. Contact Jason Peterson with PSA Lighting and Controls 713.664.7111. PSA Lighting will have additional information and knowledge of NCISD’s specific requirements and expectations.

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 and 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 load control relays, dimming outputs, manual switch stations, manual dimming stations.
- 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. Power over the network backbone from a centralized power supply is 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 and includes but not limited to the following.
 - 1. Auto-On / Auto-Off (occupancy mode)
 - 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 on or off. The lights will remain off regardless of occupancy until switch is pressed again, turning the lights on and restoring the sensor to Automatic On functionality.
 - 2. Manual-On / Auto-Off (vacancy mode)
 - a. Pushing a switch will turn lights on or off.
 - 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 on or off. The lights will remain off regardless of occupancy until switch is pressed again, turning the lights on and restoring the sensor to Automatic Off functionality.

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.
- 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 driver 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. Power/Secondary Packs shall be available that are UL924 listed for switching of Emergency Power circuits and control of 0-10 VDC dimming circuit.
 7. Secondary Packs shall be available that control louver/damper motors for skylights.

8. Secondary Packs shall be available that provide a pulse on/pulse off signal for purposes of controlling shade systems via relay inputs.
 9. Power (Secondary) Packs shall be available that provide up to 20 Amps switching of general purposed receptacle (plug-load) control.
- E. 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 LED drivers by sinking a minimum of 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).
- F. 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. Low voltage key switch shall be Hubbell Controls LV Series heavy duty rotary, momentary key switch model # LVSKEY-3M-SS with key # 126, No Exceptions.
 6. Dimmer with push button on/off and slide dimmer for 0-10Vdc control: Greengate #WBSD-010-C1, 120/277 Vac, 28mA sink current.
- G. 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.
- H. 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.

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.
- B. Provide ceiling mounted sensors. Wall mounted sensors shall only be used where ceiling mounted sensors are proven by the manufacturer to be impractical.
- C. 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.
- D. 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 = 10 minutes for vacancy mode, 20 minutes for occupancy mode.
 2. Self-Adjust = Off
 3. Disable Self-Adjust = On
 4. 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 26 09 45

SECTION 26 12 15

DRY-TYPE TRANSFORMERS

1 GENERAL

1.1 WORK INCLUDED

- A. Work Included: Low Voltage (less than 600 Volt) transformer work as shown, scheduled, indicated, and specified.
- B. Types: Transformers required for the project include dry-type transformers.

1.2 QUALITY ASSURANCE

- A. Standards: Transformers shall be designed and tested in accordance with NEMA and ANSI C33.4 and C89.2 standards.
- B. UL Label: Transformers shall be UL labeled.

1.3 STANDARDS

- A. UL-506
- B. ANSI C75.11
- C. NEMA ST-20
- D. DOE 2016 Efficiencies

1.4 SUBMITTALS

- A. Include outline and support point dimensions of enclosures and accessories, unit weight, voltage, KVA, and impedance ratings and characteristics, sound level, tap configurations, insulation system type and rated temperature rise.

2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Schneider Electric - Square D
- B. General Electric
- C. Siemens
- D. Eaton
- E. Acme
- F. Hammond

2.2 MATERIALS AND COMPONENTS

- A. Except as otherwise indicated, provide transformer manufacturer's standard materials and components as indicated by published product information, designed and constructed as recommended, and as required for a complete installation.

2.3 DRY-TYPE TRANSFORMERS

- A. General: Indoor transformers shall be dry-type, multiple-winding transformers, rated as shown, and shall have manufacturer's standard impedance.
- B. Construction: Transformer core shall be constructed of cold-rolled, oriented, high permeability silicon steel, either formed as a coil or laminated.
- C. Taps: Transformers 15 to 30 kva shall have two 5% taps, one above and one below normal. Transformers 45 kva and larger shall have four 2-1/2% taps, two above and two below normal.
- D. Temperature Rating: Transformers shall use an insulation system that has been temperature classified and approved by UL. Transformers shall have a maximum winding temperature rise of 150°C with an insulation system temperature classification of 220°C.
- E. Load Rating:
 - 1. Transformers shall be capable of operating at 100% of nameplate rating continuously while in an ambient temperature not exceeding 40°C.
 - 2. Transformers shall be capable of meeting the daily overload requirement of ANSI C57.12.
- F. Vibration Isolation: Each transformer core and coil shall be mounted in the transformer enclosure on rubber vibration isolators.
- G. Sound Rating: The transformer shall have sound levels equal to or lower than those ratings established in NEMA ST-20 and as shown in the following table. Sound ratings shall be measured in accordance with ANSI C89.91.

Transformer Rating (kva) (600 Volt Class)	Maximum Sound Level Decibels: NEMA ST-20
0 to 9	40
10 to 50	45
51 to 150	50
151 to 300	55
301 to 500	60

- H. Testing:
 - 1. The manufacturer shall have tested each transformer for proper operation before shipment.
 - 2. The manufacturer shall have performed the following additional tests on units identical to the design type being supplied. Furnish proof of performance of these tests in the form of test data sheets upon request:
 - a. Sound levels.
 - b. Temperature rise tests.
 - c. Full-load core and winding losses.
 - d. Percent regulation with 80 and 100% power factor load.
 - e. Percent impedance.
 - f. Exciting current.
 - g. Insulation resistance.

3 EXECUTION

3.1 INSTALLATION OF TRANSFORMERS

- 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. Only where specifically indicated on the plans or approved in writing by the Owner/Engineer, transformers shall be trapeze mounted using properly sized Amber/Booth type BRD rubber-in-shear hangers. Transformer enclosures shall make no contact with wall surfaces.
- C. Conduit: 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.

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. Notification: Notify Engineer in writing of any deviation from manufacturer's pre-shipment test data.

END OF SECTION 26 12 15

SECTION 26 12 17

ULTRA HIGH EFFICIENCY K-RATED TRANSFORMERS (EXCEEDS DOE 2016 EFFICIENCY)

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 be 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.

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 Losses, 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).

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

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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 26 12 17

SECTION 26 24 13

SWITCHBOARDS

1 GENERAL

1.1 WORK INCLUDED

- A. Work Included: Switchboard work as shown, scheduled, indicated, required, and specified.

1.2 QUALITY ASSURANCE

- A. UL Labels: Provide switchboards UL labeled for service entrance and meeting requirements of UL 891.
- B. NEMA Compliance: Comply with National Electrical Manufacturers Association (NEMA) Standard PB2, "Dead-Front Distribution Switchboards."

1.3 SUBMITTALS

- A. Indicate:
 - 1. Detailed dimensions for equipment foot print, front and side elevations.
 - 2. Conduit entrance locations and requirements and restrictions.
 - 3. Enclosure material, finish, and NEMA classification type.
 - 4. Nameplate legends.
 - 5. Size and number of bus bars
 - 6. Switchboard instrument details.
 - 7. Electrical characteristics including voltage, ampacity, overcurrent device frame size and trip ratings, withstand ratings, and time current curves of all overcurrent devices and components.

2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Schneider Electric - Square D
- B. ABB General Electric Co.
- C. Siemens
- D. Eaton

2.2 MATERIALS AND COMPONENTS

- A. Except as otherwise indicated, provide switchboard manufacturer's materials and components as indicated and as required for a complete installation.

2.3 DEAD-FRONT DISTRIBUTION SWITCHBOARDS

- A. 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.

- B. Provide a factory-assembled, dead-front construction, metal enclosed, self supporting, switchboard of voltage, phase, ampacity, and short circuit interrupting rating and bracing shown.
 - 1. Switchboard shall consist of the required number of front and rear aligned vertical sections bolted together to form one metal enclosed rigid switchboard. The switchboard shall be designed as a free-standing with only front access. Rear and/or side access only where indicated to reduce switchboard depth and where NEC required rear access clearance is available.
 - 2. Switchboard shall include protective devices and equipment shown with interconnections, instrumentation, and control wiring. Small wiring, necessary fuse blocks, and terminal blocks in the switchboard shall be provided. Groups of control wires leaving the switchboard shall be furnished with terminal blocks with numbering strips.
 - 3. Factory installed permanent lock-off provision for pad-locking in the off position for all protective devices.
- C. Enclosure Construction: The switchboard framework shall be fabricated for floor mounting. The framework shall be formed code gauge steel, welded and bolted together to support cover plates, busing, and component devices.
 - 1. Each section shall have an open bottom and individually removable top plates for installation and termination of conduit. Top and bottom conduit areas shall be shown and dimensioned on the shop drawings. Front plates used for mounting meters, selector switches, or other front-mounted devices shall be hinged, with wiring installed and laced, and with flexibility at the hinged side. Closure plates shall be screw removable and small enough for easy handling by one technician.
 - 2. Weatherproof enclosure front door(s) shall be pad-lockable and suitable for the intended environmental conditions. When indicated or specified, rear doors shall also be pad-lockable.
- D. Busing: The switchboard busing shall be copper.
 - 1. The bus bars shall be braced to comply with the integrated equipment rating of the switchboard. The main horizontal bus bars between sections shall be located on the back of the switchboard to permit maximum available conduit entry area. The horizontal main bus bar supports, connections, and joints shall be bolted or welded, as required, so as not to require periodic maintenance. Bolted joint connections shall have at least two bolts per joint per phase. Half lapped bus joint construction is not acceptable.
 - 2. Buses shall be arranged A-B-C, left-to-right, top-to-bottom, and front-to-rear throughout. A ground bus shall be secured to each vertical section structure and extend the entire length of the switchboard.
 - 3. The main horizontal bus and incoming line shall be isolated and insulated from outgoing busing and cable connections.
 - 4. Each group mounted section shall have maximum full height bus. Where space is indicated, space shall be bused to install future switches or future circuit breakers sized as shown or a 600 Amp frame size circuit breaker or switch, whichever is greater.
 - 5. The main horizontal bus shall be non-tapered, fully rated, extended and drilled

for future additions and splice plates.

- E. Integrated Equipment Rating: Each switchboard, as a complete unit, shall be given a single integrated equipment rating by the manufacturer. The integrated equipment short circuit rating shall certify that equipment can withstand the stresses of a fault equal to that shown in RMS symmetrical amperes. Ratings shall have been established by actual tests by the manufacturer on similar equipment construction as the subject switchboard. This test data shall be available and furnished, if requested, with or before the submittal of shop drawings.

- F. Indicating Instruments: Switchboard instrumentation shall be digital display, panel mounted, rated for 120V, 60 hertz. The display unit shall be UL listed in accordance with UL 508. The electronic metering device shall have the following features:
 - 1. Voltmeter, phase to phase and phase to ground or neutral.
 - 2. Current, per phase RMS and 3 phase coverage.
 - 3. Demand current per phase.
 - 4. Power factor per phase and 3 phase average.
 - 5. Real power, 3 phase total.
 - 6. Reactive power, 3 phase total.
 - 7. Apparent power, 3 phase total.
 - 8. Frequency.
 - 9. Average demand real power.
 - 10. Adjustable demand interval (5 to 60 minutes).
 - 11. Nonvolatile memory.
 - 12. Password protected set-up and reset.
 - 13. 3 current transformers with primary to match bus size and 5 ampere secondary with metering class accuracy.
 - 14. Full scale readouts with the following accuracy:
 - a. Current and voltage measurement +/-0.1%
 - b. Power and energy +/-0.2%
 - c. Frequency +/-0.5%
 - d. Power Factor +/-1.0%
 - e. Data update time 0.5 seconds (4 wire)
 - 15. Metering Output.
 - a. Pulse output based on kWh, kvarh, or kVAh.
 - b. Analog output 4-20mA based on kWh, kvarh, or kVAh.
 - 16. Monitoring:
 - a. Harmonic analysis through 63rd with THD and TIF.
 - b. Event recorder.
 - c. Waveform capture.
 - d. Data logger.
 - e. Triggered trace memory.
 - 17. Communication:
 - a. Front port and dual rear mounted RS485 ports.
 - b. BACnet protocol (coordinate with BMCS contractor).
 - c. Mini RTU: digital 4 in/4 out.
 - d. Analog 1 in/4 out.
 - e. Local/remote display of all values.
 - 18. Software:
 - a. Windows based software shall be provided to enable setpoint programming.

- G. The Main Protective Device(s) shall be individually mounted molded case circuit breaker(s):
 - 1. Adjustable: current, I²t settings, ground fault (where required), instantaneous

- trip, and short time trip. Solid state true RMS sensing, without fusible elements, 100-percent continuous current rating.
2. Main protective devices with frame rated at 1000 Amps or greater shall have integral ground fault interrupter and provided with a portable test set or test switch.
 3. Circuit breakers with 1,200 Amp frame and above shall have Energy Reducing Maintenance System switch with local status indicator (ERMS).
 4. Provide shunt trip capability and wiring to terminal block for remote shunt trip switch wiring termination weather remote trip device is indicated or not.
- H. Feeder and Branch Protective Devices greater than 1,200 Amps shall be individually mounted:
1. Molded case circuit breakers:
 - a. Adjustable: current, I^2t settings, ground fault (where required), instantaneous trip, and short time trip. Solid state trip true RMS sensing, without fusible elements; 100-percent continuous current rating.
 - b. Energy Reducing Maintenance System switch with local status indicator (ERMS).
 - c. Shunt trip capability and wiring to terminal block for remote shunt trip switch wiring termination weather remote trip device is indicated or not.
 2. Fusible switches:
 - a. Each switch shall have an 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.
 - b. Fused switches 600 Amps and below, equipped for class J fuses.
 - c. Fused switches 601 Amps and above shall be equipped with Class R or L rejection type fuse holders. Class RK1 or L of ampere rating and type as indicated on the plans suitable for application of the system.
 - d. When required by the latest edition of the NEC or the AHJ, 1,200 Amp switches regardless of fuse size installed shall have Energy Reducing Maintenance System switch with local status indicator (ERMS).
- I. Feeder and Branch Protective Devices 1,200 Amps and below shall be group mounted:
1. Molded case circuit breakers:
 - a. Greater than 250 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. 250 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 frame circuit breakers regardless of trip shall have Energy Reducing Maintenance System switch with local status indicator (ERMS).
 2. 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 rejection type fuse holders.

- 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).
- J. 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 switchboard manufacturer shall include in the submittal data for the switchboard, the minimum setting of the devices and the recommended setting for normal building operation.
 - 2. The ground fault system shall be factory-tested before shipment as specified:
 - a. The switchboard 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.
- K. Mimic bus: Indicate busing, connections, and devices in single line form on the front panels of the switchboard using red colored plastic strips, fastened flat against the panel face with screws.

3 EXECUTION

3.1 INSTALLATION OF SWITCHBOARDS

- A. Install switchboards where shown, in accordance with the manufacturer's written instructions, and industry practices to ensure that the switchboards meet the specifications. Provide weatherproof NEMA 3R enclosure housing outdoors, at wet locations, or where indicated on the drawings. Provide NEMA 3RX enclosure housing at corrosive locations of either aluminum or stainless-steel construction suitable for the intended environment when indicated on the drawings.
- B. Comply with the requirements of NEMA and NEC, and NECA Standard of Installation, for installation of switchboards.
- C. Where switchboard 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 switchboard.
- D. Torque bus connections and tighten mechanical fasteners.
- E. Install fuses, of ratings shown, in each switchboard. Provide spare fuse cabinet with

three fuses of each size provided. Locate in central plant as directed by Owner.

- F. Concrete Pads: Install switchboards on a 4" reinforced concrete housekeeping pad. The housekeeping pad shall extend 3" beyond the housing of the switchboard unless shown otherwise. Switchboard shall be bolted to the housekeeping pad using 3/8" minimum galvanized bolts and anchors on 30" maximum centers. Furnish the exact position of any block outs, dimensions, and location of the housekeeping pads to prevent delay of the concrete work.
- G. Adjustment: Adjust operating mechanisms for free mechanical movement. Adjust circuit breaker time characteristic curves as recommended by the Fault Current and Coordination Analysis or as directed by the Engineer.
- H. Indicating Instruments: Provide initial factory start-up and programming with Owner present. Integrate with the Building Management System for monitoring and logging of all system data.

3.2 TESTING

- A. Notify Owner's Commissioning Authority (CxA) prior to performing any tests so that the CxA may witness tests at the CxA's discretion.
- B. Pre-energization checks: Before energizing, check switchboards for continuous of circuits and for short circuits.
- C. Switchboard insulation resistance test: Each switchboard bus shall be insulation resistance tested after installation is complete except for line and load side connections. Tests shall be made using Biddle Megger or equivalent test instrument at a voltage of not less than 1000 vDC. Resistance shall be measured from phase-to-phase and from phase-to-ground. Minimum acceptable value for insulation resistance is 2 megohms.
- D. Ground Fault Interrupter (GFI) test: 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 overcurrent device rating or 1,200 Amperes, whichever is lower.
- E. Provide thermal infrared scan of switchboard 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.
- F. Submittals: Furnish instruments and personnel required for tests. Submit 4 copies of certified test results to the Architect for review. Test reports shall include switchboard tested, date and time of test, relative humidity, temperature, and weather conditions.

3.3 TRAINING

- A. Provide minimum 2 hours of dedicated training provided by a factory authorized representative to Owner's personnel regarding programming, operating, and use of switchboard components including all indicating instruments and safety features.

END OF SECTION 26 24 13

SECTION 26 24 16

PANELBOARDS AND ENCLOSURES

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.

2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Schneider Electric - Square D
- B. ABB-General Electric Co.
- C. Siemens
- D. Eaton

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, I²t 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 use 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.

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 26 24 16

SECTION 26 24 25

ENCLOSED SWITCHES

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.

2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Schneider Electric - Square D
- B. ABB-General Electric Co.
- C. Siemens
- D. Eaton

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.

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 26 24 25

SECTION 26 24 30

FUSES

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

2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Manufacturers: Provide products produced by Bussman or Littelfuse.

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.

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.

FUSES

SECTION 26 24 30

END OF SECTION 26 24 30

SECTION 26 26 00

ELEVATOR POWER MODULE SWITCH

1 GENERAL

1.1 DESCRIPTION OF WORK

- A. Work of this section shall conform to the requirements of the Contract Documents.
- B. Provide Elevator Power Module Switch, fuses and accessories as required and specified on Contract Drawings to distribute electrical power to all elevators.

1.2 CODES AND STANDARDS

- A. All work shall be performed in accordance with the latest edition of applicable standards, codes and laws.
 - 1. NFPA 70 620-51 A-B, 620-62, 645-10, 700-25 (FPN)
 - 2. ANS/ASME A17.1 102.2(4)
 - 3. UL 98, UL 50
- B. Except as modified by governing codes, all equipment shall be manufactured in accordance with the latest UL and NEMA applicable standards:

1.3 SUBSTITUTIONS

- A. Substitutions shall comply with the requirements of the General Conditions and General Requirement. The names of manufacturers and model numbers have been used to establish types of equipment and standards of quality. A submittal shall contain sufficient information to provide compliance with Contract Documents. This includes compliance with all pertinent sections of codes and standards as specified above.

1.4 SUBMITTALS

- A. Submit shop drawings and product data under the provisions of the General Conditions.
- B. Product Data: Provide manufacturer's catalog information showing dimensions, configurations and methods of mounting and installation.
- C. Submit listing of all types, sizes and quantity of fuses that will be installed including the location of each.
- D. Spare fuses shall be supplied as required by Section 26 24 30.
- E. Provide line-by-line compliance of specifications.

2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Bussmann – Power Module Switch – PS
- B. Littlefuse

- C. Siemens

2.2 POWER MODULE SWITCH

- A. The Power Module Switch shall be constructed, listed, and certified to UL 67 and UL 891. The Power Module Switch shall be 3 phase, 3 wire constructed in a NEMA 1 enclosure with copper bus. The Power Module Switch shall have individual horsepower rated fusible feeder switches with shunt trip capabilities unless noted otherwise. Feeder switches shall have voltage and ampere ratings based upon elevator manufacturer requirements and utilize Class J fuses; minimum rating 100 Amps at 480 Volts, 200 Amps at 208-240 Volts. All shunt trip fusible feeder switches shall have as an accessory a relay, control power transformer and other options noted below. The control power transformer shall be 100VA with primary and secondary fuses, with a 120V secondary. The isolation relay shall be 3PDT, 10A, 120V. The coil of the isolation relay shall be 120VAC. A 5A normally open dry contact shall be provided by the Fire Alarm Safety System to energize the isolation relay and activate the shunt trip solenoid (140VA inrush at 120V). Additional accessories provided for each fusible shunt trip switch include:
 - 1. Key to Test Switch
 - 2. Pilot Light (Red – ON)
 - 3. (2 NO & 2 NC) mechanical Interlock Auxiliary Contacts for hydraulic elevator recall and battery disconnect.
 - 4. Fire Safety Interface relay, 120 volt dc coil
- B. The module shall have been successfully tested to a short-circuit rating with Bussmann LOW-PEAK® Class J fuses at 200,000 amps RMS Symmetrical. All switches shall have shunt trip capabilities at 120 VAC from remote fire safety signal.

3 EXECUTION

3.1 INSTALLATION

- A. General: Provide elevator power module switch as required, including fuses, electrical connections, in accordance with the manufacturer's written instructions, the requirements of NEC, NECA Standard of Installation, and industry practices.
- B. Coordination: Coordinate installation with conductor and raceway installation work and Elevator Contractor / Manufacturer.
- C. Anchoring: Anchor enclosures to walls and structural surfaces ensuring that they are permanently and mechanically secured.
- D. Fuses: Install fuses, of the ratings and class shown, in each power distribution and motor control panelboard.
- E. Fuses shall not be installed until equipment is ready to be energized.
- F. Coordinate and provide elevator battery disconnect with mechanical interlock contacts.

3.2 TESTING

- A. Before energizing, energization, check for continuity of circuits and short circuits.

END OF SECTION 26 26 00

SECTION 26 27 73

LINE VOLTAGE WIRING DEVICES

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.

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
 - 4. Eaton

- 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. Heavy duty tamper resistant finger groove face (not 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. Line voltage rotary key operated switch (verify manufacturer and keying with Owner prior to construction). Refer to Lighting Controls specifications for key switch for low voltage lighting controls.
 - 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 #LVSKEY-3M-SS-#126 or as otherwise directed by Owner.
- C. Line voltage dimmer with 0-10Vdc control: Greengate #WBSD-010-C1, 120/277 Vac, 28mA sink current.

2.5 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).

2.6 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 SJO 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.

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 remains 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 utilization equipment, 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 26 27 73

SECTION 26 32 13

NATURAL GAS STANDBY GENERATOR SETS and TRANSFER SWITCH

1 GENERAL

1.1 RELATED DOCUMENTS

- A. The Conditions of the Contract and applicable requirements of Division 1 and Section 26 05 00 govern this Section.

1.2 WORK INCLUDED

- A. Furnish and install standby engine-driven generator system, complete with wiring and controls as shown on the drawings and as specified herein.
- B. The standby emergency system shall consist of an engine-driven generator set designed and sized for project site ambient conditions and project site altitude, complete for outdoor installation where specified or required outdoors, automatic transfer switches and associated fuel system.

1.3 QUALITY ASSURANCE

- A. Acceptable Manufacturers:
 - 1. Engine-Driven Generator Sets:
 - a. Cummins
 - b. Taylor Power
 - c. Generac Industrial
 - d. Caterpillar
 - e. Kohler
 - 2. Automatic Transfer Switch.
 - a. Cummins
 - b. Russelectric
 - c. ASCO
 - d. Zenith
 - e. Eaton
 - f. Standby electric generating system manufacturer (as an integral part of a complete system).
- B. NEC and NFPA Compliance: Comply with applicable portions of the NEC (NFPA 70) including, but not limited to, emergency and standby power generation systems (NFPA 99 & 110), and with NFPA 37 Installation and Use of Stationary Combustion Engines and Gas Turbines.
- C. IEEE Compliance: Comply with applicable Institute of Electrical and Electronics Engineers, Inc. (IEEE) standards pertaining to generator construction.
- D. EPA Compliance: Comply with all EPA Standards for permanently installed natural gas emergency generators.
- E. Testing: The generator set shall receive the manufacturer's standard factory load testing.
- F. Supplier: All equipment provided shall be supplied by an authorized distributor of the manufacturer who has been continuously engaged in the distribution of industrial grade

Power System products for a minimum of 15 years. The supplier shall provide initial start-up services, conduct field acceptance testing, and warranty service. The supplier is to be authorized to perform warranty service on all products provided. Within 50 miles of the job site, the supplier shall maintain; a minimum of 6 factory-trained and qualified field technicians; a proper supply of spare parts for the supplied equipment; a shop with overhaul capabilities; and be able to provide 24 hour, 7 day per week, 365 day per year field service capability.

1.4 SUBMITTALS

- A. Submit manufacturer's certified computer-generated performance and capacity data in accordance with specification requirements. Indicate and include all ambient and altitude de-ratings and calculations.
- B. Submittal drawings and information on the transfer switches including installation drawings, wiring diagrams, dimensions, weights, etc. shall be provided. Full descriptive information on accessory items shall be furnished.
- C. Submit manufacturers' "Installation, Start-Up and Service" instructions, recommended conductors, overcurrent protection, and electrical interlocks.
- D. Submit recommended clearance dimensions.
- E. Submit sequence of operation in narrative form.
- F. . Instruction Data and Drawings: Commercial type operating instructions shall be provided consisting of operating and maintenance manuals, parts books, dimensional drawings and wiring diagrams.

1.5 WARRANTY

- A. Provide five-year parts and labor warranty from date of substantial completion for generator set(s) and transfer switch(es).

2 PRODUCTS

2.1 ENGINE-GENERATOR SETS

- A. The engine-generator set shall be furnished as a complete working system. The model provided shall be a standard model that is quality assurance tested and prototype tested, not one of a kind without supporting literature.
- B. Engine shall be liquid cooled, reciprocating engine, 12V DC electric start, natural gas fueled, electronic isochronous governed with manual speed adjustment plus/minus 5%, with belt-driven battery charging alternator.
- C. The set shall provide the following performance:
 - 1. Rated power for the duration of any utility power outage, in ambient conditions to 500-feet altitude and an outside air ambient temperature of 10 degrees F to 110 degrees F. Liquid coolant system ratings for natural gas sets through 140KW shall be rated at 122 degrees F ambient.
 - 2. Start and accept rated load within 10 seconds of utility power outage.
 - 3. Voltage regulation of plus/minus 2% no load to full load with random voltage variation, at any constant load, less than plus/minus 1%.
 - 4. Isochronous frequency regulation, less than plus/minus 0.5% at any steady state load from no load to full load.

- D. Engine Coupling: Engine shall be directly connected to the generator through a suitable flexible coupling.
- E. Generator:
 - 1. The generator shall be a standard make, 4-pole, revolving field, single bearing, synchronous, brushless type with the following characteristics:
 - a. Capacity as shown on the drawings and shall operate at 1800 rpm.
 - b. Dripproof, self-ventilating, permanently aligned and complete with rotating brushless exciter and shall be of ball bearing construction and connected to the engine with flexible disc coupling.
 - c. Conform to the latest applicable IEEE and NEMA standards.
 - d. Provided with generator overload protection or generator manufacturer's overload protective circuitry.
 - e. Output main circuit breaker(s) with adjustable LIS trip for cable protection shall be provided when shown on drawings. Circuit breaker manufacturer shall be the same as switchgear manufacturers specified and submitted to be used on this project.
 - f. Voltage Regulator: Include a full wave rectified automatic digital voltage regulation system matched and prototype tested by the engine manufacturer with the governing system provided. It shall be immune from mis-operation due to load-induced voltage waveform distortion and provide a pulse width modulated output to the alternator exciter. The voltage regulation system shall be equipped with three-phase RMS sensing and shall control buildup of AC generator voltage to provide a linear rise and limit overshoot. The system shall include a torque-matching characteristic, which shall reduce output voltage in proportion to frequency below an adjustable frequency threshold. Torque matching characteristic shall be adjustable for roll-off frequency and rate, and be capable of being curve-matched to the engine torque curve with adjustments in the field.
 - g. Alternator: The generator shall be capable of withstanding a three phase load of 300% rated current for 10 seconds, and sustaining 150% of continuous load current for 2 minutes with field set for normal rated load excitation.
 - 2. Provide the generator with the following:
 - a. Minimum 130°C rise stand-by rating
 - b. NEMA Class F or H insulation as defined by NEMA MG1.65
 - c. Temperature rise by resistance and embedded detector measurements at rated load within NEMA MG1-22.40 definition.
 - d. Pre-lubricated, maintenance free ball bearing, lubricated for life.
 - e. Direct drive centrifugal blower cooling.
 - f. RFI filters on the exciter to eliminate radio frequency interference on electronic equipment.
 - g. Thermostatically controlled block strip heater mounted for condensation control.
- F. Sub-Base: The engine power plant shall be mounted on an I beam, box type sub-base of fabricated steel construction. The assembly shall be installed on a vibration-absorbing base on a concrete pad as shown on the drawings.
- G. Automatic Starting Sequence of Events:
 - 1. Upon drop in normal source voltage to 65 to 70% of rated voltage, or upon failure of the normal source of electrical supply, the engine shall be automatically cranked and brought up to the full operating speed.

2. The cranking motor circuit shall be instantly broken when the engine starts.
3. Within 10 seconds the generator shall be brought up to operating speed; the generator voltage shall operate the automatic transfer switch, disconnecting the load from the normal source of supply and connecting the emergency power to the load.
4. Upon restoration of the normal source voltage to 92 to 95% of rated voltage or restoration of normal source of supply, the sequence shall be reversed, restoring the transfer switch to the automatic normal operating position, disconnecting the load from the emergency generator and reconnecting the load to the normal source of supply. The emergency generator set will continue to operate for a period of from 1 to 5 minutes after the restoration of the normal source of supply. Should the engine fail to start upon the first crank, there shall be two additional cranking attempts made with a 15 second rest between cranks, after which the cranking cycle shall cease and an alarm shall sound to indicate malfunctioning of the system.
5. The controls shall automatically stop the engine in the event the cooling water temperature becomes too high, if the coolant level becomes too low, if the oil pressure drops below a pre-determined pressure, or if the engine overspeeds. Upon the failure of the engine for any of the above reasons, an indicating lamp will operate indicating the condition under which the engine was shut down. Also, the alarm signal shall be energized.

H. Engine Control Panel & Accessories:

1. Provide a comprehensive monitoring and control system integral to the Generator Set control to guard the electrical integrity of the alternator and power system. Provide single and 3-phase fault current regulation, so that downstream protective devices have the maximum current available to quickly clear fault conditions, without subjecting the alternator to potentially catastrophic failure conditions. Include provisions to either prevent over voltage due to single phase faults, or to shut down the generator set if line to neutral voltage on any phase exceeds 115% for more than 0.5 seconds. Acceptable methods are a fully rated (100%) 600 volt Circuit Breaker, mounted in the generator enclosure, Schneider Electric - Square D Programmable Micrologic of size as indicated on drawings with handheld programmer or inherent protection provided by microprocessor-based GenSet AmpSentry protection. Submittals shall demonstrate that the protective device provides proper protection for the alternator by a comparison of the trip characteristic of the breaker with the thermal damage characteristic of the alternator. Field circuit breakers shall not be acceptable for generator overcurrent protection. The control system shall actively control the fuel rate and excitation as appropriate to the state of the generator set. Fuel rate shall be regulated as a function of starting, accelerating to start disconnect speed, accelerating to rated speed. The governing system shall include a programmable warm up at idle and cool-down at idle function. While operating in idle state, the control system shall disable the alternator excitation system. An electronic governor system shall provide automatic isochronous frequency regulation. The governing system dynamic capabilities shall be controlled as a function of engine coolant temperature to provide fast, stable operation at varying engine operating temperature conditions. The Control Panel shall include, but is not be limited to, the following instruments and protective devices:
 - a. AC Ammeter.
 - b. Phase Selector Switch.
 - c. Current Transformers.
 - d. AC Voltmeter.
 - e. Automatic Solid State Voltage Regulator with immunity to severe induced waveshape distortion from nonlinear loads.

- f. Rheostat for Adjusting voltage \pm 5% of Rated Voltage.
 - g. Engine Malfunction Warning Lights/Audible Alarm:
 - 1) Anticipating High Engine Temperature.
 - 2) Anticipatory Low Oil Pressure.
 - 3) Low Fuel.
 - 4) Control Switch not in Automatic Position.
 - 5) Low Water Temperature.
 - 6) Low Oil Pressure.
 - 7) High Water Temperature.
 - 8) Engine Overcrank.
 - 9) Engine Overspeed.
 - h. Frequency Meter.
 - i. Non-resettable Elapsed Time Meter with a 9,999.9 Hour Maximum Indication.
 - j. Coolant Temperature Gauge.
 - k. Oil Pressure Gauge.
 - l. Provisions for Remote Emergency Shutdown.
 - m. Combination alarm shutdown system with manual reset and indicating lights for high engine temperature, low oil pressure, engine overspeed, and engine failed to start. Include an additional set of contacts for remote alarms.
 - n. Manual run/off/automatic selector switch for control of engine with flashing red light, and shall allow manual starting of plant without assuming load.
- 2. Provide low coolant level shutdown, which shall activate high engine temperature lamp and shutdown.
 - 3. Solid-state cranking cycle device preset at 15 second cranking cycle and 15 second rest cycle followed by a 15 second cranking cycle. If engine fails to start after 3 crank cycles and 2 rest cycles, an overcranking alarm shall sound and cranking cycle shall stop. Provide adjustments in accordance with manufacturers recommendations, but cumulative crank-rest timing shall not be less than 75 seconds.
 - 4. In the event of engine failure, the panel shall close alarm circuit, indicate the fault on the appropriate lamp and shut down the engine. The panel shall include a manual reset switch so that the panel can be reset immediately after a fault condition. Reset devices that require a waiting period are not acceptable.
- I. Options and accessories shall include the following:
- 1. Housing: The complete engine generator set shall be enclosed in a free-standing weather protective, aluminum (0.063-inch) panel construction housing with lockable, removable hinged door panels, hinged instrument panel door and panel light. Housing shall be wind rated to a minimum 150 mph.
 - a. All parts shall be adequately protected against oxidation and corrosion and finish painted with durable machinery enamel, minimum of 3 mils applied in a maximum of 1-1/2 mils per application.
 - b. Include within the enclosure a switched 12 or 24-Volt LED luminaire on each side of the engine and a GFCI receptacle.
 - c. The enclosure must maintain the engine and generator at 40°F or be equipped with space heaters to maintain starting batteries between 50°F and 90°F.
 - 2. 12V or 24-volt battery starting with maintenance free lead acid batteries with dual rate solid state automatic battery charger, with equalize timer, low and high battery voltage indicators and alarm terminals, charger malfunction indicator and alarm. Batteries shall be capable of providing two 45 second continuous cranking cycles. Provide battery racks, and charger shall be protected from any other

- charging source.
- 3. Muffler, critical silencing, with condensation drain; stainless steel flexible exhaust connector. Silencer shall mount horizontally on structural support inside of housing with 90° elbow termination with rain cap.
- 4. Premium exhaust rain cap, cast aluminum, stainless steel hardware, brass bushing hinge.
- 5. Gas line accessories as required for the set to include but not limited to gas line strainer, 12" braided metallic flexible fuel line, battery power operated gas line shut-off solenoid valve, pressure reducing regulator fuel pressure gauge.
 - a. Contractor shall provide natural gas fuel piping for the emergency generator set. Contractor shall install natural gas line fittings obtained from electrical contractor (as supplied with the engine generator). Plumbing line work for natural gas for the engine generator shall be with as few elbows and bends as possible (as near a straight line run from the gas supply tee-off as possible).
- 6. Coolant heater, 120VAC, 1 phase, 1000-2500 watts.
- 7. Unit mounted emergency shut-off mushroom type pushbutton switch.
- J. Testing: The unit shall be given a complete shop test before shipment. It shall be installed on the job under supervision of the manufacturer's representative and shall receive start-up / commissioning service from that representative.
 - 1. The unit shall be started cold and run for a one-hour test with building load connected. Provide additional load bank as required to achieve 100 percent loading.
 - 2. Retransfer the load after test.
 - 3. After this test, the set shall cool for five minutes, then must start and carry full building load for four hours.
 - 4. Demonstrate the cranking cycle and all engine safety devices. The Owner's authorized representative shall be instructed in the operation and maintenance of the unit.
- K. Instruction Data and Drawings: Commercial type operating instructions shall be provided consisting of operating and maintenance manuals, parts books, dimensional drawings and wiring diagrams. Three copies of dimensional drawings and wiring diagrams shall be provided as specified.
 - 1. Operating Instructions: Provide and install in a suitable enclosure operating instructions for the engine generator set.
 - 2. Contractor shall fill the radiator with a combination of water and ethylene-glycol to protect the radiator to -20°F after completion of the test.

2.2 AUTOMATIC TRANSFER SWITCHES

- A. Rating and Construction:
 - 1. Refer to the project drawings for specifications on the sizes and types of transfer switch equipment, withstand and closing ratings, voltage and ampere ratings, enclosures and accessories. All transfer switches shall have switched neutrals and shall be electrically operated and mechanically held.
 - 2. Automatic transfer switches shall be included in a factory assembly with bypass-isolation switch equipment for the emergency life safety branch, two-source type for bypassing to normal or emergency. Bypass isolation not required for equipment branch.
 - 3. All transfer switches and accessories shall be UL listed and labeled, tested per UL Standard 1008, and CSA Approved, and comply with NEMA ICS 2-447. When protected by molded case breaker withstand and closing ratings shall not be less than the following RMS symmetrical amps at 600 VAC:

Switch Size in Amps	WCR @ 480 Volts
Up to 260	30,000
300 to 1000	65,000
1200	85,000
1600 and larger	100,000

4. Provide one of the following standard products:
 - a. Onan OTPC Series as required
 - b. Standby Generator System Manufacturer, provided as a complete system
 - c. ASCO 300 Series
 - d. Russelectric RMT/RMTD Series
 - e. Zenith ZTSD Series
 5. Electrical operation shall be accomplished by a momentarily energized single solenoid operating mechanism which receives power from the source to which the load is being transferred. Fuse or thermal protection of the main operator is prohibited. The operating transfer time shall be 1/6 of a second or less. Mechanical locking in each position shall be accomplished without the aid of permanent magnets, latching solenoid, or motor operators.
 6. Operation shall be inherently double-throw whereby all contacts move simultaneously and with no programmed delay in a neutral position. Electrical spacing shall be equal to or exceed those listed in table 15.1 of UL 1008. Only those main contact structures specifically manufactured for transfer switch service shall be acceptable. An overload or short circuit shall not cause the switch to go to a neutral position.
 7. Inspection of all contacts (movable and stationary) shall be possible from the front of the switch without disassembly of operating linkages and without disconnection of power conductors. A manual operating handle shall be provided for maintenance purposes. The maintenance handle shall permit the operator to stop the contacts at any point throughout the entire travel to properly inspect and service the contacts when required.
 8. All switches for systems with switched neutrals shall have fully rated neutral transfer contacts that momentarily interconnect the neutrals of the sources and load for 100 milliseconds maximum, during the transfer/retransfer operation. The neutrals shall remain so interconnected until the line contacts close on the alternate source. Line and neutral contacts shall be driven by a single main operator.
- B. Controls and Accessories:
1. Controls shall provide for the automatic starting sequence of the generator set.
 2. Automatic controls shall signal the engine-generator set to start upon signal from normal source sensors. Solid state time delay start, adjustable from 0 to 5 seconds (factory set at 2 seconds) shall avoid nuisance start-ups. Battery voltage starting contacts shall be gold, dry type contacts factory wired to a field wiring terminal block.
 3. The switch shall transfer when the emergency source reaches the set point voltage and frequency. Provide a solid-state time delay on transfer, adjustable from 0 to 120 seconds.
 4. The switch shall retransfer the load to the normal source after a time delay retransfer, adjustable from 0 to 30 minutes. Retransfer time delay shall be immediately bypassed if the emergency power source fails.
 5. Control shall be solid state and designed for a high level of immunity to power line surges and transients, demonstrated by test to IEEE Standard 587-1980. The control shall have optically isolated logic inputs, high isolation transformers for AC inputs, and relays on all outputs. Control shall be quick disconnect for ease of service.

6. Automatic transfer switches shall have inherent phase balance protection logic to detect a 'single phasing' Solid state undervoltage sensors shall simultaneously monitor all phases of both sources. Pick-up and dropout settings shall be adjustable. Voltage sensors shall allow for adjustment to sense partial loss of voltage on any phase. Voltage sensors shall have field calibration of actual supply voltage to nominal system voltage. The transfer switch controller shall be equipped with a fault output terminal interconnected to a 24Vdc shunt trip, integral to the transfer switch and with built-in time delay, that functions to disconnect the utility source from the load should the standby emergency source fail to start.
7. For transfer switches serving non-disconnected motor loads, equip with a field adjustable time delay during switching in both directions, during which time the load is isolated from both power sources, to allow load residual voltage to decay before closure to the opposite source. The delay feature shall have an adjustable range covering 0 to 7.5 seconds. Transfer switches serving life safety equipment shall have this time delay set at 0 at startup/commissioning.
8. Controls shall signal the engine-generator set to stop after a time delay, adjustable from 0 to 10 minutes, beginning on return to the normal source.
9. Power for transfer operation shall be from the source to which the load is being transferred.
10. The control shall include latching diagnostic indicators to pinpoint the last successful step in the sequence of control functions, and to indicate the present status of the control functions in real time.
11. The control shall include provisions for remote transfer inhibit and area protection.
12. Provide front panel devices mounted on cabinet front consisting of:
 - a. A key operated selector switch to provide the following positions and functions:
 - 1) Test - Simulates normal power loss to control for testing of generator set. Refer to Part 3 for programming requirements.
 - 2) Normal - Normal operating position.
 - 3) Retransfer - Momentary position to override retransfer time delay and cause immediate return to normal source, if available.
13. Exerciser Clock: Provide solid state exerciser clock to set the day, time, and duration of generator set exercise/test period. Provide a with/without load selector switch for the exercise period. Refer to Part 3 for programming requirements.
14. Provide Phase Sequence Monitor/Balance Module to protect against inadvertent phase rotation hookup and monitor for voltage phase imbalance between phases.
15. Each transfer switch shall be provided with a control panel to allow the operator to view the status and control operation of the transfer switch. The control panel shall be a sealed membrane panel rated NEMA 3R/IP53 or better (regardless of enclosure rating) that is permanently labeled for switch and control functions. The control panel shall communicate with the engine generator, including display of all engine and alternator data, and other transfer switch data in the power system. The control panel shall allow starting and stopping of the generator set via the transfer switch control panel in both test and emergency modes.
16. Where elevator loads or load disconnect of motor controls are shown on the plans, provide in switches serving elevators or motors the following:
 - a. Signal module to delay the transfer and retransfer of the switch for up to 50 seconds to provide a pre-transfer warning or load disconnect signal contact. Provide signals for the following conditions:
 - source 1 available

- source 2 available
- test/exercise
- backup source available

Contacts for these functions are to be Form C type, rated for 120 VAC or 30 VDC at 4 amps.

17. Provide a load shed relay, to move the transfer switch from the emergency position to a neutral position, on receipt of a signal from a remote device.

2.3 REMOTE ANNUNCIATION PANEL

- A. Location as directed by NCISD, typically at the main custodial office, verify with Architect. Provide flush mounted with stainless steel plate containing the following:
 1. Trouble sonnet horn with silence switch.
 2. Illuminated annunciators with nameplates in accordance with the following table:

Lamp Legend	Generator Set Condition Indicated	Light	Audible Alarm
High Battery Voltage	Battery charger too high	Red	No
Low Battery Voltage	Battery voltage too low	Red	No
Normal Battery Voltage	Battery voltage ok	Green	No
Generator Running	Generator has output voltage	Green	No
Normal Utility Power	Utility power supplying the load	Green	No
EPS Supplying Load	Genset supplying the load	Green	No
Pre-Low Oil Pressure	Oil pressure approaching low limit	Yellow	Yes
Low Oil Pressure	Engine has shut down due to low oil pressure	Red	Yes
Pre-High Coolant Temp.	Temperature of coolant approaching high limit	Yellow	Yes
High Coolant Temp.	Genset has shut down due to high coolant temp.	Red	Yes
Low Engine Temp.	Engine heater has malfunctioned	Red	Yes
Overspeed	Engine has shut down due to overspeed	Red	Yes
Overcrank	Engine failed to start	Red	Yes
Not In Auto	Engine control switch not in AUTO position	Flashing Red	Yes
Battery Charger Malfunction	Charger is signaling a failure	Red	Yes
Low Fuel	Fuel level below preset minimum	Red	Yes
Fault	Customer preselected condition	Red	Yes

- B. Name plates shall be laminated black with white letters engraved. Letter size shall be a minimum of 3/8" high.
- C. Illuminated annunciators shall be 1 inch minimum.

2.4 ELECTRICAL AND MECHANICAL PERFORMANCE

- A. The switch must comply with UL 1008 and NEMA Standard Publication ICS 2-447. In addition, the switch must meet or exceed the following requirements and if so requested, be verified by certified laboratory test report.
 1. Temperature Rise: Measurements shall be made after the overload and the endurance tests.
 2. Withstand: UL listed to withstand the magnitude of fault current available at the switch terminals when coordinated with respective protective devices at an X/R

ratio of 6.6 or less. The main contacts of the transfer switch shall not trip open or weld when subjected to fault currents.

3. Dielectric: Test, following the withstand current rating test, at 1960 volts AC rms minimum.
4. Transient Withstandability: Control panel voltage surge withstand capability test per IEEE Standard 472-1974 and voltage impulse withstand test per NEMA Standard publication ICS-1-109.

3 EXECUTION

3.1 INSTALLATION

- A. General: Install standby engine driven generator set where shown, in accordance with the equipment manufacturer's written instructions and recognized industry practices, to ensure that the set complies with the specified requirements and serve the intended purposes. Provide and install in a Plexiglas enclosure complete operating instructions for each type of transfer switch.
- B. Standard: Comply with NEMA standards, requirements of the NEC, and applicable portions of NECA Standard of Installation pertaining to installation of standby engine-driven generator sets and accessories.
- C. Vibration Isolation:
 1. Outside Mounted: Ribbed Neoprene Vibration Isolation
 2. Roof Mounted: Install units on properly sized spring-type vibration mounts and ribbed Neoprene vibrations isolators.
 3. Generator installed inside building: Install units on properly sized spring-type vibration mounts and ribbed Neoprene vibration isolators.
- D. Concrete Pad: Install generator set on a reinforced concrete pad. The generator pad shall extend 6" beyond the generator set base, unless shown otherwise. Furnish the exact position of any block outs, mounting bolts, and the dimensions and location of the generator pad in a timely manner so as to prevent delay of the concrete work. Refer to Section 26 05 00 for housekeeping pads and Division 3 for Concrete Work.
- E. Options and Accessories: Provide circuits, conductors, and raceways as required for generator options and accessories as required and specified. Provide separate dedicated circuits from the emergency branch circuit panel board to the generator for (1) engine/coolant heaters, (2) GFCI convenience receptacle(s), (3) battery charger (LED work lights on battery), etc. Provide additional circuits as required, for a fully operational system.
- F. Provide remote alarm annunciator. Coordinate final location of annunciator with Owner / Architect prior to installation. It shall be installed near ATS.
- G. Provide dry contacts and outputs to monitor transfer switch and generator alarm conditions and notify Owner's Police or security personnel, and building management controls system and personnel, both when transfer to emergency occurs and when transfer to normal occurs.
- H. Adjust main output circuit breaker(s) adjustable trip setting based on manufacturer's fault current and coordination analysis or as directed by Engineer.

3.2 GROUNDING

- A. Install the generator as a separately derived system. Ground the generator neutral to the

generator frame. Ground the generator frame to the building grounding system and provide a driven ground electrode at the generator location.

3.3 CONTROLS

- A. Provide generator start-up control wiring and raceway from each automatic transfer switch to the respective standby generator set as required.

3.4 TESTING

- A. Notify Owner's Commissioning Authority (CxA) prior to performing any tests so the CxA may witness tests at his/her discretion. Refer to Section 26 01 00 Commissioning of Electrical Systems. Testing shall be witnessed by owner and Engineer.
- B. Provide testing in accordance with NFPA 110. Upon completion of installation of engine-driven generator set and after building circuitry has been energized with normal power source. Provide manufacturer's start-up service to test emergency power system to demonstrate standby capability and compliance with specified requirements, including automatic start-up, controls and full load acceptance. Test shall include operation of standby power system with voltage check while the system is loaded to ensure proper operation of the emergency generator, transfer switches, and other system components. Operation of the system shall simulate standby power conditions, that is, loss of main electrical power to the building. Test period shall be trouble-free operation with at least four automatic transfer switch operations (each switch) within the period of operation.
 - 1. The unit shall be started and run for 30-minute break-in period at no-load unless recommended otherwise by manufacturer.
 - 2. The unit shall be started cold and run for a four-hour test with building load connected and load bank to achieve 90 percent of rated generator capacity. Monitor and record available natural gas pressure and verify supply is adequate and stable during the entire test.
 - 3. Retransfer the load after test.
 - 4. After this test, the set shall cool for five minutes, then must start and carry 90% rated capacity load for four hours.
 - 5. Provide additional Owner witnessed testing for all ancillary equipment on generator. Demonstrate all specified functions and alarms.
 - 6. Demonstrate the cranking cycle and all engine safety devices. The Owner's authorized representative shall be instructed in the operation and maintenance of the unit. Provide minimum 4-hours training at each campus for 4-persons; one hour on four separate days
- C. Contractor shall furnish all instruments, load banks, and personnel required for test. Submit 4 copies of certified test results to Architect/Engineer for review. Test reports shall include date and time of test, relative humidity, temperature and weather conditions.

3.5 MISCELLANEOUS

- A. Provide circuits and receptacles to serve loads as directed by Owner / Architect, including, but not limited to:
 - 1. Telecommunications equipment
 - 2. Public Address Communication & Master Clock System
 - 3. Fire Detection Alarm and Signaling Systems including remote transponder panels and alarm power supply panels
 - 4. Security Systems including remote power supplies (except for battery powered access control door hardware)

5. Video Surveillance CCTV System including remote camera power supplies
 6. All receptacles and outlets in MDF/IDF rooms.
 7. Technology MDF/IDF room dedicated HVAC equipment
 8. Walk-in coolers/freezers and selected reach-in refrigeration equipment
 9. Clinic refrigerator and selected clinic receptacles
 10. Building Access control System including remote power supplies, except do not power door electric strike or hinge hardware on emergency power.
 11. Owner's Radio Base Station and handset charging equipment / Radio Repeaters / Distributive Antennae Systems (DAS)
 12. Elevators, ADA chair/personnel lifts
 13. Point of Sale Stations
 14. Kitchen Manager's Workstation
 15. Building Management and Control System (BMCS)
 16. Special education receptacles, minimum one in each room.
 17. First responder Bi-Directional Distributive Antennae System (DAS) Systems
- B. Mount annunciator alarm as directed by Owner / Architect. Coordinate final location of ATS with Owner / Architect prior to installation. Install next to ATS.

3.6 PROGRAMMING

- A. Program automatic transfer switches for delayed transfer to emergency and sequential operation to transfer loads by priority based on manufacturer recommendation or as indicated below:
1. Life Safety Loads – less than 10 seconds
 2. Critical Loads – more than 15 seconds, less than 30 seconds
 3. Equipment Loads – more than 40 seconds, less than 60 seconds
 4. Non-Legally required loads – more than 75 seconds, less than 120 seconds
- B. Program automatic transfer switch voltage and frequency pick-up and drop out for load shedding based on load priority for voltage and frequency based on manufacturer recommendations or as indicated below:
1. Life Safety pick-up 10%; drop out 20%
 2. Critical Loads pick-up 10%; drop out 15%
 3. Equipment Loads pick-up 8%; drop out 15%
 4. Non-Legally required loads pick-up 5%; drop out 10%
- C. Exerciser clock: Program automatic transfer switch exerciser clock for generator to run every Tuesday, 8:00 AM, for 15-minute run time, without load. Verify with Owner.
- D. Test switch: Program automatic transfer test switch for generator to run with load, for minimum 30-minutes to comply with NFPA 110 requirements for monthly testing. Maximum test time shall not exceed 35-minutes unless directed otherwise by Owner.
- E. Program engine cooldown time as recommended by the manufacturer.

3.7 TRAINING

- A. Provide 4 hours training, one hour each for four persons, four separate days.

END OF SECTION 26 32 13

SECTION 26 32 15

NON-AUTOMATIC TRANSFER SWITCHES

1 GENERAL

1.1 RELATED DOCUMENTS

- A. The Conditions of the Contract and applicable requirements of Division 1 and Section 26 05 00 govern this Section.

1.2 WORK INCLUDED

- A. Furnish and install non-automatic (manual) transfer switches, complete with wiring and controls as shown on the drawings and as specified herein.

1.3 QUALITY ASSURANCE

- A. Acceptable Manufacturers:
 - 1. ASCO 4000 Series Non-Automatic Transfer Switching
 - 2. Onan/Cummins/Southern Plains Power
 - 3. Generac
 - 4. Katolight
- B. NEC and NFPA Compliance: Comply with applicable portions of the NEC (NFPA 70) including, but not limited to, emergency and standby power generation systems (NFPA 99 & 110).
- C. IEEE Compliance: Comply with applicable Institute of Electrical and Electronics Engineers, Inc. (IEEE) standards pertaining to automatic transfer switches.
- D. Supplier: Authorized distributor of specified manufacturer with minimum three years documented experience.

1.4 SUBMITTALS

- A. Submit manufacturer's certified computer generated performance and capacity data in accordance with specification requirements.
- B. Submit manufacturer's "Installation, Start-Up and Service" instructions.
 - 1. Recommended conductors, overcurrent protection and disconnect size.
 - 2. Electrical interlocks.
- C. Submit recommended clearance dimensions.
- D. Submit internal wiring diagram of Control Center.
- E. Submit sequence of operation in narrative form.
- F. Instruction Data and Drawings: Commercial type operating instructions shall be provided consisting of operating and maintenance manuals, parts books, dimensional drawings and wiring diagrams. Three copies of dimensional drawings and wiring diagrams shall be provided as specified.
 - 1. Operating Instructions: Provide and install in a suitable enclosure operating

instructions for the manual transfer switch.

2 PRODUCTS

2.1 NON-AUTOMATIC TRANSFER SWITCHES

A. Rating and Construction:

1. Refer to the project drawings for specifications on the sizes and types of transfer switch equipment, withstand and closing ratings, voltage and ampere ratings, and accessories. All transfer switches shall have switched neutrals and shall be electrically operated and mechanically held.
2. All transfer switches and accessories shall be UL listed and labeled, tested per UL Standard 1008, and CSA Approved, and comply with NEMA ICS 2-447. When protected by molded case breaker withstand and closing ratings shall not be less than the following RMS symmetrical amps at 600 VAC:

Switch Size in Amps	WCR @ 480 Volts
Up to 260	30,000
300 to 400	65,000
600 to 800	65,000
1000 to 1200	100,000
1600 and larger	100,000

3. Provide one of the following standard products:
 - a. Onan OT-III Series
4. Electrical operation shall be accomplished by a momentarily energized single solenoid operating mechanism, which receives power from the source to which the load is being transferred. Fuse or thermal protection of the main operator is prohibited. The operating transfer time shall be 1/6 of a second or less. Mechanical locking in each position shall be accomplished without the aid of permanent magnets, latching solenoid, or motor operators.
5. Operation shall be inherently double-throw whereby all contacts move simultaneously and with no programmed delay in a neutral position. Electrical spacing shall be equal to or exceed those listed in table 15.1 of UL 1008. Only those main contact structures specifically manufactured for transfer switch service shall be acceptable. An overload or short circuit shall not cause the switch to go to a neutral position.
6. Inspection of all contacts (movable and stationary) shall be possible from the front of the switch without disassembly of operating linkages and without disconnection of power conductors. A manual operating handle shall be provided for maintenance purposes. The maintenance handle shall permit the operator to stop the contacts at any point throughout the entire travel to properly inspect and service the contacts when required.
7. All switches shall have fully rated neutral transfer contacts that momentarily interconnect the neutrals of the sources and load for 100 milliseconds maximum, during the transfer / retransfer operation. The neutrals shall remain so interconnected until the line contacts close on the alternate source. Line and neutral contacts shall be driven by a single main operator.
8. Enclosure shall be NEMA Type 12, indoor use, dust tight and drip-tight; NEMA 4X stainless steel for outdoor locations

B. Controls and Accessories:

1. Control shall be solid state and designed for a high level of immunity to power line surges and transients, demonstrated by test to IEEE Standard 587-1980. The control shall have optically isolated logic inputs, high isolation transformers for AC inputs, and relays on all outputs. Control shall be quick disconnect for ease of

- service.
2. Solid state undervoltage sensors shall simultaneously monitor all phases of both sources. Pick-up and dropout settings shall be adjustable. Voltage sensors shall allow for adjustment to sense partial loss of voltage on any phase. Voltage sensors shall have field calibration of actual supply voltage to nominal system voltage.
 3. Power for transfer operation shall be from the source to which the load is being transferred.
 4. The control shall include provisions for remote transfer inhibit and area protection.
 5. Provide front panel devices mounted on cabinet front consisting of:
 - a. A key operated selector switch to provide the following positions and functions:
 - 1) Test - Simulates normal power loss to control for testing of generator set. Controls shall provide for a test with or without load transfer.
 - 2) Normal - Normal operating position.
 - 3) Retransfer - Momentary position to override retransfer time delay and cause immediate return to normal source, if available.
 6. Exerciser Clock: Provide solid state exerciser clock to set the day, time, and duration of generator set exercise/test period. Provide a with/without load selector switch for the exercise period.
 7. Provide Phase Sequence Monitor/Balance Module to protect against inadvertent phase rotation hookup and monitor for voltage phase imbalance between phases.
 8. Submittals:
 - a. Submittal drawings and information on the transfer switches including installation drawings, wiring diagrams, dimensions, weights, etc. shall be provided. Full descriptive information on accessory items shall be furnished. All submittals shall be reviewed by the Engineer and approved prior to fabrication.
 9. Instruction Data and Drawings:
 - a. Commercial type operating instructions shall be provided consisting of operating and maintenance manuals, parts books, dimensional drawings and wiring diagrams. Three copies of each are to be furnished.
 - b. Operating Instructions: Provide and install in a plexiglass enclosure complete operating instructions for each type of transfer switch.

2.3 ELECTRICAL AND MECHANICAL PERFORMANCE

- A. The switch must comply with UL 1008 and NEMA Standard Publication ICS 2-447. In addition, the switch must meet or exceed the following requirements and if so requested, be verified by certified laboratory test report.
 1. Temperature Rise: Measurements shall be made after the overload and the endurance tests.
 2. Withstand: UL listed to withstand the magnitude of fault current available at the switch terminals when coordinated with respective protective devices at an X/R ratio of 6.6 or less. The main contacts of the transfer switch shall not trip open or weld when subjected to fault currents.
 3. Dielectric: Test, following the withstand current rating test, at 1960 volts AC rms minimum.
 4. Transient Withstandability: Control panel voltage surge withstand capability test per IEEE Standard 472-1974 and voltage impulse withstand test per NEMA Standard publication ICS-1-109.

3 EXECUTION**3.1 INSTALLATION**

- A. General: Install non-automatic transfer switch where shown, in accordance with the equipment manufacturer's written instructions and recognized industry practices, to ensure that the automatic transfer switch complies with the specified requirements and serve the intended purposes.
- B. Standard: Comply with NEMA standards, requirements of the NEC, and applicable portions of NECA Standard of Installation pertaining to installation of standby engine-driven generator sets and accessories.
- C. Options and Accessories: Provide circuits, conductors, and raceways as required for options and accessories as specified.

3.2 GROUNDING

- A. Install the non-automatic transfer switch as a non-separately derived system. Do not ground the generator neutral to the generator frame. Ground the generator frame to the building grounding system.

3.3 TESTING

- A. Upon completion of installation of automatic transfer switch and after building circuitry has been energized with normal power source, test emergency power system to demonstrate standby capability and compliance with specified requirements, including manual start-up, controls and full load acceptance. Test shall include operation of standby power system with voltage check while the system is loaded to ensure proper operation of the emergency generator, transfer switches, and other system components. Operation of the system shall simulate standby power conditions, that is, loss of main electrical power to the building. Test period shall be a minimum of 4 hours continuous trouble-free operation with at least four manual transfer switch operations (each switch) within the period of operation. Provide written report to Owner / Architect regarding testing of the automatic transfer switch. Portable generator for test and electrical connections shall be provided by the Owner.
- B. Provide separate written inspection report by manufacturer's factory representative regarding existing condition and/or deficiencies regarding the existing diesel generator operation.
- C. Contractor shall furnish all instruments and personnel required for test. Submit 4 copies of certified test results to Architect/Engineer for review. Test reports shall include date and time of test, relative humidity, temperature and weather conditions.

3.4 NON-AUTOMATIC TRANSFER SWITCH WARRANTY

- A. Provide two-year parts and labor warranty from date of substantial completion. Provide an additional three year parts warranty after the second year.

END OF SECTION 26 32 15

SECTION 26 43 00

SURGE PROTECTION DEVICES

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.

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. SST Southern Tier Technologies T45-VVVV-50-AWAJ2-C-RKSS (stainless steel front).
 - d. PSP H#C200-04NT1-H4-FMCSS series (stainless steel front).
 - e. SSI Surge Suppression, Inc. CSMx12-FMPxSS series.
 - 2. Branch panelboard surface mounted:
 - a. ACT Communications 455 series.
 - b. ABB Current Technology CG3 60 series.
 - c. SST Southern Tier Technologies T45-VVVV-50AWAJ2-C
 - d. PSP H#C200-04NT1 series
 - d. SSI Surge Suppression, Inc. CSMx12 series.
- 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. SST Southern Tier Technologies T45-VVVV-120A series
 - 4. PSP H#C200-04NT1 series
 - 5. SSI Surge Suppression, Inc. CSMx24 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. SST Southern Tier Technologies T45-VVVV-200A series
 - 4. PSP H#C200-04NT1 series
 - 5. SSI Surge Suppression, Inc. CHLxM series.
- D. Very high exposure at service entrance 1,201 Amps and above: Minimum 20-year parts warranty; minimum 300k Amps per mode; 600k Amps per phase, Type 1 and 2 SPD:
 - 1. ACT Communications 471 x300 SEL series.

2. ABB Current Technology SEL3 300 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	UL 1449 VPR Rating
120/240	L-N	150	700/1200
120/208	L-G	150	700/1200
	N-G	0	900/1200
	L-L	300	1000/1200
277/480	L-N	320	1000/1200
	L-G	320	1200/1200
	N-G	0	1200/1500
	L-L	550	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 easily visible in high ambient light conditions, Form C dry contacts, counter and audible alarm.
 2. Field testable while installed.
 3. High performance interconnecting cable for hard wired non-pigtail units.
 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 for hard wiring and shall have mechanical lugs that can accept up to #2 AWG wire on High and Very 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 for hard wired SPDs shall be #6 AWG minimum for Very High, High, and Medium Exposure SPDs and #10 AWG minimum for Low Exposure SPDs. Low exposure pig tail units shall utilize the factory provided cables, cut to shortest and straightest run, without splices, wiring through conduit nipple only.

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 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. (SPDSEL) Provide very-high exposure SPDs with Selenium and TPMOV technology for the following new electrical or where indicated:
 - 1. Service entrances with very high transient exposure and/or subject to utility temporary over voltages and/or projects deemed Mission Critical.
- B. (SPDH) Provide high exposure SPDs for the following new electrical equipment or where indicated:
 - 1. Service entrance rated above 800 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 26 43 00

SECTION 26 51 13

LIGHTING FIXTURES

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 luminaires 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.

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:
 - US LED
 - Extra Light
 - Acuity
 - Signify
 - Cooper Lighting Solutions
 - Pinnacle
 - HE Williams
 - Current
 - LSI
 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, cafeteriums 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 ($\pm 10\%$) 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 μ s, 10kA/8 x 20 μ s) 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): $\leq 20\%$.
 - 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

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, cafeteriums 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. 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.
- Y. 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.
- Z. 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.
- AA. Lighting Fixture Supports for aluminum canopies, Owner approved mock-up required:
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 26 51 13

SECTION 26 56 00

SITE LIGHTING

1 GENERAL

1.1 SCOPE OF WORK

- A. The extent of site lighting required is indicated on the drawings and schedules and by the requirements of this Section and Section 26 05 00 General Electrical Provisions.
- B. Poles and Standards specified in this Section are for outdoor use for the support of luminaires and include the following: Aluminum and/or steel

1.2 QUALITY ASSURANCE

- A. Codes and Standards: Provide luminaires, poles standards and appurtenances conforming to the following:
 - 1. Conform to applicable sections of American Association of State Highway and Transportation Officials (AASHTO): LTS-1 Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals.
 - 2. American National Standards Institute (ANSI):
 - a. C2 National Electrical Safety Code.
 - 3. Conform to applicable sections of American Society for Testing and Materials (ASTM) B 429, Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.
 - 4. National Electrical Manufacturers Association (NEMA):
 - a. FA 1 Outdoor Floodlighting Equipment.
 - b. OD 3 Physical and Electrical Interchangeability of Photo Control Devices and Mating Receptacles.
 - 5. Conform to applicable sections of National Fire Protection Association (NFPA) 70, National Electrical Code.
 - 6. Underwriters Laboratories, Inc. (UL):
 - 7. Design Lights Consortium (DLC)

1.3 SUBMITTALS

- A. Refer to Section 26 05 00 General Electrical Provisions. Submittal must include photometric reports, otherwise they will be rejected as incomplete.
- B. Contractor shall not rough-in, build concrete foundations, etc. for site lighting until all site lighting submittals have been approved. Contractor shall submit site lighting photometrics with product data. The review of site lighting submittals may include the relocation, addition or deletion of lighting fixtures, poles and standards due to the photometric performance of substituted manufacturers. Any changes required due to the contractor's substitution shall be at no cost to the Owner.
- C. Submittal sheets shall be sequentially numbered with the format: Sheet number of number total. Example 1 of 3
- D. Submit manufacturer's product data including the following:
 - 1. Line-by-line compliance of the specification indicating compliance or description of deviation.
 - 2. Submit a computer generated point-by-point calculations for all outside lighting.

3. Dimensioned and detailed drawings in booklet form with separate sheet or sheets for each fixture, assembled in luminaire "type" alphabetical order and showing: materials of construction; arrangement of components and wiring; gasketing for weather tightness; means of mounting luminaire and adjusting aspect; finishes; photometric data with lamp or lamps specified; electrical data including volts, amperes and watts; and for roadway type luminaires, distribution data according to Illuminating Engineering Society (IES) roadway classification type.
4. LED Driver and light engine, initial and mean lumen output, and color rendering index. LED drivers and related electrical characteristics and operating conditions.
5. Poles and standards dimensions, details of hand holes and wire entries, mast or bracket arms and connection to poles, wind load and deflection, and finishes.

2 PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers acceptable contingent upon Product's compliance with the specifications: refer to Lighting Fixture Schedules on the drawings for acceptable manufacturers of light fixtures. Acceptable Pole Manufacturers: Valmont, KW, WJM.
- B. Where lighting regulations exist by the Authority Having Jurisdiction, the Contractor shall be responsible for submission of all documentation and approval from the Authority Having Jurisdiction of the exterior lighting were alternate manufacturers are proposed other than specified. Where approval from an Authority Having Jurisdiction is required, Contractor shall submit, with those product data, confirmation of approval from the Authority Having Jurisdiction.

2.2 LUMINAIRES

- A. Refer to Section 26 51 13 Lighting Fixtures and Lamps, for ballast, drivers, and lamp requirements.
- B. Provide luminaires of the sizes, type and ratings indicated, complete with housings, lenses, refractors, lamps, lamp holders, reflectors, ballasts, starters, igniters, mounting brackets or hardware with adjusting means and wiring.
- C. Provide luminaires with rigidly formed, weather and light tight enclosures that will not warp, sag, or deform in use. Provide housings free from burrs, sharp edges or corners.
- D. Provide captive hardware hinged doors, operating freely, to allow lamp installation and removal without the use of tools. Equip door mechanism to preclude accidental falling of the door when opening or closing or when secured in the closed position. Provide for door removal for cleaning or replacing lens.
- E. Provide stainless steel hinges, latches, fasteners, and hardware to prevent corrosion of hardware or the staining of adjacent surfaces.
- F. Use interior formed and supported light reflecting surfaces having reflectances of not less than 85 percent for white surfaces, 85 percent for specular surfaces, and 75 percent for specular diffuse surfaces.
- G. Use borosilicate tempered glass, lenses and refractors. Use heat and aging resistant resilient gaskets to seal and cushion lens and refractor mounting in luminaire doors.

- H. Provide finishes of the color and type indicated and having the following properties:
 - 1. Protection of metal from corrosion - 5 year warranty against perforation or erosion of the finish from weathering.
 - 2. Color retention – 5-year warranty against fading, staining, or chalking from weathering, including solar radiation.
 - 3. Provide finish of uniform thickness and color, free from streaks, stains or orange peel texture.
- I. LED sources shall meet the following requirements:
 - 1. Operating temperature rating shall be between -40 degrees F and 120 degrees F.
 - 2. Color Rendering Index (CRI): ≥ 65 .
 - 3. 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).
- J. LED drivers shall meet the following requirements:
 - 1. Drivers shall have a minimum efficiency of 85%.
 - 2. Starting Temperature: -40° F.
 - 3. Input Voltage: 120 to 480 ($\pm 10\%$) 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 μ s, 10kA/8 x 20 μ s) 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): $\leq 20\%$.
 - 8. Comply with FCC Title 47 CFR Part 18 Non-consumer RFI/EMI Standards.
 - 9. Drivers shall be reduction of hazardous substances (ROHS)-compliant.

2.3 POLES AND STANDARDS

- A. Provide poles of the types and heights indicated. Provide internal raceway for underground power supply, with luminaire support pole base indicated. Provide poles that will carry the indicated supports, luminaires and appurtenances, at the required heights above grade, without excessive deflection or whipping of the luminaire when subjected to 120 mph basic wind speed with 1.3 gust factor. Pole structural integrity shall rely solely on the anchor bolts, nuts and washers. Pole shall not be in direct contact with concrete base or mortar.
- B. Provide metal lighting poles with steel or aluminum shaft; equipped for post top or mast arm luminaire mounting. Provide wiring access hand hole with welded 1/2" NC ground lug, readily accessible from hand hole opening. Provide features as follows:
 - 1. Provide a one-piece pole shaft fabricated from a weldable grade carbon structural steel tubing with a uniform thickness as required. Material shall conform to ASTM A-500, Grade C.
 - 2. Provide anchor base of the same material and finish as the pole, welded to the pole. Provide adequately sized (at least 15 square inches) hand hole with screwed cover. Provide galvanized steel hold-down or anchor bolts and leveling nuts. Provide full base cover.
 - 3. Factory prime coat with polyester powder-coat paint. Steel poles shall be hot dipped galvanized, with prime coat, with 8 mil minimum polyester powder-coat paint. Color to match light fixture.

- C. Anchor bolts:
 - 1. Provide zinc coated anchor bolts and nuts. Length shall be per pole manufacturer's shop drawings, complete with 3 inch right angle bend on one end and 6 inches of thread on the other end. Provide zinc coated flat washers, lock washers, and hexagonal nuts for each pole.
 - 2. Provide template for positioning of anchor bolts.
- D. Accessories:
 - 1. Full base covers, finish to match pole
 - 2. Hand hole with cover plate and vandal resistant hardware.

2.4 LUMINAIRE MOUNTING

- A. Provide corrosion resistant metal luminaire mounting compatible with the poles and fixtures that will not cause galvanic action at contact points. Provide mounting that will correctly position the luminaire to provide the required light distribution. Provide drill mounting to pole shaft unless specified otherwise.
- B. Provide brackets, cantilevered and without under brace, of the sizes, styles, and finishes indicated with straight tubular end section to accommodate the luminaire.
- C. Provide steel tenon only for single fixture yoke or spider post top mounting securely fastened to the top of the pole shaft, fabricated to accept and rigidly support the luminaire to be mounted thereon. Set screws shall have pole shaft drilled to prevent rotational movement.

3 EXECUTION

3.1 LIGHTING POLE INSTALLATION

- A. Contractor shall not rough-in conduit, drill or pour concrete foundations for site lighting until review of the site lighting submittals is complete. This is to ensure coordination with the current site plan paving and utilities and photometric performance of the submitted product.
- B. Install lighting poles as follows:
 - 1. Install lighting poles and standards as indicated, in accordance with manufacturer's written instructions, and in compliance with ANSI C2.
 - 2. Provide excavation and poured concrete bases using 3,000 pound 28-day concrete, and provide anchor hook-bolts, nuts and washers in conformance with the details and manufacturer's requirements. Refer to Division 3 for concrete work. Project anchor bolts 2-inches minimum above base. Use double nuts for adjustment.
 - 3. To protect finish, use fabric web slings (not chain or cable) to raise and set finished poles and standards.
 - 4. Install pole clear of contact of concrete base or mortar.
- C. Grounding: Provide equipment bonding and grounding connections, sufficiently tight to assure permanent and effective grounds. Bond all metal, non-current carrying parts to ground. Provide 25-feet #4 solid ground electrode from pole base hand holes encased in concrete pier, to bottom of concrete pier with excess ground electrode coiled at bottom of concrete pier. Secure the ground electrode to the reinforcement steel to prevent movement during concrete pour. Bond all metal parts of the pole shaft ground lug. Provide #6 electrode grounding conductor from pole base ground lug to the ground

conductor, using thermal fusion (exothermic) methods.

- D. Wiring:
1. Provide Type SO cord from base of pole lights to top of poles. Do not use single conductors.
 2. Install inline fuse holders, fuses, at base of pole lights on each lighting circuit. Provide Bussman Insulating boot Catalog # 2A0660 installed over conductor terminations. Fuse size shall be as follows:

WATTAGE	# OF Fixtures	208V	240V	277V	480V
0-400	1	5	5	5	5
0-400	2	8	8	5	5
0-400	3	10	10	8	5
0-400	4	15	10	10	8
401-1000	1	10	8	8	5
401-1000	2	15	15	15	8

3. Provide Styrofoam wedge at midpoint of pole to stabilize conductor.
4. Provide strain/stress relief on SO cord at top of pole.

3.2 LUMINAIRE INSTALLATION

- A. Install exterior luminaires at locations and heights as indicated, in accordance with the manufacturer's written instructions, applicable requirements of NFPA 70, ANSI C2 and with recognized industry practices to ensure that lighting installation fulfills requirements.
- B. Fasten luminaires securely to indicated structural supports and check to ensure that the required degree of freedom is provided to allow alignment or aiming of the fixtures for indicated light distribution.
- C. Clean exterior luminaires of dirt and debris upon completion of installation. Do not damage finishes or lens or refractor surfaces.
- D. Provide equipment grounding connections using branch circuit equipment and connected sufficiently tight to assure a permanent and effective ground.

3.3 TESTS AND DEMONSTRATIONS

- A. 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. Correct malfunctioning units, then retest to demonstrate proper operation; otherwise, remove and replace with new units, and proceed with retesting. Verify correct reflector types and orientation prior to final aiming.
- B. Pre-Inspection Tasks: Immediately before final inspection, clean fixtures inside and out, including reflectors, 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. Pre-aim lighting fixtures as practical prior to final aiming and adjustment.
- 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.

3.4 LAMP REPLACEMENT AND PROVISION OF SPARE LAMPS

- A. At time of substantial completion, replace lamps in luminaires that are observed to be not functioning properly after Contractor's use and testing. Provide spare replacement non-LED lamps amounting to 10 percent (but not less than ten lamps in each case) of each type and size lamp used in each type fixture.

END OF SECTION 26 56 00

SECTION 27 01 00

OPERATION AND MAINTENANCE (O&M) MANUALS OF COMMUNICATIONS SYSTEMS

1 GENERAL

1.1 WORK INCLUDED

- A. Compile product data and related information appropriate for Owner's operation and maintenance of products furnished under Contract. Prepare 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 three (3) electronic copies, on separate devices (USB Flash Drive or some type of pre-approved solid-state storage device), of complete O&M manuals in final form. The submitted manual shall be the system manufacturer's operations manual, supplemented with operations and maintenance instructions custom tailored for the system installed. Electronic documentation shall be provided in a non-proprietary PDF format, without password restrictions.
- D. Hard copies shall be provided upon request of the Owner, Architect, and/or Consultant.
- E. Recorded video of all training sessions shall be included in each copy, of each system's final submitted O&M.
- F. The final submitted manual shall include a sign-in sheet and owner/consultant signed acceptance of all training sessions.

1.2 ELECTRICAL OPERATING AND MAINTENANCE MANUAL SUBMITTAL SCHEDULE

- A. Thirty (30) days after receipt of reviewed submittals bearing the Project Technology Consultant's stamp of acceptance (including re-submittals), submit for review, an electronic copy of the first draft of the System's O&M Manual. This copy shall contain as applicable to the specific system, a minimum of the following:
 - 1. Table of Contents for each element
 - 2. Contractor information
 - 3. All shop drawings, coordination drawings and product data, bearing the Project technology Consultant'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 Speakers, Amplifiers, Sound Equipment, Etc.
 - 12. Schedule of Handsets and other Peripheral Devices, Etc.
 - 13. Schedule of Cable, Jacks, Outlets, Etc.
 - 14. Access Control Door Schedules
 - 15. Video Surveillance Camera Schedules

16. Other required operating and maintenance information that are complete.
 17. Cable pathway layout drawings and station map, including through wall and floor penetration locations and sleeve sizes.
- B. Copy will be returned to the Contractor within 15 days with comments for corrections.
- C. Submit the electronic completed manuals (hard copies upon request) in final form to the Project's Technology Consultant.
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, training videos. along with other materials and information.
- D. The Project's Technology Consultant 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 Project's Technology Consultant. The manuals will not be retransmitted.
- F. Electronic and/or hard copies of the accepted manuals shall be delivered to the Owner prior to substantial completion.

2 PRODUCTS

2.1 BINDERS

- A. Upon the request for hard copies of the O&M manuals, the binders shall consist of the following configuration:
1. Commercial quality black, 3-ring binders with clear, durable, cleanable plastic covers.
 2. Minimum ring size: 1"; Maximum ring size: 3".
 3. When multiple binders are used, correlate the data into related groupings.
 4. Label contents on spine and face of binder with full size insert. Label under plastic cover.

3 EXECUTION

3.1 SYSTEM OPERATION AND MAINTENANCE MANUAL

- A. Form for Manuals Submitted in Hard Copy Format:
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
 - 7. Provide digital copy of all manuals on flash drive.
- 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

**OPERATION AND MAINTENANCE (O&M) MANUALS
OF COMMUNICATIONS SYSTEMS**

SECTION 27 01 00

- 2) Regulation, control, stopping, shut down and emergency instructions
 - 3) 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. Manufacturer's printed operating and maintenance instructions.
 - e. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.
 - f. Complete equipment field accessible wiring diagrams
 - g. Each Contractor's coordination drawings
 - h. 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 27.
 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 27 01 00

SECTION 27 05 00

COMMUNICATIONS GENERAL PROVISIONS

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Except as modified in this Section, General Conditions, Supplementary Conditions, applicable provisions of Division 01 General Requirements, and other provisions and requirements of the Contract Documents apply to work of Division 27 Communications.
- B. Applicable provisions of this section apply to all sections of Division 27, Communications.
- C. The general provisions of the Contract and the requirements of the following Sections apply to the Work specified in this Section. See Division 26 for related general and specific requirements.

1.2 CODES AND STANDARDS

- A. All equipment and work performed shall comply with all of the current and applicable Codes, Rules, Ordinances, Regulations and Standards (including those not specifically listed in this Specification) as interpreted and enforced by the authorities having jurisdiction including:
 - 1. Americans with Disabilities Act (ADA)
 - 2. Authorities Having Jurisdiction (AHJ) - Local
 - 3. American National Standards Institute (ANSI)
 - 4. American Society of Testing and Materials (ASTM) *Communications Cables - B694, B736, D4565, D4566, D4730, D4731, D4732*
 - 5. Building Industry Consulting Services International (BICSI)
 - 6. Code of Federal Regulations - Title 47
 - 7. Electronics Industries Association (EIA) *Standard Test Procedures for Fiber Optic Fibers, Cables, Transducers, Connecting and Terminating Devices - EIA-455 Series*
 - 8. Federal Communications Commission (FCC) - Communications Act and FCC Rules
 - 9. Federal Information Processing Standards (FIPS) *Federal Building Standard for Telecommunications Pathways and Spaces - FIPS PUB 175, FIPS PUB 176*
 - 10. The Insulated Cable Engineers Association (ICEA) *Communications Cable Stands - P-47-434, S-56-434, S-80-576, S84-608, S-85-625, S-86-634, S-87-640, S-89-648, S-90-661, S-98-688, S-99-689, S-100-685*
 - 11. International Electro-Technical Commission (IEC)
 - 12. Institute of Electrical and Electronic Engineers (IEEE) *Local Area Networks/Metropolitan Networks Standards Collection - LAN/MAN 802 Series*
 - 13. International Organization for Standardization (ISO) (ISO/IEC) *Premise Wiring Core and LAN/MAN Core Equivalents-11801, 8802, 14763-1*
 - 14. International Telecommunication Union (ITU-T) *Telecommunications Standardization*
 - 15. National Electrical Code (NEC) *National Electrical Code - NFPA 70*
 - 16. National Electrical Contractors Association (NECA) *Standards of Installation*
 - 17. National Electrical Manufacturers Association (NEMA) *Performance Standard for Twisted Pair Premise Voice and Data Communications Cable-WC 63.1, WC 63.2, WC 66*
 - 18. National Electrical Safety Code (NESC)
 - 19. National Fire Protection Association (NFPA) - *National Fire Alarm Code NFPA 72, Life Safety Code NFPA 101*

20. Society of Cable Telecommunications Engineers (SCTE)
 21. Local Accessibility Standards
 22. Telecommunications Industries Association (TIA) (*ANSI/TIA/EIA Wiring and Cabling Standards - 526, 568, 569, 570, 571, 598, 606, 607, 758, TSB 31-B, 63, 67, 72, 75 and 95*)
 23. Uniform Building Code (UBC)
 24. Underwriters Laboratories, Inc. (U.L.) - *497A, 910, 1077, 1863, 1283, 1459, 1604, 1651, 1681, 1690, 1778, 1977*
- B. 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.
- C. 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.
- D. Obtain all permits required.

1.3 SUMMARY

- A. Provide complete and working Communications Systems including equipment, conduit, wiring, material, labor and training as described in this Specification and the Drawings. The Communications Systems Drawings and Specifications are the sole property of the Architect and are not to be duplicated, scanned, loaned or in any way made available to persons not designated as authorized by the Architect. All Communications Systems plans and specifications are to be returned to the Architect following completion of bid.

1.4 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.

1.5 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 connections to all communications equipment indicated on the drawings, except as noted.
- 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.

1.6 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.

1.7 GUARANTEE

- A. Guarantee work for a minimum of two years or as noted longer elsewhere 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.

1.8 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.

1.9 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.

1.10 ACCEPTABLE MANUFACTURERS

- A. Manufacturers names and catalog number specified under sections of Division 27 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 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 complete design and performance data to the Architect. The Architect and Owner issue approvals of acceptable manufacturers as addenda to the Construction Proposal Documents.

1.11 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.

1.12 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. It is the responsibility of the Contractor to compare the scale of all electrical drawings with the scale of the architectural drawings and adjust 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.

1.13 ABBREVIATIONS AND DEFINITIONS

A/V	Audio/Visual
AWG	American Wire Gauge
BCR	Building Communications Room
CATV	Cable Antenna Television
CCTV	Closed Circuit Television
CMP	Communications Media Plenum
CMR	Communications Media Riser
dB	Decibel
EMI	Electromagnetic Interference
ER	Equipment Room
FACP	Fire Alarm Control Panel
FCR	Floor Communications Room
Hz	Hertz
IC	Intermediate Cross-connect
IDF	Intermediate Distribution Frame
IM	Information Management
IS	Information Systems or Information Services (also see MIS)
IT	Information Technology
Km	Kilometer
LCD	Liquid Crystal Display
LED	Light Emitting Diode
M	Micron
MATV	Master Antenna Television (<i>A.K.A. Main Antenna Television</i>)
Mbps	Million Bits Per Second
MC	Main Cross-connect
MDF	Main Distribution Frame
MHz	Megahertz
MIS	Management Information Systems or Services
NEXT	Near-End Cross Talk
nm	Nano-meter
OFN	Optical Fiber Non-conductive

OFNP	Optical Fiber Non-conductive Plenum
OFNR	Optical Fiber Non-conductive Riser
OTDR	Optical Time Domain Reflectometer
PBX	Private Branch Exchange
POS	Point of Sale
PSELFEXT	Power Sum Equal Level Far-End Cross Talk
PSNEXT	Power Sum Near-End Cross Talk
SMATV	Satellite Main Antenna Television
TC	Telecommunications Closet (<i>Now referred to as TR</i>)
T.O.	Telecommunications Outlet
TR	Telecommunications Room (<i>A.K.A. TC - Telecommunication Closet</i>)
UTP	Unshielded Twisted Pair Wire

Definitions:

Administration Subsystem - Cable, connectors, cross-connect and inter-connect hardware, patch cords, and other equipment that allows easy reconfiguration of the telecommunications system to accommodate personnel and floor plans changes.

Campus Backbone Subsystem - Connects telecommunications processing equipment in different buildings on the same campus.

Communications Cabling - Any fiber optic, copper, coaxial or other transmission media used for transmitting or receiving communications systems data.

Communications Drawings - All floor plans, elevations, details, schematics, block diagrams, legends, tables, notes or attachments associated with any or all of the Communications Systems.

Distribution Cable - The telecommunications UTP wiring between the telecommunications room and the outlet connectors.

Equipment Subsystem - Telecommunications cable, connectors, support hardware, blocks, and protective devices that serve to connect the network interface and the backbone subsystem through the administrative subsystem.

Horizontal Subsystem - Telecommunications cable, outlets and distribution cords that extend the riser backbone from the administrative points in the TRs to work stations.

Information Systems - Software systems including operating systems, programs, data manipulation and management systems, control software and various forms of proprietary and off-the-shelf software.

Information Technology - The practical application of knowledge associated with designing, installing and maintaining the equipment, hardware and infrastructure utilized for control, distribution, or display of telecommunications, audio, video and data signals. Because computers are central to information management, computer departments within companies and universities are often called (IT Departments) and are responsible for MIS or IS personnel and services.

Low Voltage Wire - Wire or cable used for one or more systems that operate on 24 volts or less. Low Voltage Wire is used to install and interconnect one or more of the Communications Systems. Low Voltage Wire includes patch cords, jumpers and all portions of cable or wire used to make the Communications Systems operational or for system communications.

Multiplexer - A communications device that multiplexes (combines) several signals for transmission over a single medium. A multiplexer is sometimes called a "mux". A demultiplexer is required to complete the process by separating multiplexed signals from a transmission line. Frequently a multiplexer and demultiplexer are combined into a single device capable of processing both outgoing and incoming signals.

Riser Backbone Subsystem - Telecommunications cable, splice enclosures, and associated hardware that provide the main cable routes in a building. It interconnects building floors and larger areas of a single floor. It also interconnects administrative points in satellite TRs to the administrative points in the building main equipment room.

Station Cable - The wiring between the outlet connections and the work area equipment.

Communications Systems - One or more of the following and associated equipment: Data/Networking Systems, Telecommunications Systems, Paging / Intercom Systems, Clock/Control Systems, Master Antenna Television Systems, Cable Antenna Television Systems, Broadcast Video Systems, Audio/Visual Presentations Systems, Microwave/Wireless Systems.

Telecommunications - The transmission, emission or reception of signs, signals, images, sound or intelligence of any nature by wire, radio, optical or other technical transmission system.

Work Area - Location of an employee or student and their data/telecommunications equipment or devices.

Work Area Subsystem - Station mounting cords, extension cords, connectors, adapters, and interface units that provide physical and electrical connectivity between workstation equipment and the horizontal subsystem.

1.14 QUALITY ASSURANCE:

- A. Equipment Standards:
 - 1. System and all components shall be brand new stock from manufacturer.
 - 2. All electronics shall be 100% solid state.
 - 3. System and all components shall bear a UL Label.
- B. Contractor Qualifications:
- C. At the time of Proposal, the Contractor shall:
 - 1. Have manufactured, supplied or installed at least three (3) other systems of similar size, complexity, and general operation as the systems described in these

specifications. The Contractor shall furnish in writing to Architect proof of compliance with this paragraph at the time of proposal.

2. Hold all legally required Texas State Contractor's licenses necessary to accomplish the installation and activation of the described system at the facilities indicated. The Contractor shall submit copies of licenses to the Architect prior to the start of work.
3. Hold all legally required state registrations to meet local requirements for submittal drawings.
4. Have a local office within fifty (50) miles of the project site staffed with factory trained technicians who have experience on systems of similar complexity and function as the systems described in these specifications. These technicians shall be fully capable of system engineering support, installation supervising, system start-up, and providing the Owner with training and service on both hardware and software for the systems specified.
5. Certify complete and total compliance with the provisions of these specifications by letter or submittal of the proposal response forms, signed by an officer of the corporation, or a principal if other ownership currently exists. In addition, the letter or forms shall include a complete listing of exceptions, if any.

1.15 SUBMITTALS

- A. Provide SUBMITTALS according to Division 01 and the following.
- B. Requirements:
 1. Submit paragraph-by-paragraph specification review indicating compliance or deviation with explanation.
 2. Submit proof that all system components and cables are U.L. Listed.
 3. An equipment list with names of manufacturers, model numbers, and technical information on all equipment proposed. Clearly mark exact model number proposed to be installed.
 4. Product technical information sheets for each principal components in the proposed system, including cable, wire, terminal marking, and wire marking material.
 5. Certification from the manufacturer stating that the system Contractor is an authorized distributor or installer of the proposed system when such certifications exist.
 6. A statement listing every technical and operational parameter wherein the submitted equipment varies from that which was originally specified. If the submitter fails to list a particular variance and his submittal is accepted, but is subsequently deemed to be unsatisfactory because of the unlisted variance, the submitter shall replace or modify such equipment at once and without cost to the Owner.

1.16 COORDINATION

- A. The Contractor shall confirm the availability of the proper power source for each piece of specified equipment, through site visits and Drawings as necessary. Where proper power does not exist, the Contractor shall provide the required power, circuits, outlets, conduits, and wire as specified under Division 26.

1.17 DATA ACCURACY

- A. Absolute accuracy of information regarding existing conditions cannot be guaranteed. The Drawings and Specifications are for the assistance and guidance of the Contractor and

exact locations, distances, elevations, etc., shall be governed by actual field conditions. Where variations from the contract documents are required, such variations shall be approved by the Architect / Owner.

1.18 SECURITY

- A. The Contractor is responsible for complying with all of the Owner's and facility security's requirements to prevent theft or damage to equipment, tools and materials. If any deviation from facility security requirements is necessary, approval for such deviation shall be coordinated with the Owner.
- B. The Contractor shall not disclose any confidential information of the Owner. The Contractor acknowledges that such action is highly injurious and can do damage to the Owner. The Contractor will agree to and comply with the standard policies and provisions of the Owner regarding outside Contractors and Consultants.

1.19 UTILITIES

- A. It shall be the responsibility of the Contractor to provide all temporary connection and cables, lighting, light stands and power. The facilities shall be used in accordance with all applicable regulations regarding operations, safety and fire hazards of the governmental Authorities Having Jurisdiction, provided they are not used in a wasteful manner.

1.20 PERMITS

- A. All permits required for the specified performance and completion of the work shall be secured by the Contractor. These permits shall be presented and reviewed at the initial project progress meeting.

1.21 NOTIFICATION

- A. The Contractor shall not shut off any existing systems. The Contractor shall give the Owner at least ten (10) calendar days' notice of any requirements to shut off or interference with existing alarm, regulating, computer or other service systems. The Owner will arrange and execute any shutdown. All work such as splicing, connections, etc., necessary to establish or re-establish any system shall be completed by the Contractor in close coordination with the Owner.

1.22 INTERFERENCES WITH THE OWNER

- A. Transportation and storage of materials at the facility, work involving the facility, and all other matters affecting the habitual use by the Owner of its buildings, shall be conducted so as to cause the least possible interference, and at times and in a manner acceptable to the Owner. The Contractor shall make every effort to delivery equipment per the schedule required by the project.

1.23 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 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 underslab cables installed, dimensioning exact location and elevation of such installations.

- B. At conclusion of project, obtain without cost to the Owner, electronic AutoCAD 2014 / 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 digital copies and prints for Owner's use, one set of digital copies, prints, and Mylar for Architect / Engineers Records". Delivery of these as-built electronic, reproducible and prints is a condition of final acceptance.
1. Three sets of electronic AutoCAD (2014 dwg) / Revit CAD drawing files, on CD-ROM media, of each contract as-built drawing. Also, on the CD-ROM all files need to be in 30"x42" PDF format.
 2. One reproducible Dayrex Mylar film positive of each contract as-built drawing.
 3. Three sets of blue or black-line prints of each contract as-built drawing.
 4. Digital copies shall be flash drives or approved SSD devices.
- 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 AS-BUILT DRAWINGS.
 4. Clearly indicate: DOCUMENT PRODUCED BY:
 5. Indicate all changes to construction during construction. Indicate actual routing of all conduit and cables, etc that were deviated from construction drawings.
 6. Indicate exact location of all underground communications 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 communications equipment in building. Label panel schedules to indicate actual location.
 10. Exact location of all communications equipment in and outside of the building.
 11. Location, size and routing of all communications cables, conduits, equipment, etc. shall be accurately and neatly shown to dimension.
 12. Exact location of all roof mounted equipment, wall, roof and floor penetrations.
 13. Cloud all changes.

1.24 OPERATING TESTS

- A. After all communications 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 printed and digital 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.

1.25 WARRANTY

- A. All equipment shall be covered for the full manufacturer's warranty period and systems shall be warranted by the Contractor for a period of two years commencing with the filing date of substantial completion. The Warranty shall cover all costs for warranty service,

including parts, labor, prompt field service, pick-up, transportation, delivery, reinstallation, and retesting. A contract for service shall cover the period starting with the first expected activation of each system and shall continue without interruption to cover the period to the end of the two-year warranty as defined above. The end of the warranty period shall be handled such that a smooth transition to a maintenance agreement with the Owner shall be achieved with no lapse in coverage.

- B. Submit 3 printed and digital copies of all warranties and guarantees for systems, equipment, devices and materials. These shall be included in the Operating and Maintenance Manuals.

1.26 BUILDING CONSTRUCTION

- A. It shall be the responsibility of the sub-contractor to consult the Architectural and Engineering 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 piping, cables, pathways, raceways, and other items are placed in the walls, furred spaces, chases, etc., so that there shall be no delay in the job.

1.27 TEMPORARY FACILITIES

- A. General: Refer to Division 01 for general requirements on temporary facilities.
- B. Temporary Wiring: Temporary power and lighting for construction purposes shall be provided under Division 26. Installation of temporary power shall be in accordance with NEC Article 305.
- C. Temporary facilities, wire, lights and devices are the property of this Contractor and shall be removed at the completion of the Contract.

1.28 EXTRA MATERIALS

- A. Keys: Provide three (3) sets of all keys for system cabinets.

2 PRODUCTS

2.1 WORK INCLUDED

- A. All materials listed in PART 2 - PRODUCTS of this Division Sections and on the Drawings shall be provided by the Contractor unless specifically excluded or modified in other portions of this Specification or Addendums.

3 EXECUTION

3.1 INSTALLATION

- A. This project has a critical path, which must be closely followed in order to meet the completion date. The Contractor shall review the proposed schedule at the Award of Contract meeting and be prepared to staff his work force according to the schedule constraints presented at that time.
- B. Aesthetics are an important consideration in this installation. All components shall be installed so as to have aesthetically pleasing results as determined by the Owner and

Architect. Actual locations of all visible components shall be coordinated in advance with the Owner and Architect.

- C. Install, make fully operational and test the system as indicated on the Drawings and in the Specifications. Where information is not available the worst-case condition must be assumed to ensure a complete, functional system.
- D. Any interfacing with other systems shall be the Contractor's responsibility under this contract, and the details, both logical and physical, of such interfaces shall be reflected in the Submittals and As-Built drawings.
- E. If appropriate, interfaces with the Owner's Data Network, Telecommunications and Communications System shall be coordinated with the Owner and Architect.
- F. All necessary back boards, back-boxes, pull-boxes, connectors, supports, conduit, cable and wire shall be furnished and installed to provide a complete and reliable system. Exact location of all backboards, boxes, conduit and wiring runs shall be presented to the Owner / Architect for approval in advance of any installation. Provide as required and as specified in Division 26.
- G. Where required provide 120-VAC, 60 Hz power from nearest electrical panel through a junction box, to the system devices. Provide as required and as specified in Division 26.
- H. Where required, install conduit, cable and wire parallel and square with building lines, including raised floor areas. Conduit fills shall not exceed 40%.
- I. All equipment shall be mounted with sufficient clearance to minimize EMI as well as meet all applicable codes and facilitate observation and testing. Securely hand and/or fasten with appropriate fittings to ensure positive grounding, free of ground loops, throughout the entire system. Units shall be installed parallel and square to building lines.
- J. Quiet and vibration-free operation of all equipment is a requirement of this installation. Properly adjust, repair, balance or replace any equipment producing objectionable (in the judgment of the Owner or Architect) noise or vibration in any of the occupied areas of any building and provide additional brackets and bracing if necessary. Any such additions or changes shall be at no additional cost to the Owner.
- K. Installation shall comply with the CODES AND STANDARDS portion of this Section. Where more than one code or regulation if applicable, the more stringent shall apply.
- L. Install firestopping, as specified in Division 26 for all penetrations in slabs and firewalls to meet code at the completion of work and prior to final testing demonstration to the Owner.
- M. The installation shall be performed in a professional manner.
- N. Daily, clean up and deposit in appropriate containers all debris from work performed under the appropriate specification sections. Stack and organize all parts, tools and equipment when not being used.
- O. Preparation, handling and installation shall be in accordance with the Manufacturer's written instructions and technical data appropriate to the product specified.
- P. All work shall conform to the National Electrical Contractors Association "Standard of Installation" for general installation practice.

- Q. After the installation, all work areas, including all enclosures and boxes, shall be vacuumed and cleaned to remove all debris and grease.
- R. Irrespective of system, there shall be no cable ties used as cable management or support, if ties are found to be used, the cables will be re-managed at no cost to the owner.

3.2 COORDINATION WITH OWNER / ARCHITECT

- A. Close coordination with the Owner / Architect is vital to achieve a complete, aesthetically pleasing job. The Contractor shall ensure that the Owner / Architect is kept fully apprised of job progress.

3.3 CUTTING, PAINTING, AND PATCHING

- A. Structural members shall not be drilled, bored or notched in such a manner that shall impair their structural value. Cutting of holes in structural members, if required, shall be done with core drills and only with the specific approval of the Owner / Architect for each instance.
- B. All walls that require cutting or repair during the installation process shall be returned to their original condition, including the matching of colors and finishes to the satisfaction of the Owner / Architect, and at no additional cost to the Owner.

3.4 WIRE AND CABLE

- A. All low voltage cable shall be low smoke plenum rated, limited energy, with 300-volt insulation.
- B. All wires in exposed areas shall run through conduit as specified in Division 26.
- C. Provide conduits, cable trays, raceways, wireways, boxes and outlets as specified in Division 26.
- D. After installation, and before termination, all wiring shall be checked and tested to insure there are no grounds, opens, or shorts on any conductors. In addition, all wires between buildings or underground and all coax cables shall have insulation tested with a megohmmeter (megger) and a reading of greater than 20 megohms shall be required to successfully complete the test.
- E. Run wires continuously from termination to termination without splices.
- F. Wire and cable shall be supported in each equipment and terminal cabinet and in each terminal and pull box in vertical risers and horizontal runs with wire duct and strap-type supports. At any point where wire duct is required for good wire management, whether shown on elevations or not, install appropriate duct. Where terminal boards are used, wire ducts shall be supplied on both sides and at no time shall wires cross over terminal boards. Arrange cables neatly to allow inspection, removal and replacement. Lace cables as required. Spot tie wire bundles with plastic cable ties and securely affix to panels. If screw type terminals are specified, terminal strip connections shall be locking, tongue style, pressure crimp, and solderless spade lug.
- G. Visually inspect wire and cable for faulty insulation prior to installation. Protect cable ends at all times with acceptable end caps except during actual termination. At no time shall

any coaxial cable be subjected to a bend less than a 6-inch radius. Protect wire and cable from kinks. Install 1 pull rope for all 2" or larger sized conduits.

- H. Provide plastic bushings and strain relief material at all conduit exit points and where necessary, to avoid abrasion of wire and excess tension on wire and cable.
- I. Cables above accessible ceilings shall not rest on ceiling tiles. Use Velcro tie wraps, J-hooks or D-rings to hold cables. Provide independent support for all cables. Support is to be from building structure (do not support from pipes or conduits). Communications cables shall not tie off on HVAC supports, all-thread, ceiling grid hanger wire or electrical / mechanical piping system.
- J. Ground and bond equipment and circuits in accordance with NEC and Division 26.

3.5 IDENTIFICATION AND TAGGING

- A. All cables, wires, wiring forms, terminal blocks and terminals shall be identified by labels, tags to other permanent markings in accordance with TIA/EIA-606. The markings shall clearly indicate the function, source, or destination of all cabling, wiring and terminals. All cables and wires shall be identified, utilizing heat-shrink, machine printed, polyolefin wire markers (Brady Type B-32 *or equal*). Hand written tags are not acceptable.
- B. Should a situation arise where the wire tagging format as shown on the drawings cannot be used, a substitute format shall be submitted which complies with the intent to provide documentation that will permit end-to-end tracing of all Communications Systems wiring.
- C. All panels shall be provided with permanently attached engraved lamaroid labels with identifying names and functions. All terminal points shall be appropriately labeled. Labels shall be consistent in form, color, and typeface throughout the system and all must contain the name of the system or subsystem as part of the label textual information. Design, color, font and layout shall be coordinated with, and approved by, the Owner.
- D. 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.
 - 2. Permanent, waterproof, black markers shall be used to identify each communications grid junction box, clearly indicating the type of system available at that junction box.
 - 3. Pull Boxes: Field work each with a nameplate showing identity, and identifying equipment connected to it. Nameplates shall also indicate where pull box is fed from.
 - 4. Communication hardware located above accessible ceilings: Provide 1/2-inch high black name plate with white 1/4-inch letters glued to bottom of t-grid ceiling below hardware located above ceiling. Identification shall be as short as possible yet identifying device above ceiling, i.e. "A/V-EQ"
- E. 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.

- F. Warning Signs: Provide warning signs where there is hazardous exposure associated with access to or operation of communications 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.
- G. Wire and Cable Labeling: Provide wire markers on each conductor in all boxes, pull boxes, gutters, wireways. Identify with drop/circuit number.
- H. Underground Warning Tape: Thomas and Betts or approved equal. Six-inch wide plastic tape, colored red or orange with suitable warning legend describing buried communications lines. All underground 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 conduits.
- I. Provide trace wire in all conduits for fiber optic cabling.

3.6 CUTTING AND PATCHING

- A. General: Comply with the requirements of Division 01 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.

3.7 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 communications 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.
- B. Time to be allocated for instructions.
 - 1. Minimum of 20 hours dedicated instructor time
 - 2. 4 hour on each of 5 days
 - 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, 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 training. List time and date of each demonstration, hours devoted to the demonstration, and a list of people present, with their respective signatures.
- J. After 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.

3.8 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.

3.9 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.

3.10 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.
- B. Proof of delivery of these items to the Owner shall be included in the Operating and Maintenance Manuals.

3.11 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 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.

3.12 SITE MANAGEMENT RESPONSIBILITY

- A. The Contractor shall provide an on-site Project Manager as defined in SUPERVISION OF WORK portion of this Section.

3.13 START-UP RESPONSIBILITY

- A. The Contractor shall initiate System operation. The Contractor shall provide competent Start-Up personnel on each consecutive working day until all Communications Systems are functional and ready to start the acceptance test phase. If the Contractor, in the Owner / Architect's judgment, is not demonstrating progress in solving any technical problems, the Contractor shall supply Manufacturer's factory technical representation and diagnostic equipment at no cost to the Owner, until resolution of those defined problems. Where appropriate, the Contractor shall bring the Systems on-line in their basic state (i.e., alarm reporting, facility code access control, etc.) It is the responsibility of the Owner to provide the specific database information that will be utilized for initial system programming.
- B. Properly ground each piece of electronic equipment prior to applying power. Properly ground all shielded wire shields to the appropriate earth ground at the hub end only, not at the remote or device end.
- C. Use a start-up sequence that incrementally brings each portion of the system on-line in a logical order that incorporates checking individual elements before proceeding to subsequent elements until the entire system is operational. The basic steps should include:
 - 1. Establish ground planes at the equipment rooms and hub end of the systems as specified in Division 26.
 - 2. Disconnect power, connect the first device, reconnect power, and verify operational correctness. Repeat until the entire system is verified and operational.

3.14 PREPARATION FOR ACCEPTANCE (SUBSTANTIAL COMPLETION)

- A. All systems, equipment, and devices shall be in full and proper adjustment and operation, and properly labeled and identified.
- B. All materials shall be neat, clean and unmarred, and parts securely attached.
- C. All extra material as specified shall be delivered and stored at the premises as directed.
- D. Test reports of each system and each system's components and As-Built Project Drawings shall be complete and available for inspection and delivery as directed by the Owner.

3.15 SYSTEM ACCEPTANCE REQUIREMENTS

- A. Before final acceptance or work, the Contractor shall perform and/or deliver each of the following in the order stated.
- B. The Contractor shall deliver three (3) composite "System Operations and Maintenance" manuals in three-ring binders, sized to hold the material below, plus 50% excess. Each manual shall contain in appropriately tabbed sections:
 - 1. A statement of Guarantee including date of termination and the name and phone number of the persons to be called in the event of equipment failure.

2. A set of Operating procedures for the overall System that includes all required Owner activities, and that allows for the Owner operation of all attributes and facilities of the System.
 3. A section for each specific type of equipment containing the vendor manuals, instruction sheets, and any related literature that came in the original shipping container for that piece of equipment. Include all warranty cards.
 4. Provide printed and digital copies of all documents.
- C. Testing:
1. The Contractor shall perform all tests required by Division 26 and those submitted as part of this Section.
 2. The Contractor shall activate all devices for proper system operation, including supervisory and trouble circuit tests. Similarly, audible alarms will not be activated except on a one-time, coordinated basis, to check the actual sounding devices.
 3. A test report for each piece of equipment shall be prepared by the Contractor and submitted to the Owner. This report shall include a complete listing of every device, the date it was tested, by whom and the results. The final test reports shall indicate that every device tested successfully. Failure to completely test and document the tests will result in a delay of final testing and acceptance.
- D. As-Built Drawings:
1. After completion of all the tests listed above, and prior to the final acceptance test, The Contractor shall submit the complete As-Built drawings as identified in PART 1 – PROJECT RECORD DRAWINGS.
 2. The final As-Built Drawings shall consist on one set of reproducible prints, two (2) sets of Point-to-Point Detail Drawings, Equipment Schedules, and the complete detailed technical data that was shipped by the manufacturer with all installed equipment.
 3. Provide printed and digital copies of all documents.
- E. Final Acceptance Test: The Final Acceptance Test shall demonstrate the installed and activated System's performance and compliance with System Specifications. However, before this testing can begin the following must have received and reviewed by the Owner.
1. System Operations and Maintenance Manuals
 2. System Test Reports
 3. As-Built Drawings

3.16 NOTICE OF COMPLETION

- A. When the Final System Acceptance Requirements described above including the Final Acceptance Test described above have been satisfactorily completed. The Owner / Architect shall issue a Letter of Completion to the Contractor indicating the date of such completion. The Notice of Completion shall be recorded by the Contractor upon receipt of the Owner / Architect completion letter. This date of record shall be the start of the warranty period.

END OF SECTION 27 05 00

SECTION 27 05 07

COMMUNICATIONS SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA

1 GENERAL

1.1 WORK INCLUDED

- A. Prepare submittals as required by Division 01 and as outlined below.
- B. Submit product data shop drawings only for the following 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 and to imply that materials shall be provided as specified without exception.
- C. The term submittal, as used herein, refers to all:
 - 1. Shop Drawings
 - 2. Coordination Drawings
 - 3. Product data
- D. 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 relation to adjacent or critical features or work or products.

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: 1/4"=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 room containing technology equipment and each rack with technology equipment, submit plan and elevation drawings. Show:
 - 1. Actual technology equipment and components to be furnished.
 - 2. NEC working space and NEC access to NEC working space.
 - 3. Relationship to other equipment and components and openings, doors and obstructions
 - 4. Rack location and dimensions
- D. Identify field dimensions. Show relation to adjacent or critical features of work or products.

COMMUNICATIONS SHOP DRAWINGS, COORDINATION DRAWINGS

& PRODUCT DATA

SECTION 27 05 07

- E. Verify location of communications station devices, telephone outlets and other work specified in this Division.
 - 1. Coordinate with drawing details, site conditions and millwork shop drawings prior to installation.
 - 2. Where required for clarification, submit shop drawings prior to rough-in and fabrication.
- F. Submit shop drawings in plan, elevation and sections, showing outlets and other devices in casework, cabinetwork and built-in furniture.

1.4 PRODUCT DATA

- A. All product options specified shall be indicated on the product data submittal. All options listed on the standard product printed data not clearly identified as not part of the product data submitted shall become part of the Contract and shall be provided.
- 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 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:)

1.5 MANUFACTURERS INSTRUCTIONS

- A. Submit Manufacturer's instructions for storage, preparation, assembly, installation, start-up and adjusting.

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.

COMMUNICATIONS SHOP DRAWINGS, COORDINATION DRAWINGS

& PRODUCT DATA

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- 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 four opaque reproductions.
 - 2. Product Data: Submit the number of copies the contractor requires, plus those to 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 telephone 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

COMMUNICATIONS SHOP DRAWINGS, COORDINATION DRAWINGS

& PRODUCT DATA

SECTION 27 05 07

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 requiring 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 resubmittals under procedures specified for initial submittals.
1. Indicate that the document or sample is a resubmittal
 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:

COMMUNICATIONS SHOP DRAWINGS, COORDINATION DRAWINGS

& PRODUCT DATA

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1. Review identified submittals with reasonable promptness and in accordance with schedule. Specific equipment submittals 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 approval of submittal
 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 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 Division 1.

2 PRODUCTS - NOT USED

3 EXECUTION

3.1 SHOP DRAWINGS AND PRODUCT DATA

- A. Submittals shall not be combined or bound together with any other material submittal.
- B. Submit shop drawings and product data for the following when specified or provided:
1. Structural Cabling
 2. Communications System
 3. Integrated Audio Video Systems
 4. Local Sound Reinforcement

3.2 COORDINATION DRAWINGS

- A. Submit coordination drawings as specified.

END OF SECTION 27 05 07

SECTION 27 05 09

CONTRACT QUALITY CONTROL

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 / 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 a manufacturer's qualified personnel to observe:
 - 1. Field conditions.
 - 2. Condition of installation.
 - 3. Quality of workmanship.
 - 4. Start-up of equipment.
 - 5. Testing and adjusting 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 mockup 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

2 PRODUCTS**2.1 REFERENCE APPLICABLE SPECIFICATION SECTIONS.****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.

3.2 MOCK-UPS

- A. Mock-up a typical classroom, science lab of each type, and computer lab with all wiring devices, cover plates, rough-in boxes, conduits, etc. Provide all conductors from all wiring devices to above ceiling space to demonstrate conduit routing and conductor fill.

END OF SECTION 27 05 09

SECTION 27 05 10

FIRESTOPS

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 smoke stop.

1.2 QUALITY ASSURANCE

- A. UL Label: Firestops shall be UL labeled.

2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Nelson
- B. 3M (Minnesota Mining Manufacturing)
- C. Hilti
- D. Specified Technologies, Inc.

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 by drawings.

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 27 05 10

SECTION 27 10 00

DATA COMMUNICATIONS STRUCTURED CABLING

1 GENERAL

1.1 SUMMARY OF WORK

- A. Furnish and install horizontal cabling inclusive of Category 6/6A cabling, jacks, faceplates, patch cords, above-ceiling supports, labels, testing and all supporting equipment to provide a complete and fully functional solution as described in this specification.
- B. Furnish and install backbone cabling inclusive of single-mode fiber, connectors, bulkheads, patch cords, above-ceiling supports, testing, and all supporting equipment to provide a complete and fully functional solution as described in this specification.
- C. Furnish and install head-end equipment inclusive of 2/4 post racks, patch panels, fiber termination boxes, wire managers, ladder rack, fire-rated plywood, power-strips, grounding and all supporting equipment to provide a complete and fully functional solution as described in this specification.

1.2 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. The structured cabling contractor shall be licensed and shall meet all applicable regulations.
 - 2. The contractor shall be certified by the manufacturing company in all aspects of design, installation, and testing of the products described herein and must be authorized to provide warranty.
 - 3. The manufacturer shall have, at the district's disposal, a certified employee or support phone number that can be reached during normal operating hours for product support and service.
 - 4. The contractor shall be experienced in all aspects of this work and shall be required to demonstrate direct experience on recent systems of similar type and size. The contractor shall own and maintain tools and equipment necessary for successful installation and testing of optical and metallic premise distribution systems and shall have personnel who are adequately trained in the use of such tools and equipment. Contractor shall provide evidence of minimum five (5) years' experience on similar structured cabling systems.
 - 5. A resume of qualifications shall be submitted with the contractor's proposal indicating the following:
 - a. A list of five (5) recently completed projects of similar type and size with contact names, telephone numbers, and e-mail addresses for each.
 - b. A list of procedures, inclusive of testing equipment and best practices, for testing the integrity of the cabling systems on this project.
 - c. A technical resume of experience for the contractor's project manager and on-site installation supervisor who shall be assigned to this project.
 - d. A list of technical product training attended by the contractor's personnel that shall install the structured cabling systems shall be submitted.
 - e. Any subcontractor who shall assist the contractor in performance of this work shall have the same training and certification as the contractor.
 - 6. The Contractor shall employ full time local technicians and installers.

- B. The Contractor shall attend a mandatory pre-construction meeting with individuals deemed necessary by the Owner's representative prior to the start of the work.
 - 1. Items requested by the Owner/Engineer to finalize rack equipment configuration, rack cable management, rack cable terminations and other miscellaneous minor changes shall become part of the Contract Documents as supplementary information.
- C. The products specified in Part 2 of this Specification shall be supplied by a single manufacturer, within the acceptable manufacturer groups, except for data racks and other hardware that is not defined as part of the channel test configuration by TIA/EIA TSB67, Transmission Performance Specifications for Field Testing of unshielded Twisted-Pair Cabling Systems outside plant (OSP) copper cable. Manufacturer shall have a minimum of seven (7) years' experience and shall be ISO 9001 Certified.
- D. The Owner's representative reserves the right to reject all or a portion of the work performed, either on technical or aesthetic grounds.

1.3 REGULATORY REQUIREMENTS

- A. Standards: All work shall be performed in accordance with the latest revisions of the following standards and codes:
 - 1. Local Building Code
 - 2. Local Electrical Code
 - 3. NEC National Electrical Code
- B. Other References:
 - 1. ANSI/TIA-568-C.0 – Generic Communications Cabling for Customer Premises...
 - 2. ANSI/TIA-568-C.1 – Commercial Building Communications Cabling Standard Part 1: General Requirements.
 - 3. ANSI/TIA 568-C.2 – Balanced Twisted-Pair Telecommunications Cabling and Components Standards
 - 4. ANSI/TIA 568-C.3 – Optical Fiber Cabling Components Standard
 - 5. ANSI/TIA-568-C.4, Coaxial Cabling Component Standard
 - 6. ANSI/TIA-569-C – Commercial Building Standard for Telecommunications Pathways and Spaces.
 - 7. ANSI/TIA-492-AAAC-B – Detail Specification for 850-nm Laser-Optimized, 50-um Core Diameter/125-um Cladding Diameter Class 1a Graded-index Multimode Optical Fibers (OM3/OM4). Current Edition
 - 8. ANSI/ICEA S-83-596, Fiber Optic Premises Distribution Cable.
 - 9. ANSI/TIA/EIA-598, Color Coding of Optical Fiber Cables
 - 10. ANSI/ICEA S-87-640, Fiber Optic Outside Plant Distribution Cable.
 - 11. ANSI/TIA/EIA-758: Customer-Owned Outside Plant Telecommunications Cabling Standard.
 - 12. ANSI/TIA/EIA-526-7, Optical Power Loss Measurements of Installed Single mode Fiber Plant: OFSTP-7.
 - 13. ANSI/TIA/EIA-526-14-A, Optical Power Loss Measurements of Installed Multimode Fiber Plant: OFSTP-14A
 - 14. ANSI/TIA/EIA-TSB-125, Guidelines for Maintaining Optical Fiber Polarity Through Reverse-Pair Positioning
 - 15. ANSI/TIA/EIA-TSB-140, Additional Guidelines for Field Testing Length, Loss, and Polarity of Optical Fiber Cabling Systems.
 - 16. ANSI/TIA-606-B – Administration Standard for the Commercial Telecommunications Infrastructure

17. TIA/EIA-607-B - 2011 - Commercial Building Grounding and Bonding Requirements for Telecommunications
 18. Institute of Electrical and Electronic Engineers (IEEE 802.xLAN)
 19. TIA/EIA 942 Data Center Standards
 20. Current BICSI Telecommunications Distribution Methods Manual
 21. NFPA 70 – National Electrical Code (NEC).
 22. BICSI – TDMM, Building Industries Consulting Services International, Telecommunications Distribution Methods Manual (TDMM).
- B. Governing Codes and Conflicts: If the requirements of these specifications or the Project Drawings exceed those of the governing codes, regulations, and manufacturer installation requirements, then the requirements of these specifications and the drawings shall govern. However, nothing in the drawings or specifications shall be construed to permit work not conforming to all governing codes, regulations, and manufacturer installation requirements.

1.4 ABBREVIATIONS

- A. The following abbreviations are used in this document:
- | | |
|------|---|
| IDF | Intermediate Distribution Frame |
| MDF | Main Distribution Frame |
| UTP | Unshielded Twisted Pair |
| SCS | Structured Cabling System |
| RCDD | Registered Communications Distribution Designer |

1.5 SUBMITTALS

- A. Shop Drawings: Submit the following items, for Owner review and approval, within twenty-eight (28) days of Notice to Proceed:
1. Proposed circuit routing and circuit grouping plan prepared by a BICSI certified RCDD. The RCDD certification shall have been granted on or before five years previous of proposal due date.
 2. Products: Provide standard manufacturer's cut sheets and/or other descriptive information.
 3. Testing: UTP cable test result forms, fiber optic cable test result forms, and a list of instrumentation to be used for systems testing.
 4. Provide a line-by-line item specification review indicating compliance or deviation with full description of deviation.
 5. Samples: Complete manufacturer's product literature and samples of patch panel, fiber terminations, and station jacks with cover plate.
 6. Provide coordination drawing with IDF/MDF equipment layout and rack elevations for approval, by Owner, prior to installation.
- B. Documentation: Contractor shall provide documentation to include test results, and shop drawings. An example of test results as they will be presented should be included with the shop drawings.
1. Work Station Cable Results: The results of the workstation cable tests shall be provided in the form of printouts from the test equipment as well as in the native format of the provided tester.
 2. Work Station Cabling Shop Drawings: Provide a set of shop drawings, indicating work station labeling, and closet origination location. Provide PDF copies and 30"x42" acrylic printed maps in each closet.
 3. Fiber Test Results: Hand written results are not acceptable. Copies of test results are not acceptable. Results to be provided on flash drive and printed form.

- C. Project Completion: As a condition for project acceptance, the Contractor shall submit the following for review and approval:
1. Complete manufacturer's product literature for all products installed during the course of the Project for Operation & Maintenance.
 2. Inspection and Test Reports: During the course of the Project, the Contractor shall maintain an adequate inspection system to ensure that the materials supplied, and the work performed conforms to contract requirements. The Contractor shall provide written documentation that indicates that materials acceptance testing was conducted as specified. The Contractor shall also provide documentation, which indicates that all connectivity testing was completed and that all irregularities were corrected prior to job completion.
 3. Operating and Maintenance Instructions for all devices within the system. These instructions shall reflect any changes made during construction, and shall be provided to the Owner, for their use, in a three-ring binder labeled with the project name and description. Provide three printed (3) copies.
 4. As-built Drawings shall include equipment layout and rack elevations. The as-built drawings shall be prepared using AutoCAD 2014 electronic format or later, with PDFs provide on flash drive.
 5. Submit paragraph-by-paragraph specification review indicating compliance or deviation with explanation.
 6. Submit proof that all system components and cables are U.L. Listed.
 7. An equipment list with names of manufacturers, model numbers, and technical information on all equipment proposed. Clearly mark exact model number proposed to be installed.
 8. Certification from the manufacturer stating that the system Contractor is an authorized distributor or installer of the proposed system when such certifications exist.
- D. Bill of Materials: The contractor shall provide an itemized pricing breakdown for the turnkey solution that includes: labor, materials, wiring, termination, electrical equipment, electrical hardware, installation, etc. Pricing breakdown shall include the list price for each item provided.

2 PRODUCTS

2.1 GENERAL

- A. Materials shall be as listed or shall be approved equivalent products of other manufacturers meeting the intent and quality level of the TIA/EIA specifications.
- B. Ratings: All products shall be new and brought to the job site in the original manufacturer's packaging. Electrical components shall bear the Underwriter's Laboratories label. All communications cable shall bear flammability testing ratings as follows:
- | | |
|-----|-----------------------------------|
| CM | Communications Cable |
| CMP | Plenum Rated Communications Cable |
| CMR | Riser-Rated Communications Cable |
| OSP | Outside Plant Cable |
- C. Initial Cable Inspection: The contractor shall inspect all cable prior to installation to verify that it is identified properly on the reel identification label, that it is of the proper gauge, containing the correct number of pairs, etc. Note any buckling of the jacket that would

indicate possible problems. Damaged cable or any other components failing to meet specifications shall not be used in the installation.

- D. Cable specifically designed for installing communications cable may be used to reduce pulling tension as necessary when pulling cable into conduit.

2.2 ACCEPTABLE MANUFACTURERS

- A. Horizontal Cabling Systems:
 - 1. Commscope Uniprise
- B. Backbone Cabling Systems:
 - 1. Commscope Uniprise
- C. Above-Ceiling Support Systems:
 - 1. Tomarco CEAS
 - 2. Panduit
 - 3. Caddy
 - 4. Arlington
- D. Head-End Systems:
 - 1. Commscope
 - 2. Chatsworth (CPI)
 - 3. Blackhawk Labs (when approved)
- E. Surge Protection
 - 1. DITEK Surge Protection

2.3 PERFORMANCE REQUIREMENTS

- A. Horizontal Cabling System
 - 1. Cable:
 - a. The Structured Cabling System provided shall be unshielded twisted pair, four-pair, solid copper conductor, meeting the intent and quality level of the TIA/EIA-568 Commercial Building Wiring Standard.
 - b. Cabling shall be rated CMP.
 - c. Shall be Category 6 for all Data/IP Phone, Access Control, Intercom, Fire Alarm, Controls-HVAC, Projectors/TVs/Sound Systems, UN874 series (CS34P)
 - d. Shall be Category 6A for all Wireless Access Points, Video Surveillance. UN874 series (CS44P)
 - e. Shall be 874049304/10 for all cables that go under slab (CS34P-IO)
 - 2. Jacks:
 - a. Flush mount jacks shall be high quality 8p 8c modular jacks with circuit board construction 110-style wire, T568B terminations. Jacks shall meet EIA/TIA TSB40 recommendations for connecting hardware.
 - b. Shall be standard 8-position, RJ-45 Style, FCC compliant
 - c. Shall be designed for 4-pair, 100 Ohm balanced UTP Cable
 - d. Shall terminate 26-22 AWG solid or stranded conductors
 - e. Shall accept FCC compliant 6 position plugs.
 - f. All terminations shall be T568B wiring configurations.
 - g. Shall be backward compatible with existing Category 3, 5 and 5E cabling systems for fit, form and function

- h. Shall meet or exceed transmission requirements for connecting hardware, as specified in ANSI/TIA/EIA-568-C2, Transmission Performance Specifications for 4-Pair 100 Ohm.
 - i. Shall be UL Listed and CSA certified.
 - j. Each jack shall have category rating identified on the front face.
 - k. Shall be Keystone – Commscope KJ Series Modular Jacks, Cat 6/6A
 - j. Shall be Category 6 for all Data/IP Phone, Access Control, Intercom, Fire Alarm, Controls-HVAC, Projectors/TVs/Sound Systems
 - k. Shall be Category 6A for all Wireless Access Points, Video Surveillance
- 3. Patch Cords
 - a. Shall be factory terminated, snag less without strain-relief boot
 - b. Shall match manufacturer of horizontal cabling system
 - c. Shall be Category 6 for all Data/IP Phone, Access Control, Intercom, Fire Alarm, Controls-HVAC, Projectors/TVs/Sound Systems
 - d. Shall be Category 6A for all Wireless Access Points, Video Surveillance
 - e. Patch Cables shall be provided by Contractor for each station outlet and each patch panel jack (i.e. 2 cables per drop/tie cable). Patch cables shall be pinned per EIA 568B and shall be terminated with 8p8c non-keyed plugs at both ends. Patch cords shall be a length suitable to neatly run from farthest two jacks on patch panel and still provide slack to dress cable.
 - f. Patch Cords for Data Racks shall be 1 foot, UC1 series
 - g. Patch Cords for Station Cables shall be 15 foot, UC1 series
 - h. Patch Cords for Video Surveillance 15' foot for typical outlets and 30 foot for high ceilings, CO199K2-**
- 4. Faceplates.
 - a. Maximum six (6) ports per faceplate
 - b. Blank grey insert covers shall be provided for unused workstation ports, Leviton 41084-143-0BG.
 - c. Faceplates shall be compatible with standard NEMA openings and boxes.
 - d. Faceplates shall be UL Listed and CSA Certified
 - e. All faceplates shall be stainless steel and must contain ID windows
 - g. Shall be Leviton 43080-** series
 - h. Biscuit Boxes shall be Commscope 760248521 (1-port) and 760248525 (2-port)
- 5. Cabling Support Systems
 - a. J-Hooks or Saddle Bags
 - 1) Hold up to 5" diameter bundle of cable without sagging, bending or damaging cable.
 - 2) All Velcro used above ceilings must be rated CMP.
- 6. Labels
 - a. Labels: The Contractor shall label all outlets using permanent machine engraved labels approved by the Owner. Label patch panels in the wiring closet to match those on corresponding data outlets. The font shall be at least one-eighth inch (1/8") in height, block. All labels shall correspond to as-built drawings and to final test reports.
 - b. Contractor shall ensure complete durable laser printable cable labels typed labeling of all outlets and cables with numbers that correspond to locations on the punch down block. Labeling system shall correspond to the Owner's labeling system. Verify with Owner. Provide tags (black letters on white labels, plastic coated) on all cables and outlets.
 - 1) Durable laser printable cable labels.
 - 2) Durable Polyester label stock.
 - 3) Self -Laminating wrap around design.
 - 4) Clear Polyester with White and Colored Print-on areas.

- 5) Polyester rated for indoor and outdoor applications.
 - c. Patch Panel Port Identification.
 - d. Face Plate and Port Labels.
 - e. Rack and Cabinet Labels.
 - f. Fiber Adapter Labels
- B. Backbone Cabling System
 - 1. Physical Characteristics:
 - a. Shall be suitable for use in indoor or outdoor applications.
 - b. Appropriately flame rated optical cable shall be suitable for use in risers, plenums and horizontal applications.
 - c. Plenum rated optical cables shall have and be marked with an UL-OFNP and OFN FT6 Flame Rating. Riser rated optical cables shall have and be marked with an UL-OFNR and OFN FT4 Flame Rating
 - d. Shall comply with the requirements of ICEA S-83-596 (Premises), ICEA S-104-696 (I/O), or ANSI/ICEA S-87-640 (Outside Plant, OSP).
 - e. Suitable for underground or aboveground conduits.
 - f. Optical cables and fibers shall be color coded in accordance with EIA/TIA-598-C.
 - g. Shall have a ripcord for overall jacket.
 - h. Shall be in an armored jacket. Ensure bonding on both sides of armored jacketing, for all cabling. All fiber that is to be ran outside to be di-electric, all indoor fiber to have an interlocking fiber.
 - 2. Each Single-mode Fiber shall be:
 - a. Dispersion - unshifted single mode optical fibers with Low Water Peak complying with ITU-T G.652.D and with improved bending loss complying with ITU-T G.657.A1.
 - b. The zero dispersion wavelength shall be between 1300 nm and 1320 nm. The ANSI/EIA/TIA-455-168 maximum value of the dispersion slope shall be no greater than 0.090 ps/km-nm². Dispersion measurements shall be made in accordance with ANSI/EIA/TIA-455-169 or ANSI/EIA/TIA-455-175-B.
 - c. The nominal mode field diameter shall be 9.2m with a tolerance of 0.4m at 1310 nm when measured in accordance with ANSI/EIA/TIA 455 191 B.
 - d. Transmission Characteristics:
 - e. Maximum cabled attenuation for loose tube fibers shall be 0.4/0.3 dB/km @ 1310/1550 nm.
 - f. Maximum cabled attenuation for tight buffer fibers shall be 0.7/0.7 dB/km @ 1310/1550 nm.
 - g. The cabled cutoff wavelength shall be 1260 nm when measured in accordance with ANSI/EIA/TIA-455-80-C
 - 3. Single-mode Fiber shall be
 - a. 12F SM Armored – P-012-DZ-8W-FSUYL
 - b. 24F SM Armored – P-024-DZ-8W-FSUYL
 - c. 12F SM Indoor/Outdoor - P-012-OZ-8W-FSUBK
 - d. 24F SM Indoor/Outdoor – P-024-OZ-8W-FSUBK
 - e. 12F SM OSP Armored – D-012-LA-82-F12NS
 - f. 24F SM OSP Armored – D-024-LA-82-F12NS
- C. Surge Protection
 - 1. Power over Ethernet Surge Protector
 - 2. Compatible with Cat 6 and Cat 6A cabling
 - 3. Support of data speeds up to 10GbE without signal degradation
 - 4. RJ45 female connection with external grounding screw
 - 5. DTK-MRJEXTS (far end)
 - 6. DTK-RM24NETS (near end)

- D. Head-End System
 - 1. Racks/Grounding
 - a. Floor Standing 4-Post Racks
 - 1) 7' Tall
 - 2) Minimum of 36" Deep
 - 3) Black
 - 4) Commscope RK4P45-36A
 - b. Floor Standing 2-Post Racks
 - 1) 7' Tall
 - 2) Black
 - 3) Commscope RK3-45A
 - c. Patch Panels
 - 1) Modular
 - 2) Flat
 - 3) 24-Port model 760237052
 - 4) 48-Port model 760241547
 - d. Ladder Rack
 - 1) Black
 - 2) 12" Wide
 - 3) Elevation and Top Plate Kits
 - 4) Wall Angles/Vertical Wall Mount Kits
 - 5) Waterfalls
 - e. Vertical Wire Managers
 - 1) Black
 - 2) 6"/12" Sizes
 - 3) Double-Sided
 - 4) Commscope VCM-DS-84-8B (Cat6A @ ends of racks)
 - 5) Commscope VCM-DS-84-12B (Cat6A @ between racks)
 - f. Grounding
 - 1) #6 AWG copper grounding wire
 - 2) 12" grounding bus bar, TMG pattern
 - 3) 2-hole grounding lugs
 - g. PDU
 - 1) 3.8Kw Single-Phase
 - 2) Local Metered, Dual Circuit
 - 3) (32) 5-15/20R outlets
 - 4) L5-20P/5-20P
 - 5) 10 ft (3.05m) cord
 - 4) Tripplite PDUMV40
 - 5) Vertiv SP124-1026
 - h. UPS
 - 1) Installed from FF&E
 - 2. Fiber Head-End Systems
 - 1. Fiber Patch Panels
 - a. 4RU – MDF – EPX-4U-PNL-ENC
 - b. 2RU – IDF – EPX-1U-PNL-ENC
 - c. 1RU – IDF – EPX-1U-PNL-ENC
 - 2. Splicing Cassettes
 - a. 12LC – PNL-CS-12LCW-PT
 - b. 24LC – PNL-CS-24LCW-PT
 - 2. Bulkheads
 - a. 12-Port Duplex
 - b. LC
 - 3. Connectors

- a. LC
- b. Patch Cords
 - 1) 7-Foot
 - 2) LC-LC terminations
 - 3) FEWLCLC42-JXF007

3 EXECUTION

3.1 GENERAL

- A. At completion, the horizontal cabling system shall be inclusive of Cat 6/6A, jacks, faceplates, patch cords, above-ceiling supports, labels, testing, and all supporting equipment to provide a complete solution as described in this specification.
- B. At completion, the backbone cabling system shall be inclusive of fiber, multi-pair copper, connectors, bulkheads, patch cords, above-ceiling supports, testing, and all supporting equipment to provide a complete solution as described in this specification.
- C. At completion, the head-end system shall be inclusive of 2/4-post racks, patch panels, fiber termination boxes, wire managers, ladder rack, fire-rated plywood, power-strips, grounding and all supporting equipment to provide a complete solution as described in this specification.
- D. Conformance to the installation practices covered above is to be verified when completed. In some cases, the Owner/Engineer may observe before acceptance.
- E. All clean-up activity related to work performed shall be the responsibility of the contractor and shall be completed daily before leaving the facility.
- F. Surge suppression shall be provided and installed on both ends of cables exiting and entering building, including cables for video surveillance cameras and wireless access points. Surge suppressors shall be properly grounded.

3.2 COORDINATION

- A. It is encouraged that the contractor be familiar with the site and existing district infrastructure before submitting proposal. Congested building areas shall be inspected by the contractor to ensure coordination with the other trades during construction. No extras shall be permitted because of the contractor's failure to properly investigate existing conditions or building design at the time of the proposal.
- B. The Contractor shall coordinate with other system vendors, where appropriate, to facilitate equipment installation, scheduling, protection of equipment and access to the project site in order to provide the Owner a substantially complete project in a timely manner

3.3 HORIZONTAL CABLING

- A. Colors/Types
 - 1. Cable
 - a. Data/IP Phone – Blue
 - b. Wireless Access Points – Blue
 - c. Access Control/Intrusion System – Yellow
 - d. Video Surveillance - Purple
 - e. Projectors/Monitors – Green
 - f. BAS Controls – Grey

- g. Fire Alarm – Red
 - h. Intercom System - White
 - 2. Jacks
 - a. Data/IP Phone – Orange
 - b. Wireless Access Points – Blue
 - c. Access Control/Intrusion System – Yellow
 - d. Video Surveillance - Purple
 - e. Projectors/Monitors – Green
 - f. BAS Controls – Grey
 - g. Fire Alarm – Red
 - h. Intercom System – White
 - 3. Patch Cords
 - a. Data/ IP Phone Data Workstation - Blue
 - b. Data/IP Phone Rack-End – Black
 - c. Wireless Access Points – Blue
 - d. Access Control/Intrusion System – Yellow
 - e. Video Surveillance - Purple
 - f. Projectors/Monitors Rack-End - Green
 - g. Projectors/Monitors Workstation - Black
 - h. BAS Controls – Grey
 - i. Fire Alarm – Red
 - j. Intercom System – White
 - 4. Faceplates
 - a. Stainless Steel
 - B. Installation
 - 1. Horizontal Cabling
 - a. One (1) cable shall be provided for each port shown on the drawings, unless otherwise shown on drawings.
 - b. The cabling shall be installed per requirements of the manufacturer and the Project Documents, utilizing material meeting all applicable TIA/EIA standards. The contractor is responsible for providing all incidental and/or miscellaneous hardware not explicitly specified below as required for a complete and operational system.
 - c. Cable shall not run close (6 inches' perpendicular, 12 inches parallel) to power conduits (and other electrical noise sources). No patch panel, cable, outlet or punch block shall be within 6 feet of transformers or 12 inches of fluorescent lights, light fixtures, A/C wiring, radio systems or any other RF emitting device in ceilings or in/on walls.
 - d. Furnish and install pull strings in all new conduits, including all conduits with cable installed as part of this contract. Pull test is not to exceed 200 pounds.
 - e. Conduit sleeves shall be provided from outside IDF/MDF location to below ceiling area above ladder rack inside IDF/MDF. Minimum conduit size for data cabling sleeves shall be 4 inches.
 - f. Any data cabling installed in any conduit that is run underground in or under building slab shall be outside plant or indoor/outdoor plenum rated and sealed at each end with approved gel cable/conduit sealant. Transition between OSP & plenum rated cable not acceptable, for copper and/or fiber.
 - g. Cable runs shall be free of splices, kinks, excessive slack, and damage to the outer jacket
 - h. Cables shall not be painted. Any painted cable shall be replaced, at no cost to the owner.

- i. Cables shall be placed with sufficient bending radius so as not to kink, shear or damage the cable jacket or to otherwise diminish the transmission capability of the wire inside.
- j. Cable and/or cable bundles shall not be attached to any electrical wiring or light fixtures, nor will its vertical deflection allow it to encounter HVAC mechanical equipment, electrical wiring, conduits, piping, or fluorescent light fixtures.
- k. All data cables shall be home runs from outlet at final termination to patch panel at IDF/MDF.
- l. Cable Termination:
 - 1) Number of twists per foot shall be maintained all the way to cable termination point.
 - 2) Provide eighteen (18) foot service loop above ceiling for each above ceiling terminated drop, on workstation and 8' on the head-end side.
 - 3) Provide eight (8) foot service loop above ceiling for each drop, on workstation and head-end side.
 - 4) Cable shall be terminated using jack termination tool with lacing fixture (SLX/SL/KJ/UNJ), part number 1725150-6 as specified by the cable manufacturer.
- m. Cable Support
 - 1) In suspended ceiling and raised floor areas where duct, ladder trays or conduit are not available, the Contractor shall bundle, in bundles of 50 or less, station wiring with j-hooks, but not deforming the cable geometry. Cable bundles shall be supported and attached to the building structure and framework at a maximum of five (5) foot intervals.
 - 2) Cables shall not be attached to lift out ceiling grid supports or laid directly on the ceiling grid.
 - 3) Cables shall not be attached to or supported by fire sprinkler heads or delivery systems or any environmental sensor located in the ceiling air space.
- n. Fire Wall Penetrations: The Contractor shall avoid penetration of fire rated walls and floors wherever possible. Contractor shall also seal all floor, ceiling and wall penetrations in fire or smoke barriers and in the wiring closet.
- o. Wall Penetrations: Where penetrations are necessary, they shall be sleeved with metallic conduit and resealed with an Underwriter Laboratories (UL) approved sealant.
- p. After installation, exposed cable and other surfaces must be cleaned free of lubricant residue.
- q. Mounting heights shall conform to the Local Building Code Accessibility Standards. Mounting height shall match adjacent wiring devices unless noted otherwise.
- r. Contractor shall not hang cabling on pipes or wiring looms. Provide and install separate J-Hooks, cable saddles or ladder trays to carry cable plant that is installed. Cable support shall be secured to building structure.
- s. Cable shall run parallel and perpendicular to building lines. Changes in direction will be made with smooth bends, not exceeding minimum bend radius.
- t. Patch Cords:
 - 1) Furnish and install quantity one (1) 15', one (1) 1' for each cabled provided.

- u. Emergency phone copper –Shall be provided, at minimum, at the following locations, coordinate with drawings for locations of devices:
 - 1) Emergency phone locations.
 - 2) Elevator Machine Room
 - 3) Building Management Control Panel Locations
 - 4) Security System.
 - 5) Fire Alarm Panel
- v. Wireless Access Points:
 - 1) Install each outlet above ceiling in biscuit style termination of same design as station hardware. Shall also have label to match cable label on grid directly below provide biscuit block.
- w. Security Cameras:
 - 1) Install each outlet above ceiling in biscuit style termination of same design as station hardware. Shall also have label to match cable label on grid directly below provide biscuit block.
- x. Damage:
 - 1) The Contractor shall replace or rework cable showing evidence of improper handling including stretches, kinks, short radius bends, over-tightened bindings, loosely twisted and over-twisted pairs at terminals and excessive cable sheath has been removed.
 - 2) The Contractor shall replace any damaged ceiling tiles that are broken during cable installation. Ceiling tiles shall match existing or new as specified elsewhere.

3.4 TELECOMMUNICATIONS OUTLET WIRING INSTALLATION

- A. General:
 - 1. Cabling between wiring closet and workstation locations shall be made as individual home runs. No intermediate punch down blocks or splices may be installed or utilized between the wiring closet and the communications outlet at the workstation location.
 - 2. All cable must be handled with care during installation so as not to change performance specifications. Factory twists of each individual pair must be maintained up to the connections points at both ends of the cable. There shall never be more than one and one-half inches of unsheathed UTP cable at either the wiring closet or the workstation termination locations.
- B. Exposed Cable: All cabling shall be installed inside walls or ceiling spaces whenever possible. Exposed station cable shall only be run where indicated on the Drawings. Additional exposed cable runs shall require Owner approval and shall only be allowed when no other options exist. Cabling shall be installed concealed at all times, including unfinished mechanical rooms or wiring closets where cable shall not be installed exposed and located to avoid conflicts with pass-through cabling, etc. Tie wraps shall be used to provide a neat appearance. Provide Velcro straps to dress the cable.
- C. Placement: All cabling and associated hardware shall be placed so as to make efficient use of available space. All cabling and associated hardware shall be placed so as not to impair the Owner's efficient use of their full capacity.
- D. Cable Minimum Bend Radius and Maximum Pulling Tension:
 - 1. Do not exceed bend radius for UTP = 4 X Cable OD, FTP = 4 X Cable OD.

2. Install unshielded twisted-pair cables so that there are no bends smaller than 4 times cable outside diameter at any point in the run and at the termination field.
 3. Pulling Tension on 4-Pair UTP Cables: Do not exceed 25 ft.lb. for 4-pair UTP cable.
- E. Pair Untwist at Termination: Do not exceed 12 mm (1/2 inch).
- F. Bend Radius of Horizontal Cables:
1. Not less than 4 times OD of UTP cables.
 2. Not less than 4 times OD of FTP cables.
- G. Maintain cable jacket to within 25 mm (1 inch) of termination point.

3.5 BACKBONE CABLING

- A. Colors
1. Fiber:
 - a. OS2 – Yellow
- B. Installation
1. Fiber:
 - a) Furnish and install 12-Strand Fiber Between MDF and each IDF
 - b) Furnish and install factory terminated LC connectors, quantity to match number of strands installed.
 - c) Furnish and install quantity one (1) 3- meter LC-LC patch cord, factory terminated, for every 2-strands installed.
 - d) Provide 10' service loop on each side of the fiber homerun.
 - e) All splices shall be fusion splice. Mechanical splices not acceptable.

3.6 HEAD-END SYSTEMS

- A. Installation
1. Floor Mounted Equipment racks shall be assembled and mounted in IDF/MDF locations as required in locations indicated on the drawings. Each rack shall be securely mounted to the floor and braced to the wall with ladder tray in accordance with the manufacturer's instructions and recommendations. Racks shall be mounted such that the side rails are plumb. Racks and ladder tray shall be grounded in accordance with NEC requirements. Rack shall be installed for future expansion and with proper access behind after electronic equipment is installed.
 2. Coordinate final rack configurations with owner, prior to installation of all components.
 3. Backboard: Furnish and install an equipment backboard at each MDF/IDF equipment location. Backboard shall be 3/4" x 8' x 4' Minimum Grade AC fire retardant plywood, with fire retardant paint. Coordinate placement of all equipment with Owner. Two walls of every closet shall be covered from floor to ceiling.
 4. Wire Management Components: Vertical cable management panels shall be installed on each side of the rack. In instances where more than one rack is installed in a single location, vertical cable management shall be installed between the racks.
 5. Cable Placement: Cable installation in the wiring closet must conform to the Project Drawings. All cabling shall be routed so as to avoid interference with any other

service or system, operation, or maintenance location. Avoid crossing areas horizontally just above or below any riser conduit. Lay and dress cables to allow other cables to enter the conduit/riser without difficulty at a later time by maintaining a working distance from these openings.

6. Cable shall be routed as closely as possible to the ceiling, floor or corners to ensure that adequate wall or backboard space is available for current and future equipment. All cable runs within the wiring closet shall be horizontal or vertical within the constraints of minimum cable bending radii. Minimum bend radius shall be observed. Cables shall not be tie-wrapped to electrical conduit or other equipment. All incoming cables shall be routed on the ladder tray and neatly dressed down to the patch panels.
7. No conduit shall exceed 40% fill ratio, provide an additional conduit if ratio is reached.

B. Grounding: Each closet shall be grounded to building steel, water pipes.

3.7 HORIZONTAL & BACKBONE CABLE TESTING/BALANCING

- A. Notification: The Owner/Architect/Engineer shall be notified one week prior to any testing so that the testing may be witnessed.
- B. Final Acceptance: Before requesting a final acceptance, the Contractor shall perform a series of end-to-end installation performance tests. The Contractor shall submit for approval a proposal describing the test procedures, test result forms and timetable for all copper and fiber optic cabling.
- C. Procedures: Trained personnel shall perform all testing. Acceptance of the test procedures discussed below is predicated on the Contractor's use of the recommended products and adherence to the inspection requirements and practices set forth. Acceptance of the completed installation shall be evaluated in the context of each of these factors.
- D. Errors: When errors are found, the source of each error shall be determined, corrected and the cable retested. All defective components shall be replaced and retested. Retest results must be entered on the test results form. All corrections shall be made prior to final acceptance test.
- E. Twisted Pair Cable Testing
 1. At a minimum, the Contractor shall test all station drop cable pairs from data closet termination patch panel port to station insert. Products shall be tested for compliance to ANSI/TIA/EIA 568 and ISO/IEC 11801 for a rated installation. Test equipment used shall meet TIA/EIA TSB-67, Level 4 accuracy. Further, the Contractor shall have a copy of TSB-67 in their possession and be familiar with its contents. Testing shall be against either appropriate category standards or the manufacturer's specifications whichever is more stringent and applicable.
 2. Each wire/pair shall be tested at both ends for the following:
 - a. Wire map (pin to pin connectivity)
 - b. Length (in feet)
 - c. Attenuation
 - d. Near End Cross Talk (NEXT)
 - e. Power Sum
 - f. Structural Return Loss
 - g. Delay Skew
 - h. PSNEXT

- i. ACR – must produce ACR results for every 6A cable, showing passing rates for bundled cables
 - j. PSACR
 - k. Equal Level Far End Crosstalk (ELFEXT)
 - l. PSELFEXT
 - m. Far End Crosstalk (FEXT)
 - n. Propagation Delay
 3. Test equipment shall provide an electronic and printed record of these tests. Test equipment calibration documentation shall be available for on-site inspection.
 4. Test results of each four-pair UTP cable must be submitted with identification to match labels on all patch panel ports and 8p8c jacks and must match as-builts associated with that cable.
- F. Fiber Optic Cable Testing
 1. Testing device for fiber optic cables shall be a high quality OTDR (Optical Time-Domain Reflectometer) equipped with a printer. The printed data shall show, in addition to any summary information, the complete test trace and all relevant scale settings. The OTDR must have the capability to take measurements from bare fiber strands as well as LC connector terminations.
 2. All fiber optic cable shall be tested on the reel before installation to ensure that it meets the specifications outlined herein.
 3. After installation, the Contractor shall test each intra-building fiber strand with a power meter in accordance with EIA 455-171 Method D procedures (bi-directional testing) at both 850 and 1300 nm. A form shall be completed for each cable showing data recorded for each strand including length, total segment (end to end) loss (dB) and connector losses (dB) at each end. In addition, the printed data strip for each strand shall be attached to the form. Patch cables shall also be tested.
 4. Acceptable fiber optic cable and connector loss shall not exceed 1.5 dB. The Contractor is responsible for obtaining minimum loss in fiber connections and polishing per manufacturer specifications.
- G. Acceptance of the Data Communications Cabling System shall be based on the results of testing, functionality, and the receipt of documentation. With regard to testing, all fiber segments and all workstation data cables must meet the criteria specified. With regard to functionality, the contractor must demonstrate to the Owner that 1000 Base-T data signals can be successfully transmitted, bi-directionally, from the MDF and from some number of individual data outlets. The number of outlet locations to be tested shall be determined by the Owner.
- H. Coordinate with Architect and Owner's Information Systems Department the required SCS identification prior to construction. Exact nomenclature for identification shall be submitted in writing to the Architect for review prior to final identification.
- I. Cable Drop Label Nomenclature:
 1. Cable and pathway administration will comply with ANSI/TIA 606-B.
 2. Format of cable, faceplate insert, and patch panel port label will be the same
 3. The MDF identifier is "MDF"
 4. Each IDF identifier will have a unique numeric character (e.g. IDF "1")
 5. Numeric identifier will be determined by patch panel position
 6. Cable terminated to upper left port on first patch panel will be A01, cable terminated to upper left port on second patch panel will be B01 (presupposing the first patch panel is a 48-port patch panel)
 - a. Examples: MDF-A01, IDF 1-B35

3.8 WARRANTY

- A. The Product Warranty shall cover the replacement or repair of defective product(s) and labor for the replacement or repair of such defective product(s).
- B. A twenty (20) year extended product warranty and application assurance for this structured cabling system shall be provided as follows:
 - 1. The extended product warranty shall ensure against product defects, that all approved cabling components exceed the specifications of TIA/EIA 568 and ISO/IEC IS 11801, exceed the attenuation and NEXT requirements of TIA/EIA TSB 67 and ISO/IEC IS 11801 for cabling links/channels, that the installation shall exceed the loss and bandwidth requirements of TIA/EIA TSB 67 and ISO/IEC IS 11801 for fiber links/channels. The warranty shall apply to all passive SCS components.
- C. The extended warranty application assurance shall cover the failure of the wiring system to support the application which it was designed to support by recognized standards or user forums that use the ITA/EIA 568 or ISO/IEC IS 11801 component and link / channel specifications for cabling, for a twenty (20) year period.
- D. Upon successful completion of the installation and subsequent inspection, the customer shall be provided with a numbered certificate, from the manufacturing company, registering the installation.

END OF SECTION 27 10 00

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AUDIO AND VIDEO DISTRIBUTION SYSTEMS FOR SPECIAL VENUES

1 GENERAL

1.1 RELATED WORK

- A. The following sections shall associate with this specification as applicable.
 - 1. General Conditions
 - 2. Supplementary Conditions
 - 3. Division 1
 - 4. Division 26 in its entirety.
 - 5. Division 27 in its entirety.
 - 6. Division 28 in its entirety.

1.2 DESCRIPTION

- A. Summary of Work:
 - 1. Provide all equipment specified well as all miscellaneous parts and materials required for the proper, complete, and functional Video and/or Sound Distribution System at the following Venues:
 - a. Divisible Training Rooms
 - b. Conference Rooms
 - c. Office Spaces
 - d. Training Room E208
 - e. Video Production D262
 - 2. All applicable equipment shall bear the UL label.
 - 3. Governing Codes and Conflicts: If the requirements of these specifications or the Project Drawings exceed those of the governing codes and regulations, then the requirements of these specifications and the Drawings shall govern. However, nothing in the Drawings or Specifications shall be construed to permit work not conforming to all governing codes, regulations, and manufacturer installation requirements.
 - 4. Locate equipment to accommodate millwork, fixtures, marker boards and other room equipment at no additional cost to the owner.
 - 5. Plenum rated cable may be used as an option at the contractor's discretion. Wherever cabling is run exposed, conduit shall be used to cover and protect wiring.
 - 6. These documents are conceptual in nature. It shall be the responsibility of the approved installer to furnish a complete and functional system, including the items shown on the drawings, in the specifications, and items not designated in either. The installer's shop drawings and product data submittals shall represent a complete system and documents accepted do not relieve the installer from being required to provide any materials, equipment, or labor to furnish a complete and functional system as recognized by the Project's Technology Consultant and the Owner.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. The contractor providing and installing the integrated audiovisual systems and associated infrastructure shall be an authorized dealer of the specified projector manufacturer and be capable of providing the manufacturer's maximum available

- product warranty.
 2. All individuals installing the audio-video system must be employees of the authorized dealer and at least 75% of the installing staff shall have undergone a training class given by the manufacturer. Current certification indicating the successful completion of the training course shall be available upon request at the project and submitted in the contractor's product submittals.
 3. The proposing contractor and the installing contractor must be the same company. No subcontractor to the proposing audio-video contractor will be allowed for any portion of the audio-video scope of work.
 4. The System Installer shall meet all applicable regulations of the State and Department of Labor insofar as they apply to this type of system. The bidder shall be a firm normally employed in the audio-video industry and shall provide a reference list of ten (10) projects of equivalent size or larger and contact names confirming successful completion of projection system installations.
 5. The bidder shall have an authorized service center, within 75-miles of the project's location, for the brand of equipment that is submitted for bid. The Owner, Architect, and Consultant reserves the right to perform an onsite inspection as they deem necessary.
 6. The bidder must produce a letter from the manufacturer guaranteeing the delivery of all the equipment outlined in the specification herein.
 7. The bidder shall have a full-time local service personnel capable of servicing the projector system described herein.
- B. Pre-Construction Meeting:
1. The successful Contractor shall attend a mandatory pre-construction meeting with individuals deemed necessary by the Owner's representative prior to the start of the work.
 2. The contractor shall provide a mockup of the complete integrated audiovisual system solution for each of the typical spaces below before implanting the installation in multiple like rooms. Mockup shall include all products listed in part 2 of this specification. Coordinate with G.C., Architect, Consultant, and Owner for scheduling and location of mockup.
 3. All proposing contractors must have ability to demonstrate a/v system being proposed and provide owner with completely installed system to evaluate performance and operation.
- C. Acceptance: The Owner's representative reserves the right to reject all or a portion of the work performed, either on technical or aesthetic grounds.
- D. Warranty:
1. The selected system installer shall be factory authorized service center and shall provide an end-to-end performance warranty of not less than one (1) year. The proposer shall provide current certification documentation. The performance warranty shall be issued by the manufacturer and shall warrant that video projection system projectors have been tested to the district's approval. This end-to-end warranty shall cover the labor associated with removing/reinstalling any associated hardware or equipment as well as the replacement of all defective equipment or hardware.
 2. The bidder shall also submit with the materials mentioned in section 1.5 submittals of this specification a written explanation outlining the terms and conditions of product warranty of all parts and service of the integrated a/v solutions.

1.4 REGULATORY REQUIREMENTS

- A. Standards: All work shall be performed in accordance with the latest revisions of the following standards and codes:
 - 1. Latest Local Codes and Amendments
 - 2. National Electrical Code, current version
- B. Other References:
 - 1. TIA/EIA-568-A Commercial Building Telecommunications Wiring Standard
 - 2. EIA/TIA-569 Commercial Building Standard for Telecommunication Pathways and Spaces.
 - 3. TIA/EIA-606 The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.
 - 4. TIA/EIA-607 Commercial Building Grounding and Bonding Requirements for Telecommunications.
 - 5. EIA/TIA 455-A Standard Test Procedure for Fiber Optic Fibers, Cables, Transducers, Sensors, Connecting and Terminating Devices and Other Fiber Optic Components.
 - 6. TIA/EIA TSB 67 Transmission Performance Specification for Field Testing of Unshielded Twisted-Pair Cabling Systems.
 - 7. TIA/EIA TSB 72 Centralized Optical Fiber Cabling Guidelines
 - 8. ISO/IEC 1180 Generic Cabling Standard
 - 9. EN 50173 Generic Cabling Standards for Customer Premises
 - 10. ANSI/EIA/TIA 526-14 Optical Power Loss Measurements of Installed Multimode Fiber Cable Plan.
- C. Governing Codes and Conflicts: If the requirements of these specifications or the Project Drawings exceed those of the governing codes and regulations, then the requirements of these specifications and the Drawings shall govern. However, nothing in the Drawings or Specifications shall be construed to permit work not conforming to all governing codes and regulations.

1.5 ABBREVIATIONS

- A. The following abbreviations are used in this document:
 - 1. AV-*# Audiovisual input station / Presentation Station (Reference drawing legend)
 - CMP Ceiling Mounted Projector LCD or LED Flat panel screen/monitor

1.6 SUBMITTALS

- A. Project Initiation: Within fourteen (14) days of Notice to Proceed, the projection system installer shall furnish the following in a single consolidated submittal:
 - 1. Permits: The Contractor shall obtain all required permits and provide copies to the Owner/Architect/Engineer.
 - 2. Product Literature: Complete manufacturer's product literature for all, speakers, amplifiers, cable, cross-connect blocks, cable supports, cable labels, outlet devices, and other products to be used in the installation. In addition, whenever substitutions for recommended products are made, samples (when requested by the Owner/Designer) and the manufacturer's supporting documentation demonstrating compatibility with other related products shall be included.
 - 3. Construction Schedule: A time-scaled Construction Schedule, using PERT/CPM, indicating general project deadlines and specific dates relating to the installation of the cable distribution system.
 - 4. Testing: Proposed Contractor test result forms, and a list of instrumentation to be

- used for systems testing.
5. The contractor shall provide a letter from the manufacturer stating that the dealer is an authorized service center.
 6. The resume and contact information of the full-time service personnel responsible for the installed projection system.
 7. Specification Compliance: A letter shall be provided stating, by section and subsection, that the installer complies with the ENTIRE specification section. If the installer intends to deviate from any portion of the specifications, a detailed explanation of reason in which the installer would like to deviate shall be provided in addition to the specification compliance letter. No deviations shall be acceptable until they have been accepted by the project's technology consultant.
 8. Certifications: The contractor shall submit all of the following certifications and the certifications must contain dates which are valid from the date of proposal and not expire any sooner than 12 months after substantial completion of the project.
 - a. Manufacturer authorized dealer certification
 - b. Installer training certification
 - 1) Provide specification with line-by-line acknowledgement of compliance.
- B. Shop Drawings: Submit the following items, for Owner review and approval, within twenty-eight (28) days of notice to proceed:
1. Proposed wiring and connectivity diagram of the proposed projection system including all faceplates and sound reinforcing equipment
 2. In addition to the wiring/connectivity diagram, the submitted drawings shall indicate the following, even if the following is expected to be provided by the project's electrical or general contractor:
 - a. Location of wall penetrations (all penetrations shall be sleeved and contain protective bushings at both ends)
 - b. Location of sleeved wall pass-thru
 - c. Size of sleeve at each location installed
 - d. Quantity of cable passing through each sleeve
 - e. Location of drops in each room (quantity or labeling of drops are not required in the submittal plans. Labeling shall be provided in the closeout plans and quantities shall be as per the contract documents, addendums, and issued changes. Each drop shall be labeled for the type of outlet that it is)
 - f. Conduit routing, size, quantity, and stub-up locations for all floor mounted outlets.
 3. Drawing Compliance: A letter shall be provided stating that the installer complies with the ENTIRE project drawing, including all general, keyed, and notes to contractor. If the installer intends to deviate from any portion of the specifications, a detailed explanation of reason in which the installer would like to deviate shall be provided in addition to the specification compliance letter. NO DEVIATIONS SHALL BE ACCEPTABLE UNTIL THEY HAVE BEEN ACCEPTED BY THE PROJECT'S TECHNOLOGY CONSULTANT.
- C. Project Completion: As a condition for project acceptance, the Contractor shall submit the following for review and approval:
1. Samples: Complete manufacturer's product literature and samples (if requested) for all pre-approved substitutions to the recommended products made during the course of the Project.
 2. Inspection and Test Reports: During the course of the project, the Contractor shall maintain an adequate inspection system to ensure that the materials supplied, and

the work performed conform to Contract requirements. The contractor shall provide written documentation that indicates that materials acceptance testing was conducted as specified. The Contractor shall also provide documentation, which indicates that all cable termination testing was completed and that all irregularities were corrected prior to job completion.

3. Operating and Maintenance Instructions: Operating and maintenance instructions for all devices within the system. These instructions shall reflect any changes made during the course of construction and shall be provided to the Owner for their use on disc or USB drive with the project name and description (2 copies).
4. Provide schematic line diagram of system components as deployed in each installation.

PART 2 – PRODUCTS

2.1 GENERAL

All products listed in this section shall be provided and installed by the contractor unless otherwise noted below. The following list is not intended to be a complete list of required equipment or cables as the project is to be Turnkey and may require equipment beyond the depth of this list. It is the contractor's responsibility to ensure that they are providing a complete and functional system with their proposal

- A. Installation: The cabling shall be installed per requirements of the manufacturer and the Project Documents utilizing materials meeting all applicable TIA/EIA standards. The Contractor is responsible for providing all incidental and/or miscellaneous hardware not explicitly specified below as required for a complete and operational system.
- B. Materials: Materials shall be as listed or shall be approved equivalent products of other manufacturers meeting the intent and quality level of the TIA/EIA specifications. All approved equivalent products will be published by addendum ten days prior to proposal for Architect / Engineer to review.
- C. Testing: All installed cabling shall be tested 100% good after installation by the Contractor.
- D. Ratings: All products shall be new and brought to the job site in the original manufacturer's packaging. Electrical components (including innerduct) shall bear the Underwriter's Laboratories label. All communications cable shall bear flammability testing ratings as follows:
 - CM Communications Cable
 - CMP Plenum Rated Communications Cable
 - CMR Riser-Rated Communications Cable
- E. Initial Cable Inspection: The Contractor shall inspect all cable prior to installation to verify that it is identified properly on the reel identification label, that it is of the proper gauge, containing the correct number of pairs, etc. Note any buckling of the jacket that would indicate possible problems. Damaged cable or any other components failing to meet specifications shall not be used in the installation.
- F. Cable Lubricants: Lubricants specifically designed for installing communications cable may be used to reduce pulling tension as necessary when pulling cable into conduit.
 1. Approved Products
 - a. Twisted-pair cable: Dyna-Blue
American Polywater

- G. Fire Wall Sealant: Any penetration through firewalls (including those in sleeves) will be resealed with an Underwriter Laboratories (UL) approved sealant.
1. Approved Products
 - a. 3M or
 - b. Pre-approved equal

2.1 TRAINING ROOMS G101-G109 – AUDIO AND VIDEO DISTRIBUTION

- A. Contractor to provide and install a complete video and audio distribution system in compliance with the equipment specified in the table below and associated drawings. Installation shall turnkey, including programming, testing, and training. Provide any additional equipment for a fully functional system.

QTY	MFR	PRODUCT NUMBER	DESCRIPTION
AUDIO DISTRIBUTION			
Ref. Plans	QSC	AD-C8T-ZB	8", 2-way Ceiling Loudspeaker
1	QSC	Core 110F	Digital Signal Processor
1	QSC	QIO-ML4i	Networked Four (4) mic/line input expander.
1	QSC	CX-Q 8K8	8 Channel @1250W/CH Amplifier
1	QSC	CX-Q 8K4	4 Channel @1250W/CH Amplifier
VIDEO DISTRIBUTION AND CONTROL			
2	Epson	EB-PU2113W	13,000-Lumen 3LCD Laser Projector with 4K Enhancement – Projector to be at minimum of 16' AFF to bottom. Provide any accessories required for high quality image. Shaky image shall not be accepted.
2	Epson	ELPLU04	Projector Lens
2	Da-Lite	Wireline 29223	220" Projection Screen – Provide (1) RS232 interfaces per Screen
11	Kramer	WP-SW2-EN7	4K AVoIP Encoder Wall Plate over 1GbE
9	Kramer	KDS-ENC7	4K AVoIP Encoder over 1GbE
11	Kramer	KDS-DEC7	4K AVoIP Decoder over 1GbE
1	Kramer	KDS-7 MNGR	AVoIP Manager for KDS-7 Series
9	QSC	TSC-101-G3	10" Touch Control Panel
1	QSC	QIO-S4	I/O Control Expander
11	Crestron	GLS-PART-CN	Cresnet Partition Sensors.
1	Crestron	RMC4	Cresnet Partition Sensors Control Processor
1	Crestron	DIN-CENCN-2-POE	Ethernet to Cresnet Network Bridge with PoE – Provide (1) 2U Rackmount DIN Rail Bracket
AV NETWORK EQUIPMENT			
1	Netgear	M4250-40G8XF-PoE+	1G Managed Network Switch with 960W Power budget
1	Netgear	M4250-GSM4248UX	1G Managed Network Switch with 2,880W Power budget
WIRELESS MICROPHONE			

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9	Shure	QLXD124/85	Combo Wireless Handheld and Lavalier Microphone System. (1 Receiver per divisible space)
9	Shure	QLXD24/SM58	Wireless Microphone System with QLXD2/SM58 Handheld Transmitter. (1 Receiver per divisible space)
5	Shure	UA844+SWB	Active Antenna Splitter
1	RF Venue	4ZONE	Antenna Combiner for Wireless Mic Receivers
9	RF Venue	D-ARC	Diversity Architectural Antenna for Wireless Microphones
1	Shure	UA221	Passive Antenna Splitter/Combiner Kit
9	Shure	MX153	Earset Headworn Microphone
14	Shure	SBC200-US	Dual Docking Charger with PS45US Power Supply
27	Shure	SB900B	Rechargeable Battery

2.2 TRAINING ROOM E208 – AUDIO AND VIDEO DISTRIBUTION

- A. Contractor to provide and install a complete audio and video distribution system in compliance with the equipment specified in the table below and associated drawings. Installation shall turnkey, including programming, testing, and training. Equipment shall be installed at IDF E204.

QTY	MFR	PRODUCT NUMBER	DESCRIPTION
AUDIO DISTRIBUTION			
Ref. Plans	QSC	AD-C6T-ZB	6.5", 2-way Ceiling Loudspeaker – Tap @ 30W
1	QSC	Core 8 Flex	Digital Signal Processor– Shared with Video Production D262.
1	QSC	SPA4-100	4 Channel @100W/CH Amplifier – Shared with Video Production D262.
VIDEO DISTRIBUTION AND CONTROL			
1	Epson	PowerLite 800F	Ultra Short Throw Laser Projector – Connect Projector Audio output to DSP Input
1	QSC	TSC-70-G3	7" Touch Control Panel
AV NETWORK EQUIPMENT			
1	Netgear	M4250-GSM4212PX	8 Port Managed Switch - Shared with Video Production D262.
WIRELESS MICROPHONE			
1	Shure	QLXD124/85	Combo Wireless Handheld and Lavalier Microphone System.
1	Shure	SBC200-US	Dual Docking Charger with PS45US Power Supply
2	Shure	SB900B	Rechargeable Battery
1	Shure	UA864US	Wideband Antenna
1	Shure	UABIAST	Bias-T Module

2.3 VIDEO PRODUCTION D262 – AUDIO AND VIDEO DISTRIBUTION

- A. Contractor to provide and install a complete audio and video distribution system in

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compliance with the equipment specified in the table below and associated drawings. Installation shall turnkey, including programming, testing, and training.

QTY	MFR	PRODUCT NUMBER	DESCRIPTION
AUDIO DISTRIBUTION			
Ref. Plans	QSC	AD-S6T	6.5", 2-way Loudspeaker
VIDEO DISTRIBUTION AND CONTROL			
1	QSC	TSC-70-G3	7" Touch Control Panel
2	Epson	PowerLite 815E	5000 Lumen Ultra Short Throw Laser Projector – Black in color
2	DA-LITE	Parallax 28804V	100" Wall Mounted HDTV Format Projection Screen.

2.4 AUDIO AND VIDEO COMPONENTS AND EQUIPMENT

- A. Custom Plates
 - 1. Liberty Panel Crafters, Proco, or RCI are approved manufacturers.
 - 2. Provide custom plates as indicated on the drawings.
- B. Equipment Rack: Provide and install equipment rack at locations designated on the contract drawings. Equipment rack shall consist of the following:
 - 1. Enclosure:
 - a. Atlas Sound 300 Series wall mount rack with 6 spare keys. Provide size to accommodate all equipment, plus an additional 25% for future growth.
 - 2. Additional Accessories:
 - a. (2) Middle Atlantic D3. (3) RU Drawer for microphone storage.
 - b. Juice Goose JG 8LED Power Distribution Center with LED Lighting
 - c. Juice Goose CQ 1520 Sequenced Power Control System
 - d. Provide any additional hardware or lacing strips to make a complete installation
 - e. Provide blank panels necessary to enclose rack completely.
- C. Miscellaneous Equipment
 - 1. Provide the following equipment for each room, unless noted otherwise.
 - d. (1) Atlas MS20E Mic Stand
 - e. (1) Atlas PB11XEB Boom Stand
- D. Assistive Listening
 - 1. Adjust DSP for "hard knee" compression on assisted listening output. Test and use equalization for maximum sound quality.
 - a. Listen LW-210-04 4-Channel Wi-Fi Audio Server
 - b. Listen LA-326 Universal Rack Mounting Kit
 - c. Listen LWR-1050 Wi-Fi Audio Receivers
 - d. Listen LA-438 Advanced Earphone/Neck Loop Lanyard
 - e. Listen LA-480/481 Intelligent 16-Unit Charging/Carrying Case
 - f. Provide quantities needed to fulfill the quantities stipulated in the Receivers for Assistive Listening Systems Table.

RECEIVERS FOR ASSISTIVE LISTENING SYSTEMS TABLE

Capacity of Seating in Assembly Area	Minimum Number of Required Receivers	Minimum Number of Required Receivers Required to be Hearing-aid Compatible
50 or less	2	2
51 to 200	2, plus 1 per 25 seats over 50 seats	2
201 to 500	2, plus 1 per 25 seats over 50 seats	1 per 4 receivers
501 to 1000	20, plus 1 per 33 seats over 500 seats	1 per 4 receivers
1001 to 2000	35, plus 1 per 50 seats over 1000 seats	1 per 4 receivers
2001 and over	55, plus 1 per 100 seats over 2000 seats	1 per 4 receivers

- E. Programming shall be coordinated with the Owner and Project's Consultant. Programming shall include, but not be limited to the following:
1. AV Control Panel Configuration
 2. Audio routing from any source location through the DSP
 3. Projector and screen control via the Audio / Video Control panels
 4. Device resolution and over/under-scanning settings
 5. Incorporation of any Owner furnished source equipment (maximum of 2)
 6. Combine and De-Combine configurations.
 7. Partition sensors shall be integrated into the system to manage the following functions based on room configurations and partition position:
 - a. Turning video displays off or on.
 - b. Merging or separating audio and video signals in combined or dec-combined spaces.
 8. Control system shall have the ability to override sensor operation through touch control Panels.
 9. Muting/unmuting microphones.
 10. Interactive Screen Touch function to control laptops shall be utilized on this project where applicable. Coordinate programming at divisible spaces with owner.

2.5 FLAT SCREEN DISPLAYS AND INTERACTIVE VIDEO DISPLAYS

- A. Provide and install the following at each flat screen display 'FSD-1' or 'FSD-2' location shown on the drawings:
1. ClearTouch Nio Digital Signage Display Series. Refer to plans for display size at each location.
 2. (1) Tilt display wall mount, Chief Part no. RMT3
- B. Provide and install the following at each interactive video display 'IVD' location shown on drawings:
1. 65" Display: (1) ClearTouch Part no. CTI-7065XT-UH20 with PC module.
 2. 86" Display: (1) ClearTouch Part no. CTI-7086XE-UH20 With PC Module.
 3. Adjustable Wall Mount: Provide the following at each wall mounted location on the entire project.
 - a. BalanceBox Product No. 480A12 for displays weighing between 90.4 – 152 lbs.
 - b. BalanceBox Product No. 480A14 for displays weighing between 145.5 – 209 lbs.
 - c. Above listed weights shall include 11.4 lbs for the VESA bracket and any other devices mounted to the display, such as an on-board PC, AV Decoder, etc.
 - d. Universal Vesa Bracket: BalanceBox Product No. 481A70.

2.6 PROJECTOR MOUNTING HARDWARE

- A. Provide the following mounting hardware at each Ceiling Mounted Projector location
 - 1. One (1) 2'x2' Above Suspended Ceiling Storage Box with Column Drop, Chief Product No. CMS492C
 - 2. One (1) Adjustable Extension Column, Chief Product No. CMS####*
 - a. Height adjustment in 1" increments
 - b. 1.5" NPT, threaded on both ends
 - c. '####' to be replaced with a numeric value depicting the minimum and maximum adjustment capabilities.
 - d. '*' to be replaced with a 'W' if required in white.
 - 3. One (1) Universal projector mount with keyed locking, Chief Product No. RPM#U*
 - a. '#' shall be replaced with an alphabetical character that shall depict the product version
 - b. '*' to be replaced with an alphabetical character depicting the mount color.
 - 4. All product finish colors shall be coordinated with the architect. Color should match the color of the mounted device and the finish of the surface it is mounted to.

2.7 ROOM SCHEDULING DISPLAYS

- A. Provide and install the following at room scheduler display 'RSD' location:
 - 1. (1) Room scheduling display Crestron part no. TSS-1070-B-S
 - 2. (1) Room availability light bar Crestron Part no. TSW-1070-LB-B-S

2.8 HDBASET EXTENSION SETS

- A. Provide and install the following at each display location associated with a wall mounted AV input 'AV-1':
 - 1. (1) HDBaseT Wall Plate Extension Set Liberty AV Part no. DL-1H1A1UC-WPKT-W
- B. Provide and install the following at each display location associated with a floor box AV input 'AV-1':
 - 1. (1) HDBaseT Extension Set Liberty AV Part no. DL-1H1A1UCB-H3. Provide mounting brackets as needed. Provide USB-C and HDMI connections to cable cubby/pocket.

2.8 AV FACE PLATES AND INSERTS

- A. Provide the following at AV input/output locations as required:
 - 1. (1) Stainless Steel QuickPort faceplate, Leviton Part no. 43080-2S4.
 - 2. (1) Gray 3.5 mm audio Pass-Through, Hubbell Part no. SF35FFGY
 - 3. Blank QuickPort Inserts, Leviton Part no. 41084-143-0B as needed.

2.9 AUDIO VISUAL PATCH CABLES

- A. Provide and install the following Patch Cables:
 - 1. Provide the following at each AV Input Outlet:
 - a. One (1) 10' HDMI Patch Cable, C2G Product No. 56784
 - b. One (1) USB-C Patch cable, C2G Product No. 28842
 - 2. Provide the following at each AV Output Outlet:
 - a. One (1) 6' HDMI Patch Cable, C2G Product No. 56783
 - b. One (1) 6' 3.5mm Audio Cable M/M C2G Product No. 22601 at locations where displays are connected to a local sound system. Provide Audio Baluns as needed.

2.10 CABLE ROUTING/PATHWAY

- A. Cable Support System: All audio-video cabling shall be installed and supported using an approved J-Hook cable support system at 4'-0" intervals unless installed in conduit. Do not exceed manufacture recommendation for the quantity of cables supported in an individual support.
- B. All cable bundles shall be grouped together using plenum rated Velcro for the entire run above and below the ceilings.

PART 3 – EXECUTION

3.1 GENERAL

- A. Contractor is required to properly mount integrated A/V solutions and connect all ceiling video / audio cables to projector component inputs.
- B. Contractor is required to thoroughly test and verify operation of all A/V inputs and video modes prior to project completion.
- C. Contractor is required to focus and adjust projector to properly project image on viewing surface (screen or multimedia board depending on location).
- D. Contractor shall provide owner with written verification test process and results once all projectors have been installed, tested, and placed in final condition.
- E. Damage: The Contractor shall replace or rework cables showing evidence of improper handling including stretches, kinks, short radius bends, over tightened bindings, loosely twisted and over-twisted pairs at terminals and cable sheath removed too far (over 1-1/2 inches).
- F. The Contractor shall replace any damaged ceiling tiles that are broken during cable installation.
- G. Clean Up: All clean up activity related to work performed will be the responsibility of the Contractor and must be completed daily before leaving the facility.
- H. Contractor shall provide wireless microphone system Coax cabling at all spaces.

3.2 DOCUMENTATION

- A. Contractor shall provide owner with detailed serial number listing and associated graphical room number designation equipment was installed. Contractor shall use actual graphical package room numbers not architectural plan numbers from construction set.

3.3 STATION WIRING INSTALLATION

- A. General: All cable must be handled with care during installation so as not to change performance specifications. Factory twists of each individual pair must be maintained up to the connection points at both ends of all category 6 cable. There shall never be more than one and one-quarter inch of unsheathed enhanced Category6 UTP cable at either the wiring USB Transmitter or Receiver.

- B. Exposed Cable: All cabling shall be installed inside walls or ceiling spaces whenever possible. Exposed station cable will only be run where indicated on the Drawings. Additional exposed cable runs will require Owner approval and will only be allowed when no other options exist.
- C. Placement: All cabling and associated hardware shall be placed so as to make efficient use of available space. All cabling and associated hardware shall be placed so as not to impair the Owner's efficient use of their full capacity.
- D. Cable Routes:
 - 1. All cabling placed in ceiling areas must be in conduit, cable tray or an approved J-Hook cable support. Cable supports shall be permanently anchored to building structure or substrates. Provide attachment hardware and anchors designed for the structure to which attached and that are suitably sized to carry the weight of the cables to be supported. Do not route cable through webbing of structural steel. Cabling must be supported in dedicated supports intended to support cabling as described in this section. Contractor shall adhere to the manufacturer's suggested fill ratio for each size cable support installed.
 - 2. Attaching cable to pipes or other mechanical items is not permitted. Communications cable shall be rerouted so as to provide a minimum of 18 inches spacing from light fixtures, sources of heat, power feeder conduits and EMI sources. Cabling shall not be attached to ceiling. Grid support wires. Cable runs shall be routed down the corridors; parallel or perpendicular to building structure. Multiple cables to be bundled together at and between each cable support installed.
 - 3. Contractor shall be responsible for coordinating with other trades on the project so that the installed cable pathway does not interfere with the installation of other systems to insure that mechanical ducts, pipes, conduits, or any other above ceiling systems are not putting unnecessary stress on any portion of the install audio-video cabling.

3.4 STATION HARDWARE

- A. Flush mounted components: all component shall be inserted to a flush mounted faceplate unless designated otherwise.
- B. Placement: Where possible, the AV input outlets shall be located so that its centerline is 18 inches above floor level or 12 inches above permanent bench surfaces. Outlets shall not be mounted on temporary, movable, or removable surfaces, doors, or access hatches. The CMP outlet shall route directly to the rear of the projector and does not require any type of faceplates.

3.5 PROGRAMMING

- A. Programming shall be coordinated with the Owner and Project's Consultant. Programming shall include, but not be limited to the following:
 - 1. AV Control Panel Configuration
 - 2. Audio routing from any source location through the DSP
 - 3. Projector and screen control via the Audio / Video Control panel
 - 4. Device resolution and over/under-scanning settings
 - 5. Incorporation of any Owner furnished source equipment (maximum of 3)

3.6 FINAL TESTING REQUIREMENTS

- A. Notification: The Owner and Engineer shall be notified one week prior to any testing so that the testing may be witnessed.
- B. Inspection: Before requesting a final inspection, the Contractor shall perform a series of end-to-end installation performance tests. The Contractor shall submit for approval a proposal describing the test procedures, test result forms and timetable for all copper and fiber optic cabling.
- C. Procedures: Trained personnel shall perform all testing. Acceptance of the test procedures discussed below is predicated on the Contractor's use of the recommended products and adherence to the inspection requirements and practices set forth. Acceptance of the completed installation will be evaluated in the context of each of these factors. Testing procedures shall consist of, but not me limited to the following:
 - 1. Input locations to be tested utilizing multiple types of source equipment.
Equipment to include:
 - a. Personal Computer (laptop)
 - b. Apple iMac
 - c. Apple Mac Mini
 - d. Google Chromebook
 - e. Additional devices may be required at the time of testing
 - f. contractor to provide devices on a single cart, to roll between inputs during testing.
 - 2. Routing of video, from any source to each projector and display simultaneously and independently.
 - 3. Routing of audio, from any source to each audio channel simultaneously and independently.
 - 4. Control of the entire system from each installed A/V Control Panel
 - 5. Additional test requirements may be required at the Owner and/or Consultant's request.

3.7 OWNER TRAINING AND DEMO

- A. A/V integrator shall provide demonstration of all integrated a/v solutions to owner's staff that have any stake with the operation and maintenance of the a/v solutions. Integrator shall produce sign in sheets for record of who was trained and when. Copies of sign in sheets shall be submitted with close out paperwork. Coordinate training dates with owner at project completion.
- B. Integrator shall provide official factory training for owner's operations, maintenance and troubleshooting personnel for each major component of the systems listed in the A/V solutions outlined in part 2 of these specifications. Training shall be a minimum of 4 hrs. per person. Re-training of staff shall be available, at no cost to the owner, to a maximum of 3 on-site training sessions up to 1 year from the date of project competition.
- C. All training is to be recorded via video recording and a copy of the recorded video shall be provided to the owner upon completion. All video recording equipment, for the recording of training, shall be provided by the integrator.

END OF SECTION 27 41 16.20

SECTION 27 50 10

BUILDING INTERCOMMUNICATIONS AND PAGING SYSTEM

1 GENERAL

1.1 RELATED WORK

- A. The following sections shall associate with this specification as applicable.
 - 1. General Conditions
 - 2. Supplementary Conditions
 - 3. Division 1
 - 4. Division 26 in its entirety.
 - 5. Division 27 in its entirety.
 - 6. Division 28 in its entirety.

1.2 WORK INCLUDED

- A. Furnish and install a complete Building Intercommunications and Paging System.
 - 1. A complete system includes items such as wiring, push/call buttons, handsets, control consoles, and main distribution equipment.
 - 2. Integrate all components to provide a complete and functioning system that supports district wide communication.
- B. Locate equipment to accommodate millwork, fixtures, marker boards and other room equipment at no additional cost to the Owner.
- C. Integrate the communications system with the following systems:
 - 1. Owner's IP Telephone System
 - 2. Local sound reinforcement sound systems
 - 3. Fire Alarm System
- D. Return air plenum cable shall be used. Wherever cabling is run exposed, conduit shall be used to cover and protect wiring.
- f. These documents are conceptual in nature. It shall be the responsibility of the approved installer to furnish a complete and functional system, including the items shown on the drawings, in the specifications, and items not designated in either. The installer's shop drawings and product data submittals shall represent a complete system and documents accepted do not relieve the installer from being required to provide any materials, equipment, or labor to furnish a complete and functional system as recognized by the Project's Technology Consultant and the Owner.
- G. The proposed system shall be a traditional intercom system, wired for 25v/70v configuration. A system with IP based field devices will not be acceptable. All head end equipment is to be located in the building MDF, with cross-connect fields located in IDF (as required) and all termination fields shall connect to the MDF via Multi-Conductor (minimum of 25-pair per remote termination field).
- H. Any category 6 network cabling for this system shall be provided by the Structured Cabling System installers. Patch cables within the closet can be provided by the intercom installer and coordinated with the owner for patching into the Owner's network. Since this is a traditional intercom system, there should be no requirement for category 6 cable to be routed out of the MDF, for network connectivity purposes. In the event that there is any requirement, the installer of the cabling shall meet the requirements and

qualifications specified in the Structured Cabling System specification.

1.3 QUALITY ASSURANCE

- A. Provide the system by a company that has been designing and supplying similar systems for a period of 3 years. Provide, upon request by Owner or Architect / Engineer names and addresses of similar installations.
- B. Provide central processing control console wiring connections by factory engineers or authorized factory trained personnel.

1.4 WARRANTY

- A. Warranty equipment for a period of 1 year, from date of substantial completion.
- B. Correct defects in material or workmanship with a minimum loss of operating time at no cost to Owner.
- C. On site service.

1.5 SUBMITTAL

- A. The installing contractor and/or equipment supplier shall provide complete and detailed shop drawings and include:
 - 1. Wiring and interconnection schematics.
 - 2. Complete point-to-point wiring diagrams
 - 3. Riser diagrams.
 - 4. Complete floor plan drawings locating all system devices.
 - 5. Factory data sheets on each piece of equipment proposed.
 - 6. Detailed system operational description. Any specification differences and deviations shall be clearly noted and marked.
 - 7. Complete system bill of material.
 - 8. Line by line specification review stating compliance or deviation.
- B. All submittal data will be in bound form with Contractor's name, Supplier's name, and project name adequately identified.
- C. Minimum size drawings: 11" x 17".

1.6 COORDINATION

- A. It shall be the responsibility of the installing contractor to coordinate all requirements surrounding installation of the Building Intercommunications and Paging System with all other trades.
- B. Pre-installation meeting: Schedule a pre-installation meeting specifically for the Building Intercommunications and Paging System with Owner and Architect.

1.7 REFERENCES

- A. National Electrical Code.
- B. UL

- C. Building Intercommunications and Paging System connected to a telephone utility company shall comply with the Federal Communications Commission rules Section 68 and the corresponding UL listing.

2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. The products specified in are intended to establish quality, functionality, color, and standards. The following shall be considered preapproved equivalent for each specific portion of the Building Intercommunications and Paging System.
 - 1. Telcor eSeries
 - 2. Manufacturer approval request must be submitted in compliance with the Division 1 instructions and must be received no less than ten (10) business days prior to the posted proposal submission date. No substitutions will be allowed if not submitted per these instructions and approved via official pre-bid addendum.

2.2 CENTRAL CONTROL EQUIPMENT

- A. The central equipment shall be mounted wall mounted. The central equipment shall consist of but not be limited to:
 - 1. The equipment housing.
 - 2. A power supply to provide operating DC power for the circuitry contained within the central equipment housing and all administrative control stations (ACSs) shall be provided.
 - 3. A central microprocessor unit containing all solid-state memory and components necessary to provide the features specified herein.
 - 4. Zone circuit boards as required to meet the system requirements for remote stations and/or communications linkage.
 - 5. The provision for terminating the cabling from up to 128 remote stations and 8 administrative control stations (ACSs) shall be provided.
 - 6. The provisions to automatically activate a selectable program source between class changes.
 - 7. Network IP communications to receive building-wide mass notifications over Owner data communications network.

2.3 EXTERNAL PAGING AMPLIFIER

- A. External paging amplifiers shall be provided as required to meet the load requirements of the system when activated in the all-page mode. The system shall be equipped with equipment required for (one) program channel.
- B. Program/paging amplifiers shall have the following:
 - 1. Power output shall be capable of providing sufficient power for the speakers required to the project and include an additional 25% capacity.
 - 2. Maximum .5% harmonic distortion from 20-20KHz.
 - 3. Frequency response of 20Hz to 20KHz +/-1 dB.
 - 4. 90 dB signal to noise ratio at 20Hz to 20 KHz.
 - 5. 1V RMS input sensitivity at 1KHz.
 - 7. Master volume control.

2.4 PROGRAM SOURCES

- A. CD/Media Player with Bluetooth®/USB/SD/Aux and AM/FM Tuner – Denon Product No. DN-300Z

2.5 EMERGENCY TONE GENERATOR

- A. Multi-tone generator with priority relay to override any paging or program function of the system.
- B. The tone generator shall be activated from an external contact closure provided by remote emergency pushbuttons.

2.6 EQUIPMENT RACK

- A. The central equipment shall be housed in a 19-inch W X 72-inch H equipment rack with casters. The rack shall be of sufficient vertical size to contain all of the specified equipment to be housed within. The rack shall be equipped with a locking rear door and removable side panels. All unused front panel space shall be filled with the appropriate size blank panels.
- B. Telephone Type 66 blocks shall be mounted inside lockable, hinged panel with 3/4" painted plywood backboard.
- C. The program sources shall be remotely located from the control equipment. The rack shall be a wood grain finish, tabletop rack located as directed by the Owner.

2.7 SPEAKERS

- A. Ceiling speakers:
 - 1. General Purpose Speaker: 8" speaker with 5 oz. magnet complete with line matching transformer. Program rating shall be 5 watts continuous. The speaker shall be a Quam System 12, 2x2 lay-in at grid ceilings and Quam Solution 1 at hard ceilings. 25/70V transformers shall have primary taps of 0.25, 0.5, 1, 2 and 5 watts. Tap speaker at 0.25 watt. White finish unless indicated otherwise.
 - 2. office, conference, telephone, workroom speakers: 8-ohm speaker with 5 oz. magnet, complete with line matching transformer. Program rating shall be 4 watts continuous. The speaker shall be a Quam System 12/VC 2x2 lay-in at grid ceilings and Quam Solution 2 at hard ceilings, with integral volume control. 25/70V transformers shall have primary taps of 0.25, 0.5, 1, 2, 5 watts; tap speaker at 0.5 watt.
- B. Recessed Vandal proof wall mounted paging horn:
 - 1. Provide and install at all exterior device locations and interior device locations that are subject to high impact (gymnasium)
 - 2. Exterior Speakers to be tapped at 7.5 watts.
 - 3. Interior Speakers to be tapped at 4 watts
 - 4. Atlas Sound APF-15T with 193-8-6 square recessed back box and VP161-APF aluminum alloy grille, white finish, neoprene gasket.
- C. Surface mount speaker/horn:
 - 1. Provide for interior use, in areas that are not subject to high impact.
 - 2. Quam H16/SVP vandal resistant loudspeaker with multitap line matching transformer.
 - a. Provide recessed mount enclosure at each location, Quam Product No. ES-8S

- D. Wall mounted volume control: Atlas Sound AT-10PA or Quam QC-10P recessed autotransformer volume control. Volume control shall have public address (PA) emergency override of volume control.
- E. Remote Source Output Volume Control: Rack mounted in remote source rack. Provide line level volume control of output of each remote source device. Label each volume control for each output device.

2.8 CALL-IN DEVICES

- A. Administrative Control Station (ACS)
 - 1. The administrative control station (ACS) shall be the control center for communications, paging, and signaling functions for the system. The ACS shall contain control panel with buttons for functional control and user programming.
 - 2. For voice intercom, the ACS shall be equipped with a handset, keypad, speaker, microphone, and a TALK/LISTEN button.
 - 3. Each ACS shall be equipped with a sounder for audible annunciation of incoming calls.
 - 4. The ACS shall be capable of answering the next call in the calls waiting stack by depressing only one button.
 - 5. An ACS shall have the ability to forward its call-in coverage to another ACS. An indication shall be shown in both the ACS forwarding coverage of calls as well as the ACS to which call coverage is being forwarded to. When in the forward coverage mode, an ACS shall still visibly annunciate incoming calls, and it can be used to make and answer calls or other assigned functions.
 - 6. It shall be possible to manually activate and sound the time event signal to any of the 8 time zones from the ACS.
 - 7. The ACS shall be equipped with a built-in tone generator, which provides for both time signal tone and user accessible tones (single chime, repetitive chime, steady tone, hi-lo, alarm, wail, and warble) for use as manually activated emergency or other signals.
 - 8. All ACSs shall have a dedicated control labeled "ALL PAGE". The operation of this control shall gather all speakers for distribution of tone signaling distress or emergency signals, and emergency voice announcements. This control shall be defeatable as to restrict access into the all-page function only to assigned ACSs.
 - 9. A designated ACS within the system shall have the ability to enter the user accessible functions for data input and programming. A "Security Code" number shall be required to enter this programming mode.

2.9 WALL MOUNTED VOLUME CONTROL (ATTENUATORS)

- A. Attenuator(s) shall be Atlas Sound AT Series Model AT10-PA auto transformer or approved equal. The power rating shall be 10W and total attenuation shall be 33dB. Attenuation per step for AT10-PA shall be 8 steps of 3dB and 6dB each for the last two positions. Attenuator shall be a step type control with a positive off position. There shall be no stop between the maximum and off positions. Switch shall have silver plated contacts to eliminate noise and contact loss. All terminations must be made via a removable terminal block. Unit(s) shall be supplied with stainless steel single gang face plates (with dial scale to indicate attenuator position).

2.10 ANTENNA

- A. Roof Mounted FM Antenna.
 - 1. Gain of not less than 6.5dB at frequencies of 88 to 108 MHZ and 20 dB front to back rejection ratio.

2. Coaxial antenna lead-in.
- B. Loop type indoor AM antenna oriented and located as required.

2.11 MASTER CLOCK SYSTEM

- A. The system shall contain an integral Master Clock and Programmer that shall be capable of performing the following functions:
1. Provide 500 discrete time event entries for programming functions based upon:
 - a. The time of day in hours and minutes
 - b. The day or combination of seven days of the week on which the event is to occur
 - c. The selection of any one or any combination of 32 zones or (8) outputs to be activated
 - d. The selection of any one or combination of 16 schedules to allow for maximum flexibility due to special circumstances or seasonal changes.
 - e. The selection of 16 user-programmable Event Tones
 - 1) Any combination of time schedules may be active simultaneously
 - 2) Event Tones are programmable from a library of 25 Tone Types
- B. Provide for Automatic Daylight Savings Time adjustment with Leap Year programming.
- C. Provide momentary contact closures for external device operation. Provide four inputs, four outputs and four flex-puts.
1. Inputs shall be programmable by the user to initiate any desired system activity (e.g. Page, Tone, Program, Event, System Reset, etc.)
 2. Outputs shall be programmable by user to activate during any desired system activity (e.g. Page, Tone, Program, Time of Day, etc.)
 - a. Display the time of day in either 12 or 24-hour format at each Administrative telephone
 - b. Master clock shall correct compatible secondary clocks, analog, digital, or both
- D. The system shall provide for an editing and review routine to permit the user to change and edit time events, zones, and schedules.
- E. The system shall allow pre-selected program material to be distributed according to pre-programmed schedules, i.e. March to Music, National Anthem, etc.

2.12 UPS BATTERY BACK-UP

- A. Provide UPS Battery back up for the communications system to operate a minimum of 24 hours stand-by then 30 minutes of operation upon loss of power.
- B. Acceptable Manufacturers: Liebert, APC, or TrippLite

3 EXECUTION

3.1 INTERCOM SYSTEM DESCRIPTION

- A. The intercom system shall consist of a central equipment cabinet, microprocessor control unit, power supply, zone modules, administrative control stations (ACSs), amplifiers, and station loudspeaker assemblies. Provide all associated material hardware, wiring, and

options as described herein to provide a complete working system, which shall meet the specified requirements.

- B. The intercom system shall provide the following communications paths and functions.
 - 1. ACS to remote loudspeaker station (provide two channels).
 - 2. Administrative control station to administrative control station.
 - 3. Remote speaker to administrative control station.
 - 4. Zone paging.
 - 5. Network IP Mass Notification
- C. The system shall be designed so as to accomplish any combination or all of the above functions simultaneously.
- D. The system shall provide the facilities for the paging or sounding emergency signals or time event signals to selected groups or all remote speakers.
- E. The system shall provide facilities for the control and distribution of up to two program channels to individual, selected groups, or all remote speakers, as well as intercom communications and class change signals.
- F. The system shall include the facilities of a built-in master clock and programmer capable of correcting appropriate secondary clock displays and controlling events based on user programmed time schedule programs.
- G. Provide remote control of program distribution. Distribution of the program source shall be possible from any administrative control station (ACS).
- H. Zone system as follows:
 - 1. All speakers in corridors shall be zone area designation. (ie. all speakers in corridors in the 100 series rooms, all speakers in corridors in the 200 series rooms. etc. etc.)
 - 2. Restrooms, Toilets, Electrical Rooms, Mechanical Rooms, Telephone Closets, Data Closets, Janitor's Rooms, and Storage Rooms shall be zoned with the nearest corridor zone.
 - 3. All outside horns shall be one zone.
 - 4. Each individual room such as and not limited to cafeteria, kitchen office, conference room and gymnasium shall be an individual zone.

3.2 INTERCOM SYSTEM FUNCTIONS

- A. The base system shall provide one simultaneous open voice speech paths between administrative control station and station loudspeakers within each 24-zone / group
 - 1. The speech channels shall be true multiple, simultaneous, UNRESTRICTED, amplified voice channels requiring no automatic queue or call stacking to access the intercom amplifier.
 - 2. The system shall come equipped to provide modular expansion to eight (8) simultaneous open voice speech paths and a minimum expansion capability of 128 additional stations.
 - 3. An intercom amplifier shall be provided integral with each ACS.
- B. The system shall provide the capacity for both a loudspeaker station and a pushbutton at each remote location. Each remote station shall be assigned an architectural or ID number to communicate with its assigned ACSs. The system shall permit user selection of 2, 3, 4, or 5-digit architectural dialing.

- C. The system shall allow preselected coverage of calls from remote station to ACS on a remote station basis. A remote station shall be able to report to multiple administrative control stations simultaneously. Functions of an unattended ACS may be forwarded by the user to an attended ACS. This provides overlapping or distinct coverage of remote stations by administrative control stations. Systems not allowing programmable flexibility of remote station coverage shall be unacceptable.
- D. The system shall incorporate all necessary circuitry to prevent monitoring of remote stations equipped with call origination switches with privacy mode.
- E. The system shall have 8 user assignable groups of stations for zoned audio paging with any remote station belonging to more than one group. A separate group/zoning shall be user assignable for 8 zones of class change signals.
- F. The system shall allow for user definable pre-selective access to "zone" and "all-page" functions. This feature will prevent unauthorized paging from designated ACSs.
- G. The system shall provide facilities so that the user has access for sounding selected tones from any ACS on either all-page or by zone basis for use as emergency or other alarm signals.
- H. Provisions shall be provided inherent to the system, to allow for the use of a priority override inputs (i.e. principal's microphone and telephone extension). This circuit, when activated by an external source, shall gather all speakers for distribution of the signal information provided by the external source. This priority override input shall preempt other functions currently under way in the system. Upon conclusion of the priority override function, all pre-empted functions shall be automatically restored.
- I. The system shall have the capability to operate with external paging amplifiers to increase the audio output available for paging. Adequate audio amplification shall be provided as required.
- J. The system shall be equipped with control point outputs and activate outboard devices such as priority override muting relays on remote local sound reinforcement systems. The control point outputs shall be activated when the system is placed in the emergency page mode or if the emergency tone generator is activated and shall mute the output of the local sound reinforcement system.
- K. The system shall be equipped with RS-232 ports to allow for the following:
 - 1. Diagnostics via a standard computer terminal.
 - 2. Modem interface to allow remote factory engineering assistance. Systems not providing a port of access to the system shall not be acceptable.
- L. System must allow simultaneous operation of both diagnostic and functional routines (paging, zone page, time events, call-in, etc.).
- M. The system shall have the ability to perform scan functions from the administrative control stations or computer terminal for:
 - 1. Review of call-in coverage assignments to an ACS.
 - 2. Review ID numbers of remote stations assigned to either of the two program channels.
 - 3. Review that ACSs are forwarding coverage.
 - 4. Edit and review master clock time programs.

- N. Higher priority calls shall not cancel when the "Clear All Calls" routine is used. Only normal calls shall clear and cancel.
- O. Line loss on two-way communications circuits to be no greater than .5dB per 500 feet of circuit length.
- P. The system shall be provided with the capability to activate an emergency tone / signal / wav file from remote emergency pushbuttons located throughout the building. Deactivation shall require password protected access from an ACS.

3.3 INSTALLATION

- A. General: Install new Building Intercommunications and Paging System components in accordance with the manufacturer's instructions.
 - 1. Terminate all field wiring on telephone punch blocks mounted in an enclosure as specified.
 - 2. Label cables and wiring logically, legibly, and permanently for ease of identification, using adhesive strip type labels.
 - 3. All communications wires and cables, which are to be routed in the ceiling spaces shall be identified and tagged every 50 feet. The identification shall include the room number on markers similar to T&B sleeve marker.
 - 4. Provide integration of clock and bell, telephone system.
 - 5. Provide integration of local sound reinforcement system override.
 - 6. Provide integration of remote emergency pushbuttons.
- B. Speaker Installation:
 - 1. Install new speaker types as indicated on the drawings.
 - 2. Speakers in high ambient noise areas (cafetorium, gymnasiums, etc.) Shall be tapped as required to overcome the ambient noise generated by the public.
 - 3. Provide silicone sealant to all openings and conduit penetrations at all exterior back box locations.
- C. Conduit and Cables
 - 1. Install conduit, fittings and boxes as specified in Division 26.
 - 2. Single system cables shall be grouped together in a common conduit of adequate capacity to facilitate the ease of installation and prevent conductor or insulation damage.
 - a. In no case shall the conduit fill exceed 50% capacity.
 - b. Do not group conductors or cables of different systems in a common conduit.
 - 3. Cable:
 - a. Install cables as recommended by the system manufacturer. Conductor quantities specified are minimum required. Conductors to be installed shall be coordinated with the system equipment supplier.
 - b. Cables installed on exposed surfaces, in inaccessible locations, or underground shall be installed in conduit.
 - c. Cables installed above accessible, ceiling spaces may be installed without conduit. All cables not installed in conduit shall be plenum rated.
 - 4. Cables not installed in conduit shall be grouped and bundled. Cable shall be bundled on a maximum of 2'-6" on center. Support cables from D-rings or J-hooks. D-rings and J-hooks shall be secured to the structure at a maximum of 5' on center. Bundling and support shall be with plenum rated cable ties.
 - 5. Cables installed in hollow wall spaces shall be installed in conduit to an accessible location.
 - 6. Tag each circuit at each end and at each terminal with a separate tag indicating

the area served.

3.4 INSTRUCTIONS

- A. Provide eight hours instruction to the operating/maintenance personnel, which shall include initial programming of eight schedules.

3.5 TESTING AND ACCEPTANCE

- A. General
 - 1. After completion of installation and start-up procedures, commence a verification and testing sequence leading to final acceptance.
 - 2. Submit for approval, a sample of the form on which the test will be reported.
 - a. Identify project.
 - b. Provide a list of all system devices, arrange in numerical order of point addresses.
 - 1) Show descriptor and location of each.
 - c. Signatures of participants and observers.
 - d. Results.
 - e. Description of adjustment or corrections of defective components.
 - f. Date.
 - 3. Provide schedule of tests. Estimate dates of significant events.
 - a. All testing shall be performed in the presences of the Owner / Engineer.
 - 4. Test, calibrate and adjust each device in the system.
 - 5. Verify operation of all specified functions.
 - 6. Provide documentation of all tests and verifications as specified.

3.6 GRAPHIC FLOOR PLANS

- A. Provide two (2) color coded floor plan detailed with actual room names, actual graphic room numbers as directed by the Owner, and adequate information to indicate group / zone / circuit information with non-fading floor plan media. Do not use architectural plan room names and numbers.
- 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. The floor plan shall be solvent welded in acrylic plastic.
 - 1. Mount in an extruded aluminum frame.
- D. Install graphic floor plans as directed by Architect / Owner prior to substantial completion. Each area or room designation shall be verified with the communication device during testing.

3.7 GROUNDING OF EQUIPMENT

- A. Racks and cabinets shall be grounded to the metallic structure of the building or to the building system power ground in accordance with NEC section 250. Securely bond equipment to the ground system through a minimum 14-gauge green insulated conductor.
- B. Electronic systems shall be grounded to the building system ground, with a maximum

resistance of 0.1 ohm. Systems ground shall be a driven ground rod, building steel, or other approved ground of the building power systems ground.

3.8 ANTENNA

- A. Furnish and install the Antenna as specified.

3.9 SERVICE AND MAINTENANCE

- A. The contractor shall provide a 1-year warranty of the installed system against defects in material and workmanship. All labor and materials shall be provided at no expense to the Owner during normal working hours. The warranty period shall begin on the date of acceptance by the Owner/Engineer.
- B. The contractor shall, at the Owner's request, make available a service contract offering continuing factory authorized service of this system after the initial warranty period.
- C. The installing contractor shall submit evidence that he maintains in his service department the following items:
 - 1. Central Switch Assembly
 - 2. Station Line Card
 - 3. Master Station Module
 - 4. System Control Card

END OF SECTION 27 50 10

SECTION 28 01 00

ELECTRONIC SAFETY AND SECURITY OPERATING AND MAINTENANCE MANUALS

1 GENERAL

1.1 WORK INCLUDED

- A. Compile Electronic Safety and Security (ESS) product data and related information appropriate for Owner's operation and maintenance of products furnished under Contract. Prepare ESS 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 5 copies of complete manual in final form.

1.2 ESS OPERATING AND MAINTENANCE MANUAL SUBMITTAL SCHEDULE

- A. Thirty (30) days after receipt of reviewed submittals bearing the Architect/Engineer's stamp of acceptance (including resubmittals), submit for review 1 copy of the first draft of the ESS 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 Low Voltage Wire and Cable
 - 12. Schedule of ESS Equipment
 - 13. Schedule of ESS Field Devices
 - 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 (5) completed manuals in final 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. Four complete manuals shall be delivered to the Owner.

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 ESS 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:

**ELECTRONIC SAFETY AND SECURITY OPERATING AND
MAINTENANCE MANUALS**

SECTION 28 01 00

- a) Supplement product data with drawings as necessary to illustrate:
 - (1) Relations of component parts of equipment and systems.
 - (2) Cable Plant Layout
 - 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 which 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 data, engineering data and tests.
 - (3) Complete nomenclature and commercial number of replaceable parts.
 - b) Operating procedures:
 - (1) Start up, routine and normal operating instructions.
 - (2) Regulation, control, stopping, shut down and emergency instructions.
 - (3) Special operating instructions.
 - c) Maintenance procedures:
 - (1) Routine operations
 - (2) Guide to trouble-shooting.
 - (3) Disassembly, repair and reassembly.
 - (4) Adjusting and checking.
 - (5) Routine service
 - d) Manufacturer's printed operating and maintenance instructions.
 - e) Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.
 - (1) Items recommended to be stocked as spare parts.
 - f) Schedule of low voltage wire and cable
 - g) Schedule of ESS equipment
 - h) Schedule of ESS field devices
 - i) Each Contractor's coordination drawings.
 - (1) As installed color-coded wiring and cabling diagrams.
 - j) List of original manufacturer's spare parts and recommended quantities to be maintained in storage.
 - k) 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 28.
 - 5. Provide certificates of compliance as specified in each related section.
 - 6. Provide start up and testing reports as specified in each related section.
 - 7. Provide signed receipts for spare parts and material.

**ELECTRONIC SAFETY AND SECURITY OPERATING AND
MAINTENANCE MANUALS SECTION 28 01 00**

8. Provide training report and certificates.

END OF SECTION 28 01 00

SECTION 28 05 00

ELECTRONIC SAFETY AND SECURITY GENERAL PROVISIONS

1 GENERAL

1.1 RELATED DOCUMENTS

- A. Except as modified in this Section, General Conditions, Supplementary Conditions, applicable provisions of Division 01 General Requirements, and other provisions and requirements of the Contract Documents apply to work of Division 28.
- B. Applicable provisions of this section apply to all sections of Division 28.
- C. The general provisions of the Contract and the requirements of the following Sections apply to the Work specified in this Section. See Division 26 for related general and specific requirements.

1.2 CODES AND STANDARDS

- A. All equipment and work performed shall comply with all of the current and applicable Codes, Rules, Ordinances, Regulations and Standards (including those not specifically listed in this Specification) as interpreted and enforced by the authorities having jurisdiction including:
 - 1. Americans with Disabilities Act (ADA)
 - 2. Authorities Having Jurisdiction (AHJ) - Local
 - 3. American National Standards Institute (ANSI)
 - 4. American Society of Testing and Materials (ASTM) *Communications Cables - B694, B736, D4565, D4566, D4730, D4731, D4732*
 - 5. Building Industry Consulting Services International (BICSI)
 - 6. Code of Federal Regulations - Title 47
 - 7. Electronics Industries Association (EIA) *Standard Test Procedures for Fiber Optic Fibers, Cables, Transducers, Connecting and Terminating Devices - EIA-455 Series*
 - 8. Federal Communications Commission (FCC) - Communications Act and FCC Rules
 - 9. Federal Information Processing Standards (FIPS) *Federal Building Standard for Telecommunications Pathways and Spaces - FIPS PUB 175, FIPS PUB 176*
 - 10. The Insulated Cable Engineers Association (ICEA) *Communications Cable Stands - P-47-434, S-56-434, S-80-576, S84-608, S-85-625, S-86-634, S-87-640, S-89-648, S-90-661, S-98-688, S-99-689, S-100-685*
 - 11. International Electro-Technical Commission (IEC)
 - 12. Institute of Electrical and Electronic Engineers (IEEE) *Local Area Networks/Metropolitan Networks Standards Collection - LAN/MAN 802 Series*
 - 13. International Organization for Standardization (ISO) (ISO/IEC) *Premise Wiring Core and LAN/MAN Core Equivalents-11801, 8802, 14763-1*
 - 14. International Telecommunication Union (ITU-T) *Telecommunications Standardization*
 - 15. National Electrical Code (NEC) *National Electrical Code - NFPA 70*
 - 16. National Electrical Contractors Association (NECA) *Standards of Installation*
 - 17. National Electrical Manufacturers Association (NEMA) *Performance Standard for Twisted Pair Premise Voice and Data Communications Cable-WC 63.1, WC 63.2, WC 66*
 - 18. National Electrical Safety Code (NESC)
 - 19. National Fire Protection Association (NFPA) - *National Fire Alarm Code NFPA 72, Life Safety Code NFPA 101*

20. Society of Cable Telecommunications Engineers (SCTE)
 21. Local Accessibility Standards
 22. Telecommunications Industries Association (TIA) (*ANSI/TIA/EIA Wiring and Cabling Standards - 526, 568, 569, 570, 571, 598, 606, 607, 758, TSB 31-B, 63, 67, 72, 75 and 95*)
 23. Uniform Building Code (UBC)
 24. Underwriters Laboratories, Inc. (U.L.) - 497A, 910, 1077, 1863, 1283, 1459, 1604, 1651, 1681, 1690, 1778, 1977
- B. 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.
- C. 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.
- D. Obtain all permits required.

1.3 SUMMARY

- A. Provide complete and working ESS Systems including equipment, conduit, wiring, material, labor and training as described in this Specification and the Drawings. The ESS Systems Drawings and Specifications are the sole property of the Architect and are not to be duplicated, scanned, loaned or in any way made available to persons not designated as authorized by the Architect. All ESS Systems plans and specifications are to be returned to the Architect following completion of bid.

1.4 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.

1.5 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 connections to all ESS equipment indicated on the drawings, except as noted.
- 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.

1.6 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.

1.7 GUARANTEE

- A. Guarantee work for a minimum of two years or as noted longer elsewhere 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.

1.8 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.

1.9 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.

1.10 ACCEPTABLE MANUFACTURERS

- A. Manufacturers names and catalog number specified under sections of Division 28 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 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 complete design and performance data to the Architect. The Architect and Owner issue approvals of acceptable manufacturers as addenda to the Construction Proposal Documents.

1.11 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.

1.12 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. 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.

1.13 ABBREVIATIONS AND DEFINITIONS

A. Abbreviations:

A/V	Audio/Visual
AWG	American Wire Gauge
BCR	Building Communications Room
CMP	Communications Media Plenum
CMR	Communications Media Riser
Db	Decibel
EMI	Electromagnetic Interference
ER	Equipment Room
ESS	Electronic Safety and Security
FACP	Fire Alarm Control Panel
FCR	Floor Communications Room
Hz	Hertz
IDF	Intermediate Distribution Frame
Km	Kilometer
LCD	Liquid Crystal Display
LED	Light Emitting Diode
M	Micron
MDF	Main Distribution Frame
MHz	Megahertz
NEXT	Near-End Cross Talk
Nm	Nano-meter
OFN	Optical Fiber Non-conductive
OFNP	Optical Fiber Non-conductive Plenum
OFNR	Optical Fiber Non-conductive Riser
OTDR	Optical Time Domain Reflectometer
TC	Telecommunications Closet (<i>Now referred to as TR</i>)
TR	Telecommunications Room (<i>A.K.A. TC - Telecommunication Closet</i>)
UTP	Unshielded Twisted Pair Wire

- B. Definitions:
 - 1. Low Voltage Wire - Wire or cable used for one or more systems that operate on 24 volts or less. Low Voltage Wire is used to install and interconnect one or more of the ESS Systems. Low Voltage Wire includes patch cords, jumpers and all portions of cable or wire used to make the ESS Systems operational or for system communications.
 - 2. Electronic Safety and Security Systems - One or more of the following and associated equipment: Fire Detection/Alarm Systems, Intrusion Detection/Alarm Systems, Access Control Systems, Video Surveillance Systems,

1.14 QUALITY ASSURANCE

- A. Equipment Standards:
 - 1. System and all components shall be brand new stock from manufacturer.
 - 2. All electronics shall be 100% solid state.
 - 3. System and all components shall bear a UL Label.
- B. Contractor Qualifications:
- C. At the time of Proposal, the Contractor shall:
 - 1. Have manufactured, supplied or installed at least three (3) other systems of similar size, complexity, and general operation as the systems described in these specifications. The Contractor shall furnish in writing to Architect proof of compliance with this paragraph at the time of proposal.
 - 2. Hold all legally required Texas State Contractor's licenses necessary to accomplish the installation and activation of the described system at the facilities indicated. The Contractor shall submit copies of licenses to the Architect prior to the start of work
 - 3. Hold all legally required state registrations to meet local requirements for submittal drawings.
 - 4. Have a local office within fifty (50) miles of the project site staffed with factory trained technicians who have experience on systems of similar complexity and function as the systems described in these specifications. These technicians shall be fully capable of system engineering support, installation supervising, system start-up, and providing the Owner with training and service on both hardware and software for the systems specified.
 - 5. Certify complete and total compliance with the provisions of these specifications by letter or submittal of the proposal response forms, signed by an officer of the corporation, or a principal if other ownership currently exists. In addition, the letter or forms shall include a complete listing of exceptions, if any.

1.15 SUBMITTALS

- A. Provide SUBMITTALS according to Division 1 and the following.
- B. Requirements:
 - 1. Submit paragraph-by-paragraph specification review indicating compliance or deviation with explanation.
 - 2. Submit proof that all system components and cables are U.L. Listed.
 - 3. An equipment list with names of manufacturers, model numbers, and technical information on all equipment proposed. Clearly mark exact model number proposed to be installed.

4. Product technical information sheets for each principal components in the proposed system, including cable, wire, terminal marking, and wire marking material.
5. Certification from the manufacturer stating that the system Contractor is an authorized distributor or installer of the proposed system when such certifications exist.
6. A statement listing every technical and operational parameter wherein the submitted equipment varies from that which was originally specified. If the submitter fails to list a particular variance and his submittal is accepted but is subsequently deemed to be unsatisfactory because of the unlisted variance, the submitter shall replace or modify such equipment at once and without cost to the Owner.

1.16 EXAMINATION OF SITE

- A. The Contractor shall have visited the site and familiarized himself with all existing conditions prior to submitting his proposal and shall be prepared to carry out the work within the existing limitations. Failure or neglect to do so shall not relieve the Contractor of his responsibilities not entitle him to additional compensation for work overlooked and not included in his proposal.
- B. The Contractor shall confirm the availability of the proper power source for each piece of specified equipment, through site visits and Drawings as necessary. Where proper power does not exist, the Contractor shall provide the required power, circuits, outlets, conduits, and wire as specified under Division 26.

1.17 DATA ACCURACY

- A. Absolute accuracy of information regarding existing conditions cannot be guaranteed. The Drawings and Specifications are for the assistance and guidance of the Contractor and exact locations, distances, elevations, etc., shall be governed by actual field conditions. Where variations from the contract documents are required, such variations shall be approved by the Architect / Owner.

1.18 SECURITY

- A. The Contractor is responsible for complying with all of the Owner's and facility security's requirements to prevent theft or damage to equipment, tools and materials. If any deviation from facility security requirements is necessary, approval for such deviation shall be coordinated with the Owner.
- B. The Contractor shall not disclose any confidential information of the Owner. The Contractor acknowledges that such action is highly injurious and can do damage to the Owner. The Contractor will agree to and comply with the standard policies and provisions of the Owner regarding outside Contractors and Consultants.

1.19 UTILITIES

- A. It shall be the responsibility of the Contractor to provide all temporary connection and cables, lighting, light stands and power. The facilities shall be used in accordance with all applicable regulations regarding operations, safety and fire hazards of the governmental Authorities Having Jurisdiction, provided they are not used in a wasteful manner.

1.20 PERMITS

- A. All permits required for the specified performance and completion of the work shall be secured by the Contractor. These permits shall be presented and reviewed at the initial project progress meeting.

1.21 NOTIFICATION

- A. The Contractor shall not shut off any existing systems. The Contractor shall give the Owner at least ten (10) calendar days' notice of any requirements to shut off or interference with existing alarm, regulating, computer or other service systems. The Owner will arrange and execute any shutdown. All work such as splicing, connections, etc., necessary to establish or re-establish any system shall be completed by the Contractor in close coordination with the Owner.

1.22 INTERFERENCES WITH THE OWNER

- A. Transportation and storage of materials at the facility, work involving the facility, and all other matters affecting the habitual use by the Owner of its buildings, shall be conducted so as to cause the least possible interference, and at times and in a manner acceptable to the Owner. The Contractor shall make every effort to delivery equipment per the schedule required by the project.

1.23 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 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 underslab cables installed, dimensioning exact location and elevation of such installations.
- B. At conclusion of project, obtain without cost to the Owner, electronic AutoCAD 2012 / 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, reproducible and prints is a condition of final acceptance.
 - 1. 3 sets of electronic AutoCAD (2012 dwg) / 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 or black-line prints of each contract as-built drawing.
- 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 AS-BUILT DRAWINGS.
 - 4. Clearly indicate: DOCUMENT PRODUCED BY:
 - 5. Indicate all changes to construction during construction. Indicate actual routing of all conduit and cables, etc that were deviated from construction drawings.
 - 6. Indicate exact location of all underground ESS 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 ESS equipment in building. Label panel schedules to indicate actual location.
10. Exact location of all ESS equipment in and outside of the building.
11. Location, size and routing of all ESS cables, conduits, equipment, etc. shall be accurately and neatly shown to dimension.
12. Exact location of all roof mounted equipment, wall, roof and floor penetrations.
13. Cloud all changes.

1.24 OPERATING TESTS

- A. After all ESS 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.

1.25 WARRANTY

- A. All equipment shall be covered for the full manufacturer's warranty period and systems shall be warranted by the Contractor for a period of two years commencing with the filing date of substantial completion. The Warranty shall cover all costs for warranty service, including parts, labor, prompt field service, pick-up, transportation, delivery, reinstallation, and retesting. A contract for service shall cover the period starting with the first expected activation of each system and shall continue without interruption to cover the period to the end of the two-year warranty as defined above. The end of the warranty period shall be handled such that a smooth transition to a maintenance agreement with the Owner shall be achieved with no lapse in coverage.
- B. Submit 3 copies of all warranties and guarantees for systems, equipment, devices and materials. These shall be included in the Operating and Maintenance Manuals.

1.26 BUILDING CONSTRUCTION

- A. It shall be the responsibility of the sub-contractor to consult the Architectural and Engineering 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 piping, cables, pathways, raceways, and other items are placed in the walls, furred spaces, chases, etc., so that there shall be no delay in the job.

1.27 TEMPORARY FACILITIES

- A. General: Refer to Division 01 for general requirements on temporary facilities.
- B. Temporary Wiring: Temporary power and lighting for construction purposes shall be provided under Division 26. Installation of temporary power shall be in accordance with NEC Article 305.

- C. Temporary facilities, wire, lights and devices are the property of this Contractor and shall be removed at the completion of the Contract.

1.28 EXTRA MATERIALS

- A. Keys: Provide three (3) sets of all keys for system cabinets.

2 PRODUCTS**2.1 WORK INCLUDED:**

- A. All materials listed in PART 2 - PRODUCTS of this Division Sections and on the Drawings shall be provided by the Contractor unless specifically excluded or modified in other portions of this Specification or Addendums.

3 EXECUTION**3.1 INSTALLATION:**

- A. This project has a critical path, which must be closely followed in order to meet the completion date. The Contractor shall review the proposed schedule at the Award of Contract meeting and be prepared to staff his work force according to the schedule constraints presented at that time.
- B. Aesthetics are an important consideration in this installation. All components shall be installed so as to have aesthetically pleasing results as determined by the Owner and Architect. Actual locations of all visible components shall be coordinated in advance with the Owner and Architect.
- C. Install, make fully operational and test the system as indicated on the Drawings and in the Specifications. Where information is not available the worst-case condition must be assumed to ensure a complete, functional system.
- D. Any interfacing with other systems shall be the Contractor's responsibility under this contract, and the details, both logical and physical, of such interfaces shall be reflected in the Submittals and As-Built drawings.
- E. If appropriate, interfaces with the Owner's Data Network or Telecommunications System shall be coordinated with the Owner and Architect.
- F. All necessary back boards, back-boxes, pull-boxes, connectors, supports, conduit, cable and wire shall be furnished and installed to provide a complete and reliable system. Exact location of all backboards, boxes, conduit and wiring runs shall be presented to the Owner / Architect for approval in advance of any installation. Provide as required and as specified in Division 26.
- G. Where required provide 120-VAC, 60 Hz power from nearest electrical panel through a junction box, to the system devices. Provide as required and as specified in Division 26.
- H. Where required, install conduit, cable and wire parallel and square with building lines, including raised floor areas. Conduit fills shall not exceed 40%.
- I. All equipment shall be mounted with sufficient clearance to minimize EMI as well as meet all applicable codes and facilitate observation and testing. Securely hand and/or fasten

with appropriate fittings to ensure positive grounding, free of ground loops, throughout the entire system. Units shall be installed parallel and square to building lines.

- J. Quiet and vibration-free operation of all equipment is a requirement of this installation. Properly adjust, repair, balance or replace any equipment producing objectionable (in the judgment of the Owner or Architect) noise or vibration in any of the occupied areas of any building and provide additional brackets and bracing if necessary. Any such additions or changes shall be at no additional cost to the Owner.
- K. Installation shall comply with the CODES AND STANDARDS portion of this Section. Where more than one code or regulation if applicable, the more stringent shall apply.
- L. Where new equipment is replacing old equipment, the Contractor is responsible for removing and disposing of the old equipment and doing whatever repair work is necessary as specified by the Owner / Architect.
- M. Install firestopping, as specified in Division 26 for all penetrations in slabs and firewalls to meet code at the completion of work and prior to final testing demonstration to the Owner.
- N. The installation shall be performed in a professional manner.
- O. On a daily basis, clean up and deposit in appropriate containers all debris from work performed under the appropriate specification sections. Stack and organize all parts, tools and equipment when not being used.
- P. Preparation, handling and installation shall be in accordance with the Manufacturer's written instructions and technical data appropriate to the product specified.
- Q. All work shall conform to the National Electrical Contractors Association "Standard of Installation" for general installation practice.
- R. At the conclusion of the installation, all work areas, including all enclosures and boxes, shall be vacuumed and cleaned to remove all debris and grease.

3.2 COORDINATION WITH OWNER / ARCHITECT

- A. Close coordination with the Owner / Architect is vital to achieve a complete, aesthetically pleasing job. The Contractor shall ensure that the Owner / Architect is kept fully apprised of job progress.

3.3 CUTTING, PAINTING, AND PATCHING

- A. Structural members shall not be drilled, bored or notched in such a manner that shall impair their structural value. Cutting of holes in structural members, if required, shall be done with core drills and only with the specific approval of the Owner / Architect for each instance.
- B. All walls that require cutting or repair during the installation process shall be returned to their original condition, including the matching of colors and finishes to the satisfaction of the Owner / Architect, and at no additional cost to the Owner.

3.4 WIRE AND CABLE

- A. All low voltage cable shall be low smoke plenum rated, limited energy, with 300-volt insulation.
- B. All wires in exposed areas shall run through conduit as specified in Division 26.
- C. Provide conduits, cable trays, raceways, wireways, boxes and outlets as specified in Division 26.
- D. After installation, and before termination, all wiring shall be checked and tested to insure there are no grounds, opens, or shorts on any conductors. In addition, all wires between buildings or underground and all coax cables shall have insulation tested with a megohmmeter (megger) and a reading of greater than 20 megohms shall be required to successfully complete the test.
- E. Run wires continuously from termination to termination without splices.
- F. Wire and cable shall be supported in each equipment and terminal cabinet and in each terminal and pull box in vertical risers and horizontal runs with wire duct and strap-type supports. At any point where wire duct is required for good wire management, whether shown on elevations or not, install appropriate duct. Where terminal boards are used, wire ducts shall be supplied on both sides and at no time shall wires cross over terminal boards. Arrange cables neatly to allow inspection, removal and replacement. Lace cables as required. Spot tie wire bundles with plastic cable ties and securely affix to panels. If screw type terminals are specified, terminal strip connections shall be locking, tongue style, pressure crimp, and solderless spade lug.
- G. Visually inspect wire and cable for faulty insulation prior to installation. Protect cable ends at all times with acceptable end caps except during actual termination. At no time shall any coaxial cable be subjected to a bend less than a 6-inch radius. Protect wire and cable from kinks. Install 1 pull rope for all 2" or larger sized conduits.
- H. Provide plastic bushings and strain relief material at all conduit exit points and where necessary, to avoid abrasion of wire and excess tension on wire and cable.
- I. Cables above accessible ceilings shall not rest on ceiling tiles. Use Velcro tie wraps, J-hooks or D-rings to hold cables. Provide independent support for all cables. Support is to be from building structure (do not support from pipes or conduits). ESS cables shall not tie off on HVAC supports, all-thread, ceiling grid hanger wire or electrical / mechanical piping system.
- J. Ground and bond equipment and circuits in accordance with NEC and Division 26.

3.5 IDENTIFICATION AND TAGGING

- A. All cables, wires, wiring forms, terminal blocks and terminals shall be identified by labels, tags to other permanent markings in accordance with TIA/EIA-606. The markings shall clearly indicate the function, source, or destination of all cabling, wiring and terminals. All cables and wires shall be identified, utilizing heat-shrink, machine printed, polyolefin wire markers (Brady Type B-32 *or equal*). Hand written tags are not acceptable.
- B. Should a situation arise where the wire tagging format as shown on the drawings cannot be used, a substitute format shall be submitted which complies with the intent to provide documentation that will permit end-to-end tracing of all ESS Systems wiring.

- C. All panels shall be provided with permanently attached engraved lamaroid labels with identifying names and functions. All terminal points shall be appropriately labeled. Labels shall be consistent in form, color, and typeface throughout the system and all must contain the name of the system or subsystem as part of the label textual information. Design, color, font and layout shall be coordinated with, and approved by, the Owner.
- D. 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.
 - 2. A black-white-black 3-layer laminated plastic engraved identifying nameplate shall be permanently secured to each wireway, terminal cabinet, and ESS cabinet or rack.
 - a. Identifying nameplates shall have 1/2-inch high, engraved letters.
 - 3. Permanent, waterproof, black markers shall be used to identify each ESS grid junction box, clearly indicating the type of system available at that junction box.
 - 4. Pull Boxes: Field work each with a nameplate showing identity, and identifying equipment connected to it. Nameplates shall also indicate where pull box is fed from.
- E. 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.
- F. Warning Signs: Provide warning signs where there is hazardous exposure associated with access to or operation of ESS 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.
- G. Wire and Cable Labeling: Provide wire markers on each conductor in all boxes, pull boxes, gutters, wireways. Identify with drop/circuit number.
- H. Underground Warning Tape: Thomas and Betts or approved equal. Six-inch wide plastic tape, colored red or orange with suitable warning legend describing buried ESS lines. All underground 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 conduits.

3.6 CUTTING AND PATCHING

- A. General: Comply with the requirements of Division 01 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.

3.7 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 ESS 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.
- B. Time to be allocated for instructions.
1. Minimum of 12 hours dedicated instructor time
 2. 4 hours on each of 3 days
 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, 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 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.

3.8 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.

3.9 HOUSEKEEPING PADS

- A. Provide concrete equipment housekeeping pads under outdoor mounted ESS equipment.
- B. Concrete and reinforcing steel shall be as specified in Division 03, or as indicated or noted.

- C. Concrete pads:
 - 1. 6-inches thick minimum indoors; 8-inches thick minimum outdoors, or as indicated on the drawings 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.

3.10 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.

3.11 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.
- B. Proof of delivery of these items to the Owner shall be included in the Operating and Maintenance Manuals.

3.12 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.

3.13 EQUIPMENT BACKBOARDS

- A. Backboards: $\frac{3}{4}$ 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 location shown.
 - 2. Provide minimum of two 4-ft. by 4-ft. sheets of plywood for each ESS location.

3.14 SITE MANAGEMENT RESPONSIBILITY

- A. The Contractor shall provide an on-site Project Manager as defined in SUPERVISION OF WORK portion of this Section.

3.15 START-UP RESPONSIBILITY

- A. The Contractor shall initiate System operation. The Contractor shall provide competent Start-Up personnel on each consecutive working day until all ESS Systems are functional and ready to start the acceptance test phase. If the Contractor, in the Owner / Architect's judgment, is not demonstrating progress in solving any technical problems, the Contractor shall supply Manufacturer's factory technical representation and diagnostic equipment at no cost to the Owner, until resolution of those defined problems. Where appropriate, the Contractor shall bring the Systems on-line in their basic state (i.e., alarm reporting, facility code access control, etc.) It is the responsibility of the Owner to provide the specific database information that will be utilized for initial system programming.
- B. Properly ground each piece of electronic equipment prior to applying power. Properly ground all shielded wire shields to the appropriate earth ground at the hub end only, not at the remote or device end.
- C. Use a start-up sequence that incrementally brings each portion of the system on-line in a logical order that incorporates checking individual elements before proceeding to subsequent elements until the entire system is operational. The basic steps should include:
 - 1. Establish ground planes at the equipment rooms and hub end of the systems as specified in Division 26.
 - 2. Disconnect power, connect the first device, reconnect power, and verify operational correctness. Repeat until the entire system is verified and operational.

3.16 PREPARATION FOR ACCEPTANCE (SUBSTANTIAL COMPLETION)

- A. All systems, equipment, and devices shall be in full and proper adjustment and operation, and properly labeled and identified.
- B. All materials shall be neat, clean and unmarred, and parts securely attached.
- C. All extra material as specified shall be delivered and stored at the premises as directed.
- D. Test reports of each system and each system's components and As-Built Project Drawings shall be complete and available for inspection and delivery as directed by the Owner.

3.17 SYSTEM ACCEPTANCE REQUIREMENTS

- A. Before final acceptance or work, the Contractor shall perform and/or deliver each of the following in the order stated.
- B. The Contractor shall deliver three (3) composite "System Operations and Maintenance" manuals in three-ring binders, sized to hold the material below, plus 50% excess. Each manual shall contain in appropriately tabbed sections:
 - 1. A statement of Guarantee including date of termination and the name and phone number of the persons to be called in the event of equipment failure.
 - 2. A set of Operating procedures for the overall System that includes all required Owner activities, and that allows for the Owner operation of all attributes and facilities of the System.
 - 3. A section for each specific type of equipment containing the vendor manuals, instruction sheets, and any related literature that came in the original shipping container for that piece of equipment. Include all warranty cards.
- C. Testing:

1. The Contractor shall perform all tests required by Division 28 and those submitted as part of this Section.
 2. The Contractor shall activate all devices for proper system operation, including supervisory and trouble circuit tests. Similarly, audible alarms will not be activated except on a one-time, coordinated basis, to check the actual sounding devices.
 3. A test report for each piece of equipment shall be prepared by the Contractor and submitted to the Owner. This report shall include a complete listing of every device, the date it was tested, by whom and the results. The final test reports shall indicate that every device tested successfully. Failure to completely test and document the tests will result in a delay of final testing and acceptance.
- D. As-Built Drawings:
1. After completion of all the tests listed above, and prior to the final acceptance test, The Contractor shall submit the complete As-Built drawings as identified in PART 1 – PROJECT RECORD DRAWINGS.
 2. The final As-Built Drawings shall consist on one set of reproducible prints, two (2) sets of Point-to-Point Detail Drawings, Equipment Schedules, and the complete detailed technical data that was shipped by the manufacturer with all installed equipment.
- E. Final Acceptance Test: The Final Acceptance Test shall demonstrate the installed and activated System's performance and compliance with System Specifications. However, before this testing can begin the following must have received and reviewed by the Owner.
1. System Operations and Maintenance Manuals
 2. System Test Reports
 3. As-Built Drawings

3.18 NOTICE OF COMPLETION

- A. When the Final System Acceptance Requirements described above including the Final Acceptance Test described above have been satisfactorily completed. The Owner / Architect shall issue a Letter of Completion to the Contractor indicating the date of such completion. The Notice of Completion shall be recorded by the Contractor upon receipt of the Owner / Architect completion letter. This date of record shall be the start of the warranty period.

END OF SECTION 28 05 00

SECTION 28 05 07

SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA

1 GENERAL

1.1 WORK INCLUDED

- A. Prepare submittals as required by Division 1 and as outlined below.
- B. Submit product data shop drawings only for the following 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 and to imply that materials shall be provided as specified without exception.
- C. The term submittal, as used herein, refers to all:
 - 1. Shop Drawings
 - 2. Coordination Drawings
 - 3. Product data
- D. 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 relation to adjacent or critical features or work or products.

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: 1/4"=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 room containing ESS equipment and each rack with ESS equipment, submit plan and elevation drawings. Show:
 - 1. Actual ESS equipment and components to be furnished.
 - 2. NEC working space and NEC access to NEC working space.
 - 3. Relationship to other equipment and components and openings, doors and obstructions
 - 4. Rack location and dimensions
- D. Identify field dimensions. Show relation to adjacent or critical features of work or products.

- E. Verify location of ESS station devices and other work specified in this Division.
 - 1. Coordinate with drawing details, site conditions and millwork shop drawings prior to installation.
 - 2. Where required for clarification, submit shop drawings prior to rough-in and fabrication.
- F. Submit shop drawings in plan, elevation and sections, showing outlets and other devices in casework, cabinetwork and built-in furniture.

1.4 PRODUCT DATA

- A. All product options specified shall be indicated on the product data submittal. All options listed on the standard product printed data not clearly identified as not part of the product data submitted shall become part of the Contract and shall be provided.
- 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 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:)

1.5 MANUFACTURERS INSTRUCTIONS

- A. Submit Manufacturer's instructions for storage, preparation, assembly, installation, start-up and adjusting.

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 four opaque reproductions.
 - 2. Product Data: Submit the number of copies the contractor requires, plus those to 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 telephone 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 requiring 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 resubmittals under procedures specified for initial submittals.
 1. Indicate that the document or sample is a resubmittal
 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. Specific equipment submittals 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 approval of submittal
 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 and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

1.13 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 Division 01.

2 PRODUCTS - NOT USED**3 EXECUTION****3.1 SHOP DRAWINGS AND PRODUCT DATA**

- A. Submittals shall not be combined or bound together with any other material submittal.
- B. Submit individually bound shop drawings and product data for the following when specified or provided:
 1. Low Voltage Wire
 2. Electronic Access Control and Intrusion Detection
 3. Electronic Surveillance
 4. Fire Detection and Alarm

3.2 COORDINATION DRAWINGS

- A. Submit coordination drawings as specified.

END OF SECTION 28 05 07

SECTION 28 05 10

CONTRACT QUALITY CONTROL

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 / 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 a manufacturer's qualified personnel to observe:
 - 1. Field conditions.
 - 2. Condition of installation.
 - 3. Quality of workmanship.
 - 4. Start-up of equipment.
 - 5. Testing and adjusting 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 mockup 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

2 PRODUCTS**2.1 REFERENCE APPLICABLE SPECIFICATION SECTIONS.****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.

3.2 MOCK-UPS

- A. Mock up a typical classroom, science lab of each type, and computer lab with all wiring devices, cover plates, rough-in boxes, conduits, etc. provide all conductors from all wiring devices to above ceiling space to demonstrate conduit routing and conductor fill.

END OF SECTION 28 05 10

SECTION 28 05 50

FIRESTOPS

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.

2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Nelson.
- B. 3M (Minnesota Mining Manufacturing).
- C. Hilti
- D. Specified Technologies, Inc.

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.

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 28 05 50

SECTION 28 10 00

ELECTRONIC ACCESS CONTROL SYSTEM

1 GENERAL

1.1 WORK INCLUDED

- A. The contractor shall furnish and install a complete microprocessor-based access control system as specified herein. The system shall include, but not be limited to, all control equipment, signal initiating and signaling devices, door hardware, conduit, wire, fittings, labor and all other accessories required to provide a fully functioning system.

1.2 CODES AND STANDARDS

The system shall comply with the applicable Codes and Standards as follows:

- A. National Fire Protection Association Standards:
 - 1. NFPA 70 National Electric Code
 - 2. NFPA 72 National Fire Alarm Code
 - 3. NFPA 101 Life Safety Code
- B. Local & State Building Codes
- C. Requirements of Local Authorities having Jurisdiction
- D. Underwriters Laboratory Requirements and Listings for use in Security Alarm Systems.
- E. Requirements of American Disabilities Act (Public law 101-336).
- F. Texas Accessibility Standards (T.A.S.)
- G. State Fire Marshall.
- H. Texas Insurance Code.

1.3 RELATED WORK

- A. Division 08 - Door Hardware

1.4 DEFINITIONS

- A. ACS – Access Control System
- B. CSA – Client Software Application
- C. DGM – Dynamic Graphical Maps
- D. ALPR – License Plate Recognition
- E. SDK – Software Development Kit
- F. SMA – Software Maintenance Agreement
- G. SSM – Server Software Module
- H. UI – User Interface
- I. USP – Unified Security Platform
- J. USW – Unified Web Client
- K. VMS – Video Management System
- L. DVS – Digital Video Server

1.5 QUALITY ASSURANCE

- A. Contractor Qualifications:
 - 1. The installing contractor shall be the authorized representative of the access control system manufacturer to sell, install, and service the proposed manufacturer's equipment. The installing contractor shall have represented the security alarm manufacturer's product for at least two years.
 - 2. The installing contractor shall be licensed by the State of Texas as a security services contractor to design, sell, install, and service security alarm systems.
 - 3. The installing contractor shall provide 24 hours, 365 day per year emergency service with factory trained service technicians.
 - 4. The installing contractor shall have personnel on their staff that has been actively engaged in the business of designing, selling, installing, and servicing security alarm systems for at least ten (10) years.
- B. The system programmer shall have attended manufacturer training and obtained certification in RS2.
- C. Optionally, the system programmer shall have attended manufacturer training and obtained certification in RS2.
- D. The system programmer shall be a RS2 certified partner.
- E. All Contractors shall submit to the Owner prior to starting any work the factory training certificates for all personnel that will be working on the access control system. No person is allowed to work on the system without proper manufacturer's certification.

1.6 SUBMITTALS

- A. The installing contractor and/or equipment supplier shall provide complete and detailed shop drawings and include:
 - 1. Control panel wiring and interconnection schematics.
 - 2. Complete point to point wiring diagrams.
 - 3. Riser diagrams.
 - 4. Complete floor plan drawings locating all system devices.
 - 5. Factory data sheets on each piece of equipment proposed.
 - 6. Detailed system operational description. Any specification differences and deviations shall be clearly noted and marked.
 - 7. Complete system bill of material.
 - 8. Line by line specification review stating compliance or deviation.
- B. All submittal data will be in bound form with Contractor's name, supplier's name, project name, and state security license number adequately identified.

2 PRODUCTS**2.1 ACCEPTABLE MANUFACTURERS**

- A. Head-End/Software
 - 1. RS2 Enterprise

- B. Controllers
 - 1. Mercury
- C. Card Readers
 - 1. HID
- D. Security Devices
 - 1. Door Position Switch - 1076DN
 - 2. REX – Kantech TREX-XL2
- E. Wiring
 - 1. Belden
 - 2. Lake Cable
 - 3. Windy City Wire
 - 4. Approved Equal

2.2 PERFORMANCE REQUIREMENTS

- A. Controllers:
 - 1. LP1502 Intelligent Controllers
 - 2. MR52 Reader Interface Panel
 - 3. MR-16 Multi-Device Interface Panel
- B. Card Readers
 - 1. Multi-Frequency Authentication Capable
 - 2. Wiegand interface
 - 3. Standard Card Reader: RP-40
 - 4. Mullion Mount Reader: RP-10
- C. Power Supply
 - 1. LifeSafety Power Supplies
- D. Wiring
 - 1. Plenum rated multi-conductor composite cable
 - 2. Minimum of 18 AWG
 - 3. Shall be yellow

3 EXECUTION

3.1 GENERAL

- A. The contractor shall have furnished and installed a complete microprocessor based access control system as specified herein. The system shall include, but not be limited to, all control equipment, power circuits, signal initiating and signaling devices, door hardware, conduit, wire, fittings, labor and all other accessories required to provide a fully functioning system.

3.2 HARDWARE INSTALLATION

- A. General
 - 1. Provide mock-up of a typical entry door, complete with conduit, outlet boxes, cables and access control devices prior to installation.

2. All security conduit as required for a complete installation of this system shall be provided as specified in Division 26.
3. Coordination with the Division 26 is the responsibility of the Security Contractor to ensure all conduit is in place for a complete installation.
4. All door hardware to be coordinated with Division 08, reference Division 08 for hardware requirements.
5. All electrified hardware, as specified in Division 08 shall be installed by Division 28.
6. Provide and install Assa Abloy power supply at each door location, each power supply have battery backup.

B. Wiring/Conduit

1. All wiring shall be in accordance with the National Electrical Code, Local Codes, and article 760 of NFPA Standard 70. All wiring sizes shall conform to recommendations of the equipment manufacturer, and as indicated on the engineered shop drawings.
2. All wire shall be UL Listed CL2 for limited energy (300V) applications and shall be installed in conduit. Limited energy 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 if so approved by the local authority having jurisdiction.
3. No AC wiring or any other wiring shall be run in the same conduit as security alarm wiring.
4. All wire shall be installed in an approved conduit/raceway system (except where permitted by NEC and the local authority having jurisdiction). Maximum conduit "fill" shall not exceed 40% per NEC.
5. Minimum conduit size shall be 3/4" EMT. Install conduit per engineered shop drawings.
6. 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 or subject to damage.
7. 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 trans versing the respective box as well as the number of terminations required.
8. All plenum wiring is to be installed parallel and perpendicular to the building structure. Install wiring tight up against structure for protection. Cable shall be bundled on a maximum of 2'-6" and secured to the structure at a maximum of 5' on center. Bundling and support shall be with plenum rated cable ties.
9. Contractor is required to provide all mapping and software configuration required to operate system as per manufacturer's recommendations.
10. All wire not installed inside conduit or a designated cable tray system shall be installed in a dedicated j-hook style cable support system for the entire run of each cable. Including, but not limited to service loops.
11. The cable support system shall be attached directly to the building steel at a serviceable height. If the building steel is not within 5' of the finished ceiling, the contractor shall provide a dedicated threaded rod extending within 5' of the finished ceiling and mount the support hook to the treaded rod.

C. System

1. Furnish and install one (1) card reader for each location shown on drawings.

2. Provide one (1) controller in MDF. Route all cabling to nearest controller, all cabling shall be home-runs. Each controller shall tie into nearest switch within the data closet.
3. Provide and install one (1) REX and door contact for the access control system, per installed door. Provide and install quantity of MR-16 necessary for integration of each device.
4. Provide an additional sixteen (16) hours of programming, coordinate final programming with district personnel.
5. Provide (200) HID iClass 202x, coordinate all facility codes and numbering with district prior to purchase, to get numbers as necessary.
6. All final terminations of electrified hardware shall be completed by Division 28.
7. All electrified hardware that is scheduled, but not to receive a card reader, shall be integrated into the RS2 system for administration and scheduling.

3.3 TESTING

- A. Submit a written test report from an authorized representative of the equipment manufacturer that the system has been 100% tested and approved. Final test shall be witnessed by Owner, Engineer, Electrical Contractor and performed by the equipment supplier. Final test report shall be received and acknowledged by the Owner prior to substantial completion. All test reports to be verified by Crowley.
- B. Provide instruction as to proper use and operation of system, for the Owner's designated personnel.

3.4 WARRANTY

- A. Contractor shall provide minimum of one (1) year warranty of workmanship and product. Must support (24) hour turn time to fix and/or replace any system issues or hardware
- B. The product shall perform in all material respects in accordance with the accompanying user manual, and the media on which the Software Product resides will be free from defects in materials and workmanship under normal use. Software defects are covered through Service Releases and Cumulative Updates which are available for a period of 1 year from the date of substantial completion

END OF SECTION 28 10 00

SECTION 28 20 00

VIDEO SURVEILLANCE SYSTEM (VSS)

1 GENERAL

1.1 RELATED WORK

- A. The following, in their entirety and as applicable, shall apply to this section. Including any associated drawings.
 - 1. Conditions of the Contract
 - 2. Division 1
 - 3. Division 26
 - 4. Division 27
 - 5. Division 28

1.2 GENERAL PRODUCT REQUIREMENTS

- A. The software used shall be designed for enterprise level use, with an expected use period of 24/7. It shall be the Manufacturer's official software.
- B. The software shall incorporate open standards and published protocols and use standardized components.
- C. The Video Management System provider shall be defined as the provider of the video management software, and the party responsible for rigorous self-testing of the video management software prior to the release of the software.

1.3 GENERAL SYSTEM DESCRIPTION

- A. The Video Management System shall support both centralized and decentralized configurations as well as hybrid options for architecture. Centralized management shall be available no matter the surveillance architecture. The system shall allow for integration with other security devices and products and be designed to allow for leveraging of those products to improve the user experience of the VMS.
- B. The VMS shall not require a central management server.
- C. The VMS shall make the user experience seamless to the end user irrespective of the system architecture.
- D. The VMS must be capable of each server being able to handle an unlimited number of cameras for recording.
- E. The VMS must support Windows Server 2008, 2012, and Windows Server 2016 for the server side. Client-side software must be available for Windows 7, 8 and 10, Mac OSX, iOS 6 and above, and Android. The operating system shall have all current and available patches.
- F. The VMS shall include the following without additional license fees:
 - 1. Client software for Windows.
 - 2. Client software for Mac OSX.
 - 3. Client software for iOS 6 and above.

4. Client software for Android-based platforms.
 5. Client software using a web-based interface.
 6. Standalone clients designed to provide fixed displays.
 7. Video Wall functionality.
 8. SmartSearch.
 9. Access Control Integration.
 10. Full Access Control software platform.
 11. Failover server functionality.
 12. A separate health monitor application.
- G. The VMS shall not require a separate application for administration and user-based roles. Limitations for non-administrative users shall be handled via permissions.
- H. The system shall support running in Virtual Servers for both the server application and client applications

1.4 SECTION INCLUDES

- A. Video Management Systems:
1. Server application.
 2. Desktop application.
 3. Mobile application.
- B. Servers:
1. Rackmount.
 - a. Servers will be provided, installed, and programmed by the system installer.
 - b. Server sizes and quantities shall be based on the needs to meet the requirements established by, but not limited to the following:
 - 1) Bandwidth
 - 2) Camera resolution
 - 3) Client workstation access
 - 4) Frame rates
 - 5) Video Compression
 - 6) Motion based recording
 - 7) Maximum of sixty-four (64) views per server
 - 8) Days of Retention
 - c. Provide a minimum of one server per site
- C. IP security cameras.
- D. VMS software licenses.
- E. Encoders and decoders.
- F. Controller systems.
- G. Accessory products.

1.5 REFERENCES

- A. Code of Federal Regulations (CFR).

- B. Institute of Electrical and Electronics Engineers (IEEE):
 - 1. 802.3 Ethernet Standards.
- C. International Electrotechnical Commission (IEC).
- D. International Organization for Standardization (ISO):
 - 1. ISO / IEC 10918 - Information technology -- Digital compression and coding of continuous-tone still images: Requirements and guidelines; JPEG.
 - 2. ISO / IEC 14496-10 - Information Technology - Coding Of Audio-Visual Objects - Part 10: Advanced Video Coding; MPEG-4 Part 10 (ITU H.264).
 - 3. ISO / IEC 23008-2 - High Efficiency Coding and Media Delivery In Heterogeneous Environments - Part 2: High Efficiency Video Coding; MPEG-H Part2 (ITU H.265, HEVC).
- E. Federal Communications Commission (FCC):
 - 1. FCC Rules and Regulation of Title 47 of CFR Part 15 Subpart B Class A.
- F. Open Network Video Interface Forum (ONVIF):
 - 1. ONVIF - Profiles S Specification.
- G. Underwriters Laboratories (UL):
 - 1. UL listed.

1.6 DEFINITIONS

- A. Abbreviations:
 - 1. ARP - Address Resolution Protocol.
 - 2. DHCP - Dynamic Host Configuration Protocol.
 - 3. DNR - Digital Noise Reduction.
 - 4. DDNS - Dynamic Domain Name Server.
 - 5. FPS - Frames Per Second.
 - 6. GUI - Graphical User Interface.
 - 7. HDD - Hard Disk Drive.
 - 8. HTTP - Hypertext Transfer Protocol.
 - 9. ICMP - Internet Control Message Protocol.
 - 10. IGMP - Internet Group Management Protocol
 - 11. IP - Internet Protocol.
 - 12. iSCSI - Internet Small Computer System Interface.
 - 13. JBOD - Just a Bunch of Disks.
 - 14. JPEG - Joint Photographic Experts Group.
 - 15. MJPEG - Motion JPEG.
 - 16. MP - Megapixel.
 - 17. MPEG - Moving Pictures Experts Group.
 - 18. NAS - Network Attached Storage.
 - 19. NTP - Network Time Protocol.
 - 20. POS - Point of Sale.
 - 21. PPPoE - Pont to Point Protocol over Ethernet.
 - 22. RAID - Redundant Array of Independent Disks (Drives).
 - 23. RTP - Real-Time Transport Protocol.
 - 24. RTCP - Real-Time Control Protocol.
 - 25. RTSP - Real-Time Streaming Protocol.
 - 26. SMTP - Simple Mail Transfer Protocol.
 - 27. SNMP - Simple Network Management Protocol.

- 28. SSL - Secure Sockets Layer.
- 29. TCP - Transmission Control Protocol.
- 30. UDP - User Datagram Protocol.
- 31. UPnP - Universal Plug and Play.
- 32. VMS - Video Management System.
- 33. PoS - Point of Sales.
- 34. VA - Video Analytics.
- 35. PnP - Plug and Play.
- 36. ARB - Auto Recovery Backup.
- 37. NVR - Network Video Recorder.
- 38. RAID - Redundant Array of Independent Disks.

B. Definitions:

- 1. JBOD: A collection of hard disks that have not been configured to act as a redundant array of independent disks (RAID) array.
- 2. GOV (Group of Video object planes): A set of video frames for H.264 and H.265 compression, indicating a collection of frames from the initial I-Frame (key frame) to the next I-Frame. GOV consists of 2 kinds of frames: I-Frame and P-Frame.
- 3. Dynamic GOV: Dynamic assignment of GOV length based on the complexity of the scene to efficiently manage bitrate of the video stream and reduce the storage required.
- 4. Dynamic fps: Dynamic assignment of frames per second based on the complexity of the scene to efficiently manage bitrate of the video stream and reduce the storage required.
- 5. ARB (Auto Recovery Backup): Automatic backup mechanism that enables cameras to store videos on to SD card during failures and stream it to the storage device after recovery.
- 6. Failover: A feature that automatically switches to a redundant or standby device upon failure or unexpected shutdown of an active device.

1.7 SUBMITTALS

A. Project Initiation:

- 1. Within fourteen (14) days of Notice to Proceed, the data network system installer shall furnish the following in a single consolidated submittal:
 - a. Permits: The Contractor shall obtain all required permits and provide copies to the Owner / Architect / Engineer.
 - b. Product Literature: Complete manufacturer's product literature for all material, hardware, and equipment to be used in the installation of the specified system. In addition, whenever substitutions for recommended products are made, samples (when requested by the Owner / Designer) and the manufacturer's supporting documentation demonstrating compatibility with other related products shall be included. The submittal shall have some type of distinguishing marker or pointer to indicated what specific product is to be provided
 - c. Construction Schedule: A time-scaled Construction Schedule, indicating general project deadlines and specific dates relating to the installation of the cable distribution system.
 - d. Specification Compliance: A letter shall be provided stating, by section and subsection, that the SCS installer complies with the entire specification section. If the installer intends to deviate from any portion of the specifications, a detailed explanation of reason in which the installer would

like to deviate shall be provided in addition to the specification compliance letter. No deviations shall be acceptable until they have been approved by the Owner.

- e. Each Submittal must have a detailed parts list. Quantities will not be required as the quantity of any portion of this system shall be as required for a complete and functional system and in conjunction with the contract documents.
- f. Certifications: The contractor shall submit all certifications for approved products and the certifications must contain dates which are valid from the date of proposal and not expire any sooner than 12 months after substantial completion of the project.
 - 1) Physical Security Professional (PSP) Certification: This certification must be held by an on-staff, full-time employee of the system installer. The holder must be staffed out of the office that is located within 75 miles of the project.
 - 2) Manufacturer Authorized Dealer Certification must be held by the system installer's office that is located within 75 miles of the project and shall be a company certification, not an individual certification.
 - 3) Installer Certifications: Certification indicating that an individual has successfully completed installer training, issued by the VMS and Cameras Manufacturers specified herein, must be held by at least 25% of the, on-site, staff and be made available at the site if requested by the owner, architect, and/or project's technology consultant.

B. Shop Drawings:

- 1. Submit the following items, for Owner review and approval, within twenty-eight (28) days of notice to proceed:
 - a. Proposed cable routing and grouping plan.
 - b. In addition to the cable routing, the submitted drawings shall indicate the following, even if the following is expected to be provided by the project's electrical or general contractor:
 - 1) Location of sleeved wall and floor pass-thru
 - 2) Size of sleeve at each location installed
 - 3) Quantity of cable passing through each sleeve
 - 4) Location of devices and head end equipment.
 - 6) Conduit routing, size, and quantity
 - c. Drawing Compliance: A letter shall be provided stating that the system installer complies with the entire project drawing, including all general, keyed, and notes to contractor. If the installer intends to deviate from any portion of the specifications, a detailed explanation of reason in which the installer would like to deviate shall be provided in addition to the specification compliance letter. No deviations shall be acceptable until they have been approved by the Owner.
 - d. All subcontractors shall provide submittals to general contractor for normal distribution to Architects, Engineers and the Owner's project managers.

C. At Substantial Completion: Provide drawings, to the Owner, to reflect installed cabling with correct labeling and cable routing.

D. Close-out Procedures:

- 1. Two (2) copies of the following documents shall be delivered to the building

owner's representative at the time of system acceptance. Close out technology documents shall be separated from all other trade's documents. The close out finals shall include:

- a. Inspection and Test Reports: During the course of the Project, the Contractor shall maintain an adequate inspection system to ensure that the materials supplied, and the work performed, conform to contract requirements. The Contractor shall provide written documentation that indicates that materials acceptance testing was conducted as specified. The Contractor shall also provide documentation, which indicates that all cable termination testing was completed and that all irregularities were corrected prior to job completion.
- b. Include the Name, address and telephone of the authorized factory representative with a 24-hour emergency service number.
- c. The manual shall also include Manufacturer's data sheets and installation manuals/instructions for all equipment installed a list of recommended spare parts.
- d. Generic or typical owner's instruction and operation manual shall not be acceptable to fulfill this requirement.
- e. An up-to-date record ("as-built") set of approved shop drawing prints that have been revised to show each and every change made to the structure cabling system from the original approved shop drawings. Drawings shall consist of a scaled plan of each building showing the placement of each individual item of the technical cabling system equipment as well as raceway size and routing, junction boxes, and conductor size, quantity, and color in each raceway.
- f. As-built Drawings shall include cable pathways, camera locations with correct labeling and MDF/IDF locations. A copy of the As-Built drawings reflecting the final locations of all cabling shall be given to the designated Owner's representative. The as-built drawings shall be prepared using AutoCAD 2012 or later. Provide the Owner with electronic versions of the as-builts on CD media.
- g. All drawings must reflect final graphic numbering, point to point wiring, device address and programmed characteristics as verified in the presence of the engineer and/or the end user unless device addressing is electronically generated, and automatically graphically self-documented by the system.
- h. A copy of the manufacturer's warranty on the installed system.
- i. Any keys to cabinets and/or equipment and special maintenance tools required to repair, maintain, or service the system.
- j. Operating and Maintenance Instructions for all devices within the system. These instructions shall reflect any changes made during the course of construction, and shall be provided to the Owner, for their use, in a three-ring binder labeled with the project name and description. (4 copies)
- k. Upon completion of the work and at a time designated by the Architect or owner, provide formal training sessions for the Owner's operating personnel to include location, operation, and maintenance of all included systems and equipment. Minimum amount of training time shall be at least 4 hours.

1.8 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Minimum 5-year experience manufacturing similar products.

- B. System Integrator shall provide the following as part of the System Solution:
 - 1. Complete product and technical data specification sheets that include all material and equipment and shall be available freely online.
 - 2. List of all equipment with part numbers, manufacturer, firmware, and assigned IP addresses.
 - 3. Locations and details for all components to be installed under this scope of work.
 - 4. Placement Diagram showing the proposed location of all system hardware devices.
 - 5. System Calculation of all network bandwidth and storage requirements for System Servers to ensure proper planning of computing and networking infrastructure.
- C. Installer Qualifications: Minimum 10-year experience installing similar products. Installers shall be trained and authorized by the Manufacturer to install, integrate, test, and commission the system.

1.9 PRE-INSTALLATION MEETINGS

- A. Convene minimum two weeks prior to starting work of this section.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store products in manufacturer's unopened packaging bearing the brand name and manufacturer's identification until ready for installation.
- B. Handling: Handle materials to avoid damage.

1.11 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.

1.12 SEQUENCING

- A. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.13 WARRANTY

- A. The security system VMS software and labor furnished by the System Integrator including wiring, software, hardware and third-party products shall be fully warranted for parts, materials and labor for a minimum of 1 year from date of the final acceptance of the Video Surveillance System.
- B. Manufacturer shall provide a limited 3-year warranty for the product to be free of defects in material and workmanship.
- C. Software Licensing and Warranty:
 - 1. Software licensing should be on a per device basis (e.g. 1 x license for 1 IP Camera or I/O device) with no base license for additional features or capabilities.
 - 2. The VMS Software should be completely free for live streaming or playback of

3. offline media files (images, videos).
Lifetime software upgrades shall be provided by the Manufacturer without cost and without the need for an annual maintenance agreement.

2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer:
 1. VMS – Video Insight
 2. Cameras - Advidia
- B. Requests for substitutions will be considered in accordance with provisions of Division 1

2.2 IP SERVER

- A. IP Server shall be designed to run on a Windows platform, supporting both Desktop and Server class operating systems including Windows 7, 10(Pro), 2008 R2, 2012, 2016.
- B. It shall run as a Window's Service. This service shall run as part of the local service account. This service shall be running as long as the system is booted and has started Windows. It shall not require the user to be logged in.
- C. It shall store settings in SQL Express and shall not require a full MS-SQL license.
- D. It shall have an option for a 32-bit binary and a true 64-bit binary. In a 64-bit OS, it shall run as a native 64-bit application, not merely a 32-bit application.
- E. The service shall connect to the camera and handle streaming to the server. It shall not require each client to connect to individual cameras.
- F. This service shall allow the cameras to be placed on one network and the clients on a separate network using a different IP range.
- G. The software shall support the ONVIF standard.
- H. The software shall support Megapixel virtual cameras within a single camera license.
- I. The server shall only require two ports for streaming video as well as handling any setting changes or commands from the client software.
- J. IP Server shall record the video streams from different cameras.
 1. The service shall handle transcoding of the camera streams if the cameras are MJPEG based. The video shall be re-encoded to WMV to reduce storage needs and to reduce the impact of streams to clients on the server.
 2. For MPEG-4 based cameras, the video shall be stored in the native codec of the server.
 3. For H.264/H.265 based cameras the video shall be stored in the native codec of the server.
 4. Each camera will have the option to be able to be stored in different locations (i.e. One locally, another on a NAS, a third on a different network share).
 5. Streaming from server to client shall support H.264/H.265.
 6. The server must have Pivot 3 integration.

- K. IP Server shall support H.264/H.265, MPEG-4, MJPEG and MXPEG based cameras.
- L. IP Server shall support motion detection at the camera and at the software levels.
- M. IP Server shall provide graphic examples of what it determines as motion to thick clients if the thick client requests it.
 - 1. The software shall display the motion detection as an outline around the area moving.
 - 2. The software shall provide a bar showing the total percentage of change. This bar shall have a slider on it to allow the user to quickly set motion detection.
- N. IP Server shall allow for multiple zones to be set within an image that support differing motion detection values within a cameras field of view.
 - 1. There shall be no limit on the total number of zones allowed, either on a per camera or per server basis.
 - 2. Zones should allow the ability to ignore motion within an area.
 - 3. The user shall have the ability to move the zones after the fact.
 - 4. Motion zones should be able to be tied into a rules engine to allow the software to use them as triggers for events.
- O. IP Server shall support the use of imported maps to show camera placement. These formats for these maps will be JPG, GIF or BMP as determined by the user.
 - 1. Hovering over a camera on a map shall cause it to be displayed in a window on the side.
 - 2. When the camera is displayed on the side, the option to review recently recorded video will be available to them.
 - 3. The user shall be able to embed layouts onto the facility map. Clicking on the layout shall change the display of the client software.
 - 4. Alarms from DIOs shall be able to be embedded as well.
 - 5. Audio sources shall also be an option.
 - 6. Other facility maps shall also be an option to embed. Clicking on a different embedded map shall bring up that map.
 - 7. Doors from certain access control systems can be imported and displayed. Hovering over the door shall display the last badge used to badge in, a live view of the camera associated with the door. The user from this pop up shall be able to see badge events and alarm events along with the associated video.
- P. IP Server shall not require the administrator to contact the manufacturer to replace a camera.
- Q. IP Server shall support reporting to a diagnostic tool.
 - 1. Number of active cameras.
 - 2. Active cameras offline.
 - 3. Version of the server.
 - 4. Amount of disk space left.
 - 5. Recording status of the server.
- R. IP Server shall support pre-motion and post motion recording.
- S. IP Server shall support customizable layouts. The layouts will allow for blank spaces within the layout.

- T. IP Server shall support an unlimited number of users.
 - 1. Users can be drawn from either an Active Directory server, Novell eDirectory or entered manually.
 - 2. There will be five different levels of user.
 - 3. Users can be members of a group with settings set for the group. Individual user settings can override the group settings.
 - 4. Permissions can be set for live viewing, access to recorded video, control of PTZ cameras, access to audio, the ability to export video, custom layouts, facility maps and rules. Permissions can be defined on a per camera basis.
 - 5. It shall support the option of having the users limited to being signed in, to a single location.
- U. IP Server will include a diagnostic version with limited interface, to allow for testing of the server.
- V. It shall support an optional secondary server with failover capacity.
- W. A rules engine shall be included to allow the server to handle more complex tasks.
 - 1. Triggers will include:
 - a. Dry contacts (DIO).
 - b. Motion detection of a camera stream.
 - c. Scheduled events. Events can be scheduled on daily, weekly, or monthly basis. Individual events can be handled as well.
 - d. An Alert button for the user interaction in the VI Monitor.
 - e. Inputs sent programmatically via appropriate APIs.
 - f. Access control events from supported Access Control Vendors.
 - 2. Actions will include:
 - a. Logging the event.
 - b. Opening or closing a dry contact.
 - c. Sending an e-mail with a custom text message tied to the trigger. Multiple texts will be allowed for different triggers.
 - d. Sending an e-mail with an AVI/MP4 clip from a selected camera.
 - e. Sending an e-mail with a JPG file of a selected event from a camera.
 - f. Opening a live window for a user who is viewing.
 - g. Move a PTZ to a certain preset location.
 - h. Force recording.
 - i. Force recording with audio.
 - j. Instant Replay.
 - k. Sending video to a Network Decoder.
 - l. Switching single camera or layout views.
 - m. Message Instruction.
 - o. Moving, copying or deleting of files.
 - p. Execute a program or batch file.
 - q. Send an ASCII string to a TCP port.
- X. IP Server shall support time out functionality.
 - 1. A universal RTSP option shall exist for adding cameras if they are not currently supported through native APIs.
- Y. PTZ functionality within the camera will be supported.
- Z. Dewarping of Panoramic shall be supported for the following manufacturers:
 - 1. Advidia

2. AMG
3. Axis
4. Dahua
5. Hikvision
6. Oncam
7. Pelco
8. Panasonic
9. Sentry 360
10. Uniview
11. Vivotek
12. Dlink
13. Dynacolor
14. EverFocus
15. GridSmart
16. IDIS
17. ACTi
18. GeoVision
19. Hanwha
20. Samsung
21. ImmerVision

- AA. IP Server will only stream video to the clients that requested them.
- BB. If live video is paused, then IP Server shall stop streaming video to the clients to conserve bandwidth.
- CC. IP Server shall support integration with various access control platforms, including:
1. Imron
 2. MonitorCast v.3
 3. MonitorCast v.4
 4. AMAG
 5. Badge Pass
 6. Blackboard
 7. Continental
 8. Infinias
 9. Isonas
 10. Lenel
 11. Paxton
 12. CCURE
 13. DSX
 14. Gallagher
 15. Maxxess
 16. RBH
 17. S2
 18. Sureview
- DD. IP Server shall have support panic button functionality through rules engine.

2.3 WEB CLIENT

- A. The Web Client shall be a truly thin client with no download required other than an internet web browser or standard web browser plugins.

- B. The Web Client shall be platform independent and run within Microsoft Edge, Internet Explorer, Firefox, Safari, and Google Chrome.
- C. Users will not be able to change any settings within IP Server via the thin client without Admin privileged.
- D. Users will be able to select layouts for live viewing, or individual cameras or groups of cameras.
- E. Users will be able to access recorded video.
- F. Users will be able to download recorded video from the system.
- G. Users will be able to use the motion log to find recorded video.
- H. The Web Client shall support the use of facility maps.
- I. The Web Client will support the use of custom layouts.
- J. The Web Client shall allow remote access for iPhone, Blackberry, Windows Mobile, and Android mobile phones without the installation of an app.

2.4 HEALTH MONITOR

- A. Front end, or by sending out an e-mail to one or more users.

2.5 VIDEO WALL

- A. The VSS shall support video wall applications by connecting and controlling multiple workstations and monitors simultaneously.

2.6 VSS MOBILE APPLICATION

- A. The VSS shall support module applications that run on the following Operating Systems:
 - 1. Google Android.
 - 2. Android 4.0: Ice Cream Sandwich thru the most current version
 - 3. Apple iOS: 5 thru the most current version
- B. The App will have access to live cameras.
- C. PTZ functionality will be available in the App.
- D. The App will have access to recorded video.
- E. Snapshots will be able to be e-mailed from the App.

2.7 SERVERS

- A. Rackmount Servers:
 - 1. Server sizes and quantities shall be provided on storage and server calculations conducted by the system installer, based on the minimum parameters stated within the contract documents.

2. Server Requirements shall meet the specifications of the VSS Manufacturer. The following specifications shall be considered minimum requirements:
 - a. Record Video and Audio: 470 Mbps.
 - b. Send data from video cameras to a hard disk array of 1 to 8 HDDs within a rack mountable format and enable playback of video and audio from the hard disk array.
 - 1) Pre-configured with VSS software.
 - 2) Remote monitoring environment for video and audio over network using a remote computer.
 - 3) SQLite, a free database technology included in the installation package.
 - c. General Properties:
 - 1) Camera Search and Discovery: Search network for connected compatible cameras via Onvif Profile S.
 - a) Cameras are Searched or Discovered:
 - b) Cameras automatically registered and current camera information (fps, days of recording) displayed.
 - c) Ability to selectively register as many as cameras can be found.
 - 2) Support dual monitor out.
 - 3) Support server backup if multiple servers are in the hive for failover for redundancy.
 - 4) Recording and Playback Functions:
 - a) Support recording 128 dual streams (256 streams) from 352 x 288 (CIF) up to 4000 X 3000 (12 MP) per channel.
 - b) 470 Mbps network camera recording throughput.
 - c) Simultaneous Playback Capability: 128 video channels.
 - d) Compression Support: H.265, H.264, and MJPEG.
 - e) NVR to record and stream AAC, PCM, g726, and MPS audio.
 - f) View status of internal connected storage hardware.
 - g) Set recording schedules.
 - h) Set up triggered recording based on:
 - (1) Sensor (input) detection.
 - (2) Motion Detection.
 - (3) Video loss detection.
 - i) Available recording settings by channel for standard and event-based recording types:
 - (1) Compression type.
 - (2) Resolution.
 - (3) Images per second.
 - (4) Quality.
 - (5) Data transfer limit.
 - (6) Pre-event and post-event record duration.
 - (7) I-frame and full frame recording.
 - j) Available actions upon reaching full HDD storage capacity:
 - (1) Stop recording.
 - (2) Overwrite.

- k) Search recorded data by time, event trigger, motion alarms, events.
 - 5) Storage: Four, 8 TB HDDs in JBOD configuration for a maximum of 32TB.
 - a) USB connection for memory/storage device for video clip backup and settings export.
 - 6) Live View:
 - a) Remote monitoring using VSS supplied viewer.
 - b) Streams: H.265, H.264, MJPEG.
 - c) Offline Media: AVI, MKV, MP4, MOV, TS, M2TS, MPEG, MPG, FLV, WMV, 3GP, JPG, PNG, GIF, BMP, and TIFF.
 - d) Configure and exercise functions for connected PTZ cameras, including functionality with compatible USB joystick.
 - e) Capture and save snapshot images.
 - f) Record current video in AVI format.
 - 7) Remote Access:
 - a) Multicast or Unicast: Simultaneous access is unlimited.
 - b) Mobile Device:
 - (1) Supported Platforms:
 - (a) Andriod.
 - (b) IOS.
 - (2) Supported Remote Users: Unlimited amount either live or playback.
 - (3) Dynamic DNS (DDNS) support.
 - 8) VGA and High Definition (HDMI) local monitor outputs live viewing, playback, and backup functions.
 - 9) ONVIF Profile S compliance.
 - 10) Alarm Connections: None on server. Use of I/O software module to support I/O control.
- d. System:
 - 1) Processor: Intel Core i5-7500 3.4 GHz.
 - 2) Memory: 8 GB DDR4.
 - 3) Operating Systems: Windows 10 IoT Enterprise.
 - 4) USB Ports: 4x USB 3.0(rear), 1x USB 3.0 Type-C (rear), 2x USB 2.0(front).
 - 5) Video Output: 2x HDMI (rear), 1x DVI (rear).
 - 6) Wi-Fi: IEEE 802.11ac.
 - 7) Other Ports: 1x PS2, 2x Wi-Fi Antennas, 3.5 mm audio in/out, 1x SPDIF out.
 - 8) Keyboard and Mouse: Included.
- e. RAID Support: None.
- f. Video Compression: H.265, H.264, and MJPEG.
- g. Recording:
 - 1) Channel Capability: No limit but recommended to use VSS Calculator.
 - 2) Bit Rate: 470 Mbps.
 - 3) Resolution Range: 352 x 288 to 4000 X 3000.
- h. Events and Response Actions:

- 1) Triggers:
 - a) Motion.
 - b) Video loss.
 - c) Event defined by camera.
- 2) Response Actions:
 - a) Record.
 - b) E-mail.
 - c) Activate PTZ preset.
 - d) Event Trigger program.
 - e) Sound output.
- i. Playback:
 - 1) Number of simultaneous channels: Not limited.
 - 2) Bandwidth: 470 Mbps.
- j. OS Drive: OS Drive Bays: 1, 256 GB SSD internally mounted.
- k. Storage:
 - 1) Internal:
 - a) Number of HDDs Bays: 1 to 8 Bays
 - b) Capacity: 1 to 8 TB per HDD.
 - 2) External Types: USB HDD/Flash drive for backup of video clips, firmware update, settings backup/restore, log export.
- l. Network:
 - 1) Connectivity: 1000 Base-T Ethernet, 2 x RJ-45 connectors.
 - 2) Protocols Supported:
 - a) Transmission Control Protocol (TCP), Internet Protocol (IP) v4 and v6, User Datagram Protocol (UDP).
 - b) Configuration: Dynamic Host Configuration Protocol (DHCP).
 - c) Web Services: Hypertext Transfer Protocol (HTTP), Secure HTTP (HTTPS).
 - d) Network Services: Address Resolution Protocol (ARP), Domain Name System (DNS), Internet Control Message Protocol (ICMP): Network Time Protocol (NTP), Simple Network Management Protocol (SNMP v1/2c/3 – MIB-2), Universal Plug and Play (UPnP).
 - e) Media: Real-Time Transport Protocol (RTP), Real-Time Control Protocol, Real-Time Streaming Protocol (RTSP).
 - f) Multicast: Internet Group Management Protocol (IGMP).
 - g) Notifications: Simple Mail Transfer Protocol (SMTP).
 - h) Remote Access: Point-to-Point Protocol over Ethernet (PPPoE).
 - 3) DDNS: Support DDNS services offered by the Manufacturer and other publicly available service offerings.
 - 4) Security Features:
 - a) User password protection with group restrictions.
 - b) IP address filtering, list of allowed or blocked IP addresses.
 - c) HTTPS(SSL) login authentication.
 - d) User access log.
 - e) 802.1x authentication.

- f) Restriction of network access/web viewer access.
 - 5) Discovery: Manufacturer shall offer a discovery program to identify all devices of his manufacture on the network, as well as ONVIF Profile S conformant devices.
 - m. Alarm/Sensor Interface:
 - 1) Input (0): NO or NC, selectable.
 - 2) Output (0): NO or NC, selectable.
 - 3) Use of I/O software module to support I/O control.
 - n. Audio:
 - 1) Direction: Bi-directional.
 - 2) Compression: AAC (16/48KHz), G.711 u-law, G.726 selectable.
 - 3) Output: Line level (RCA).
 - 4) Output: Line level (RCA).
 - o. Electrical:
 - 1) Power: 100 to 240 VAC.
 - 2) Power Supply: 800 W Redundant.
 - p. Mechanical and Environmental:
 - 1) Color: Black / metal.
 - 2) Front Bezel and lock.
 - 3) Form Factor 2U Rack Mount Chassis. Sliding rails included.
 - 4) Mouse and Keyboard: Included.
 - 5) Dimensions (W x H x D): 17.2 x 3.5 x 26 inch (438 x 87.0 x 660 mm)
 - 6) Weight: 30.86 lbs. (14kg).
 - 7) Temperature; Operating and Storage: 32 to 122 degrees F (0 to 50 degrees C)
 - 8) Humidity: 5 to 85 percent, RH non-condensing.
- B. All equipment shall be delivered to the site following the schedule provided. Provide full manufactures warranty for all server equipment.
 - C. Servers shall be preprogrammed to include a floor plan graphic of all applicable sites and the exact camera locations and name of cameras. Field verification of camera names is required to complete this task.
 - D. In response to proposal, contractor shall provide owner with amounts for annual service maintenance agreement that can be purchased after warranty period has expired.

2.8 CLIENT WORKSTATIONS

- A. Contractor to provide one (1) client workstation with the installation location to be determined at the time of install. Additional workstation will be furnished by the Owner as required.
- B. Contractor shall include configuration of two (2) additional, owner furnished workstations.

2.09 CAMERAS

- A. Camera Types:

1. Tamper resistant with all movable parts enclosed behind a protective cover.
 2. Integrated Dome In-Ceiling flush mount.
 3. Water resistant.
 4. 3-year warranty on all cameras.
- B. Color Cameras
1. Acceptable Manufacturers:
 - Type A – Digital Watchdog DWC-VSDG04Bi (4MP)
 - Type B – Hanwha QNV-C9011R (8MP)
 - Type C – iPRO WV-U85402 (2x4MP)
 - Type D – iPRO WV-S85702-F3L (2x4MP)
 - Type E – iPRO WV-S8573LG (3x4MP)
- C. Field of View Determination by the contractor as necessary for fixed camera locations shall be performed at no additional cost to provide the view desired by the owner. Contractor shall coordinate all final camera views and locations with owner for final approval.

2.10 ADDITIONAL HARDWARE OR EQUIPMENT REQUIRED

- A. Licensing
1. Provide the owner with all licenses as required for installation

3 EXECUTION

3.1 PREPARATION

- A. System Integrator: Confirm the solution proposal planning and design with the installing contractor.
- B. The network design and configuration to be verified for compatibility and performance with the input/output devices.
- C. Network Configuration: Tested and qualified by Contractor prior to remote device installation.
- D. Equipment to be tested and configured in accordance with instructions provided by the manufacturer prior to installation.
- E. All firmware found in products to be the latest and most up to date provided by the manufacturer, or of a version as specified by the provider of the Video Management Application (VMA).
- F. All equipment requiring users to log on using a password to be configured with user/site-specific password/passwords. No system/product default passwords shall be allowed.
- G. Confirm hardware will be stored in an environment where temperature and humidity are in the range specified by the Manufacturer.

3.2 INSTALLATION

- A. General
1. Install products per manufacturer's recommendations and approved submittals.

- a. Comply with documentation provided by the System Integrator to ensure all steps have been taken to provide a reliable, easy-to-operate system.
 2. Contractor personnel must comply with all applicable state and local licensing requirements.
 3. Before permanent installation of the system, the Contractor will test the system in conditions simulating the final installed environment witnessed by the System Integrator. Adjust as required until proper operation is achieved.
- B. Cable Support:
1. All wire not installed inside conduit or a designated cable tray system shall be installed in a dedicated cable support system for the entire run of each cable. Including, but not limited to service loops.
 2. The approved cable support system shall be attached directly to the building steel at a serviceable height. In the event that the building steel is not 5' of the finished ceiling, the contractor shall provide a dedicated threaded rod extending within 5' of the finished ceiling and mount the J-MOD™ support hook to the treaded rod.
 3. Cable support shall be installed at a maximum of 5' on center.
 4. All cable installed shall be attached to the support system with plenum rated Velcro and a plenum rated Velcro tie shall be installed between each cable support to keep wires neatly bundled throughout the entire run. Tie wraps will only be allowed to be used inside the control panels as required to manage the wires within each type of panel.
 5. Absolutely no cable, not installed in conduit, will be allowed to be attached directly to the building's steel or supported in any other method than that stated above.
 6. It is the responsibility of the installing contractor to coordinate with all other trades on the project to insure that the pathway of this system does not interfere with the installation of the other trades and to prevent the installed product of other trades from putting strain on the installed wiring.
 7. Do not route cable through webbing of structural steel.
- C. Conduit / Raceway:
1. All wire shall be installed in an approved conduit/raceway system (except where permitted by NEC and the local authority having jurisdiction). Maximum conduit "fill" shall not exceed 40% per NEC.
 2. Conduit and raceway system shall be installed as specified under the general electrical section of the specifications, and per NEC.
 3. Minimum conduit size shall be 3/4" EMT. Install conduit per engineered shop drawings.
 4. 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 or subject to damage.
 5. All conduit ends shall have a protective bushing to prevent cable damage. Bushings must be installed prior to installing cable. Cutting bushing to install around installed cables will not be accepted.
- D. Fire Wall Penetrations: The Contractor shall avoid penetration of fire rated walls and floors wherever possible. Contractor shall also seal all floor, ceiling and wall penetrations in fire or smoke barriers and in the wiring closet.
- E. Wall Penetrations: Where penetrations are necessary, they shall be sleeved with metallic

conduit and resealed with an Underwriter Laboratories (UL) approved sealant.

- F. Provide three-sided pre-finished metal hood and seal to wall where conduit penetrates exterior wall.
- G. Install new roof mounted conduits on portable pipe supports – (low profile type), as manufactured by Portable Pipe Hangers or Advanced Support Products. Provide roof protection pads under each support. Coordinate location and routing with design engineer prior to rough-in or installation of system.
- H. Do not install wall mounted cameras into metal fascia. Ensure they are mounted into brick, and sealed top and sides (not bottom)

3.3 EQUIPMENT RACK CONFIGURATION

- A. Cable Placement: Cable installation in the wiring closet must conform to the Project Drawings. All cabling shall be routed so as to avoid interference with any other service or system, operation, or maintenance location. Avoid crossing areas horizontally just above or below any riser conduit. Lay and dress cables to allow other cables to enter the conduit/riser without difficulty at a later time by maintaining a working distance from these openings.
- B. Cable shall be routed as closely as possible to the ceiling, floor or corners to ensure that adequate wall or backboard space is available for current and future equipment. All cable runs within the wiring closet shall be horizontal or vertical within the constraints of minimum cable bending radii. Minimum bend radius shall be observed. Cables shall not be tie-wrapped to electrical conduit or other equipment.
- C. All incoming cables shall be routed on the cable tray and neatly dressed down to the patch panels.

3.4 WIRING INSTALLATION

- A. General:
 - 1. Cabling between wiring closet and camera locations shall be made as individual home runs. No intermediate splices may be installed or utilized between the wiring closet and the camera location.
 - 2. All cable must be handled with care during installation so as not to change performance specifications.
- B. Placement: All cabling and associated hardware shall be placed so as to make efficient use of available space. All cabling and associated hardware shall be placed so as not to impair the Owner's efficient use of their full capacity.
- C. Cabling connecting any cameras located on the exterior of the building require DITEK surge suppressors on both ends of data cabling. Provide proper grounding for surge suppressors.

3.5 DOCUMENTATION

- A. Labels: The Contractor shall label all outlets using permanent machine engraved labels approved by the Owner. Label patch panels in the wiring closet to match those on corresponding camera locations. The font shall be at least one-eighth inch (1/8") in height, block. All labels shall correspond to as-builts and to final test reports.

- B. Contractor shall ensure complete typed labeling of all cameras with numbers that correspond to locations on video server. Labeling system shall correspond to the Owner's labeling system. Verify with Owner. Provide tags (black letters on white labels, plastic coated) on all cables and outlets.
- C. All cables shall be labeled at both ends with a machine label and all terminations shall be stenciled with a typed label for quick circuit identification. Labeling shall conform to TIA/EIA standard 606 and include interconnect cable identification numbers.
- D. A floor plan, clearly labeled with all numbered camera locations, shall be included in the as-built plans.

3.6 CABLE TESTING - BY MANUFACTURER'S REQUIREMENTS

- A. Notification: The Owner/Architect/Engineer shall be notified one week prior to any testing so that the testing may be witnessed.
- B. Final Acceptance: Before requesting a final acceptance, the Contractor shall perform a series of end-to-end installation performance tests. The Contractor shall submit for approval a proposal describing the test procedures, test result forms and timetable for all copper and fiber optic cabling.
- C. Procedures: Trained personnel shall perform all testing. Acceptance of the test procedures discussed below is predicated on the Contractor's use of the recommended products and adherence to the inspection requirements and practices set forth. Acceptance of the completed installation shall be evaluated in the context of each of these factors.
- D. Errors: When errors are found, the source of each error shall be determined, corrected and the cable retested. All defective components shall be replaced and retested. Retest results must be entered on the test results form. All corrections shall be made prior to final acceptance test.

3.7 INSPECTION

- A. Conformance to the installation practices covered above are to be verified when completed. In some cases, the Owner/Architect/Engineer may observe before acceptance.

3.8 WARRANTY

- A. Guarantee and warrant all equipment provided for a period of 3 years following date of substantial completion, or a period equal to the stated guaranty/warranty offered by the product manufacturer, whichever is the longest in duration.
- B. All such warranties shall include all parts (NVR's, and Power Supplies).
- C. Labor and all other costs as necessary to maintain the equipment in operating condition as intended by the product manufacturer after a period of 1 year shall be negotiated with the owner upon project completion

END OF SECTION 28 20 00

SECTION 28 23 06

INTRUSION DETECTION SECURITY SYSTEM

1 GENERAL

1.1 WORK INCLUDED

- A. Provide a complete intrusion detection and alarm system as specified herein. The system shall include, but not be limited to, all control equipment, power supplies, power circuits, signal initiating and signaling devices, conduit, wire, fittings, and all other accessories required to provide a complete and operable system.
- B. Security system devices indicated are for reference and coordination purposes only. The installing contractor shall design and provide an intrusion detection and alarm system meeting the requirement of specification. Provide all security system devices required for complete system acceptable to all governing authorities, Architect, and Owner.
- C. Provide system equipment as required, specified and as indicated on drawings. The system shall include, but not be limited to, all control equipment, power supplies, power circuits, signal initiating and signaling devices, conduit, wire, fittings, and all other accessories required to provide a complete and operable system.
- D. The contractor shall schedule a pre-construction meeting with the security sub-contractor's installing technician, the contractor's project superintendent, door hardware installer, the Owner's security personnel, and the Architect to aid in coordination and help to avoid overlap during the installation phase.
- E. Interface this campus location to the district security and access control monitoring station as designated by the Owner.
- F. Contractor must be in good standing with the district and have no outstanding performance or warranty items at the time of submitting the proposal. Any outstanding items or issues is grounds to disqualify the Contractor's proposal.
- G. All structured cabling for data connections for door controllers to connect to the owner's LAN shall be installed by the structured cabling contractor.

1.2 CODES AND STANDARDS

- A. National Fire Protection Association Standards, latest published edition:
 - 1. NFPA 70 National Electric Code
 - 2. NFPA 72 National Fire Alarm and Signaling Code
 - 3. NFPA 101 Life Safety Code
- B. Local & State Building Codes
- C. Requirements of Local Authorities having Jurisdiction
- D. Underwriters Laboratory Requirements and Listings for use in Security Alarm Systems.
- E. Requirements of American Disabilities Act

- F. Local Accessibility Standards
- G. State Fire Marshall.
- H. State Insurance Code.

1.3 QUALITY ASSURANCE

- A. Contractor Qualifications:
 - 1. The installing contractor shall be the authorized representative of the intrusion detection control system manufacturer to sell, install, and service the proposed manufacturer's equipment. The installing contractor shall have represented the security alarm manufacturer's product for at least two years. The contractor's access control system installers and programmer shall have attended manufacturer installation and programming training and shall be a certified partner by the manufacturer in all aspects of installation, programming, and providing end-user training.
 - 2. The installing contractor shall be licensed by the State as a security services contractor to design, sell, install, and service security alarm systems.
 - 3. The installing contractor shall provide 24-hour, 365 day per year emergency service with factory trained service technicians.
 - 4. The installing contractor shall have personnel on their staff that has been actively engaged in the business of designing, selling, installing, and servicing security alarm systems for at least ten (10) years.
 - 5. All Contractors must submit to the owner prior to starting any work the factory training certificates for all personnel that will be working on the access control system. No person is allowed to work on the system without proper manufacturer's certification.
 - 6. The proposing contractor for this system and the installing contractor of this system shall be of the same organization. Absolutely no subcontracting of any portion of this system by the proposing contractor will be allowed.
 - 7. Contractor must be a current integrator of the specified solution in the closet major metropolitan area marketplace, have a permanent office located within 75 miles of the project, and be able to include information on current support staff to be able to service the equipment provided.

1.4 SUBMITTALS

- A. Contractor shall meet with CFISD Security representative prior to submission of formal / final shop drawings to Architect to allow the Owner and Architect to review a preliminary draft copy of the submittal to verify compliance with the specifications and any detailed requirements of the project. After the submittal has been reviewed by the Architect / Owner / Engineer, the required preconstruction meeting shall take place with the Owner's Security Personnel / Architect / Engineer.
- B. The installing contractor and/or equipment supplier shall provide complete and detailed shop drawings and include:
 - 1. Bosch/Radionic Distribution/Installer Factory Authorization Certificates
 - 2. Control panel wiring and interconnection schematics.
 - 3. Complete point-to-point wiring diagrams of each device.
 - 4. Riser diagrams.
 - 5. Complete floor plan drawings locating all system devices and system zoning.
 - 6. Factory data sheets on each piece of equipment proposed.
 - 7. Detailed system operational description.
 - 8. Complete system bill of material.

9. Factory training certificates for all personnel that will be working on the Radionics System. No person is allowed to work on the Radionics system without proper manufacturer's certification.
 10. Line by line specification review stating compliance or deviation.
- C. All submittal data will be in bound form with Contractor's name, supplier's name, project name, and state security license number adequately identified.
- D. Mark up a complete copy of the specifications including all addenda items 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:)

1.5 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".

1.6 WARRANTY

- A. The security system, 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 test of the complete system at the end of the warranty period and correct any and all items to bring the system to an approved status at no cost to the Owner. Clean all smoke detectors and replace all defective parts 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.

2 PRODUCTS**2.1 ACCEPTABLE MANUFACTURERS AND INSTALLERS**

- A. Acceptable Manufacturer: Bosch Security Systems, no exceptions.

2.2 CONTROL COMMUNICATOR PANEL

- A. The IDS control panel shall be Bosch Security Systems, Inc., model # B9512G comprising a fully integrated intrusion, fire, and access control system. The system will not be used for fire alarm purposes or access control purposes. The IDS shall be integrated with the AMAG access control system to allow shunting of door contacts. The control panel shall include the following:
 - 1. Telephone Line Module Interface with programmable options for signaling and supervision.
 - 2. Conettix IP based communication for high-speed, secure alarm transport and control.
 - 3. 32 programmable areas with perimeter and interior partitioning.
 - 4. 8 on-board, class B hardwired points with expansion capability for a total of at minimum 500 wired or wireless points.
 - 5. Compatibility with touch-screen color LCD, vacuum fluorescent, ATM style LCD or LED style Alarm Command Centers.
 - 6. Local or remote programming, test, and diagnostic capability via a computer running the Remote Programming Software (RPS).
 - 7. The system shall support the use of an Apple iOS device for control. Functions to include arming, disarming, control of outputs, lock, unlock, cycle and secure access doors.
 - 8. Integrated real time clock, calendar, test timer and programmable

- scheduling capability for relay control and automatic execution of system functions based on a time / event.
9. Minimum 1.4 amps of power for standby operation and 2 amps of alarm power, both rated at 12 VDC.
 10. 2 wet-contact relay outputs and 1 Auxiliary wet-contact relay output with expansion capability for up to an additional 128 dry-contact relay outputs.
 11. Integrated battery charger with reverse hook up protection, battery supervision and battery deep discharge protection.
 12. Supervision of peripheral devices and communications interface(s).
- B. Programmable features shall include:
1. Independently control zones through an independent zone control keypad.
 2. Two telephone number dial up for primary and secondary remote receivers.
 3. Automatic test reports.
 4. Selective zone shunting.
 5. Custom text on the associated command centers.
- C. Zone Expansion - Expanded to 500 (8 on-board, 492 off-board) individually annunciated points of protection through the addition of a two-wire multiplex zone expansion system (ZONEX). Points of protection are annunciated with custom text at the B915 Command Center and they can be reported to a Radionics D6600Receiver.
- D. User Pass Codes – nine hundred ninety-nine (999) user pass codes shall be available to identify the user when arming/disarming the system.
- E. Protective Circuits shall consist of zones designed for fire and/or panic (holdup, duress, or emergency) and/or burglary and/or supervisory. Each zone represents a protective circuit and shall accommodate normally opened and closed devices with end-of-line resistor supervision. Each of the 500 points are programmable as to whether they are controlled versus 24 hours; interior versus perimeter; instant versus delayed; silent versus audible (and if audible, pulsed or steady); and local or reporting.
1. Additional programmable parameters for each point include the ability to suppress trouble or restoral reports, designate it as a priority zone (system cannot be armed if this point is off-normal), report two separate telephone numbers and provide for automatic shunting of points from the system in the event that the detection device malfunctions and creates numerous false alarms.
 2. Each POPIT shall accommodate normally opened and normally closed devices with end-of-line resistor supervisor.
 3. Minimum total points, 500.
- F. Entry/exit delays shall be independently programmable from 10 to 150 seconds. A pre-warn audible shall be coincident with the entry delay.
- G. Programming of all system functions shall be achievable at system site or remotely via the use of the dial-up telephone network. Minimum programmable functions shall include:
1. User pass codes, entry/exit delay times, master zone personality, day/date/time, telephone numbers, point of protection text labels, and bell time.
 2. A programmable system pass code shall be used to prevent unauthorized remote programming attempts.
 3. Remote programming capability shall be automatic or require user enabling at the discretion of the user.
- H. Remote control via the use of the dial-up telephone and owner's local area network shall include:

1. System arming.
 2. Reset of audible signals.
 3. Activation/deactivation of relay contacts.
 4. Interrogation of battery.
 5. Zone and armed status.
 6. Enable/disable of reporting functions and removing reporting devices for servicing while the remainder of the system is operative.
- I. Recognitions shall include: UL for central station fire and/or burglary, local burglary and/or fire and FM for fire.
- J. Miscellaneous built-in features shall include:
1. Real-time clock.
 2. Interrogator.
 3. Auto-answer modem.
 4. Phone line monitor.
 5. Loop start/ground start telephone interface.
 6. Auto bell test.
 7. Lug-in terminal strips, and user controlled zone bypass.
- K. Command centers shall be functional at each of the locations required, specified, and as shown on the floor plans.
1. 16 character illuminated alpha-numeric display.
 2. Burglary and fire sounders.
 3. Pre-warn tone.
 4. The arming station shall have the ability to annunciate the English language format via the 16-character alphanumeric display by the following:
 - a. Master zone (alarm, service, faulted, and function), POPIT (alarm, service, faulted, missing, extra, function, and location), arm/disarm status (system diagnostics, time/day/date, and user prompts).
 5. Additional features shall include local system test, sensor reset, panic and/or medical and/or duress alarm initiation, independent master zone by-pass with automatic restoration to normal status to next system arming, perimeter watch mode, user changeable pass codes, remote programming initiation, and system/monitoring service test.
 6. Radionics model B915 for educational facilities with students.
- L. Modules and Accessories
1. POPEX Module (Zone Expansion B299)
 2. B8103 Main Panel Enclosure & D101 Lock set- one required for the main panel and one for each quadrant of the project receiving a B299.
 3. D9002-5 6 location 3 hole Mounting plate- adapter used for hanging modules in all expansion panels.
 4. B430 Telephone line interface
 5. B308 Octo-Relay module - provides eight form "C" dry contact relay outputs for a variety of programmable responses to alarm, trouble and other system conditions.
 6. Auxiliary power supplies as required for powering of motion detectors, Altronix Power Supply (Part # SMP10PM12P8) - one required for each area of the project receiving a B299 zone expansion module.

2.3 FIELD DEVICES

- A. Ceiling mounted 360 Degree, infrared sensors / microwave motion sensors. Model DS 9370
1. Bracket for direct mounting to standard 3-1/2" and 4" electrical back boxes.

2. All units must be adjusted/masked to reduce false signals for the covered area.
 3. Contractor to provide a dedicated POPIT for each motion detector on the project.
- B. Ceiling mounted 200-ft long range infrared sensor. Model DS794Z
1. Bracket for direct mounting to standard 3-1/2" and 4" electrical back boxes.
 2. All units must be adjusted/masked to reduce false signals for the covered area.
 3. Contractor to provide a dedicated POPIT for each motion detector on the project.
- C. Wall mounted, high performance, Tri Tech PIR/Microwave sensor, Model ISC-CDL1-W15G
1. Bracket for direct mounting to standard 3-1/2" and 4" electrical back boxes.
 2. All units to have areas of coverage, which would cause false alarm signals to be generated, masked out and adjusted to reduce false signals.
 3. Provide model correct protective wire cage in gymnasiums.
 4. Contractor to provide a dedicated POPIT for each motion detector on the project.
- D. Magnetic Door / Hatch / Overhead Contacts
1. Where exposed contacts are used they shall be heavy duty switches protected by die cast aluminum housing and the leads shall be encased in steel armor jacket. The leads must pass through the back box by the correct size twin screw cable clamp connector.
 2. Magnetic Door / Hatch contacts shall be model Sentrol 2505A-L contact
 3. Overhead Roll up contacts shall be model Ademco 958 contact
 4. Contractor to provide door contacts with a dedicated POPIT for each entry door, set of doors, roof hatch or rollup door on the project.
- E. Glass Break Detector
1. Bracket for direct mounting to standard 3-1/2" and 4" electrical back boxes.
 2. Provide model correct protective wire cage in gymnasiums.
 3. Model GE Solution 2000 or GE Model 5812-RND
 4. Contractor to Provide dedicated POPIT for each room of glass break detectors on the project.
- F. Sirens
1. Shall be installed on Wall / Ceiling within 50 foot of every keypad location.
 2. Wired directly to corresponding relay module and not the main control panel.
 3. Model SSX-52 Amseco or compatible siren shall be used.
- G. Printer
1. Compatible with the main controller panel to print event history.

2.4 WIRING

- A. All wiring shall be as recommended by the manufacture's (Bosch/Radionics) installation instructions and as specified below. Cables shall be shielded only if required by manufacturer.
- B. Each remote area of a building shall provide its own Popex Module(s), power supply(ies) and enclosure(s) in that area's IDF. All areas considered for Popex Modules should be at minimum 500-ft from the main panel or as otherwise instructed by owner.
- C. All 120-volt Power shall be provided by the contractor.
- D. All Security system conduits as show on the drawings shall be provided by the

contractor.

- E. Coordination with the electrical contractor and other trades is the responsibility of the Security Contractor to ensure all conduit and other infrastructure is in place for a complete installation.
- F. All systems shall be connected to the emergency power source life safety branch.
- G. Color code of all security intrusion detection system and access control wiring shall be purple in color.
- H. Approved Products:
 - 1. 18/2 unshielded:
 - a. Belden #6300UE0071000
 - b. Tappan Wire & Cable, Inc. #P40020.122
 - 2. 18/4 unshielded:
 - a. Belden #6302UE0071000
 - b. Tappan Wire & Cable, Inc. #P41387.28
 - 3. 18/6 unshielded:
 - a. Belden #6304UE0071000
 - b. Tappan Wire & Cable, Inc.
 - 4. All cabling shall be in accordance with Manufacturer's requirements.

3 EXECUTION

3.1. INSTALLATION

- A. Contractor shall provide all equipment, cabling and accessories required to provide complete intrusion detection system and proper integration with building access control system for door contact shunting.
- B. Door locations: Provide additional accessories and wiring as required to interface with existing, new, or modified door hardware and framing.
- C. Provide all cable required for connection between the all intrusion detection equipment, key pads, and door hardware. All LAN structured communication cabling shall be provided by the structured cabling contractor.
- D. Provide ethernet network interface to connect school to district-wide networked access control system. Connect to local area network at each facility.
- E. Locate POPITs in proximity for doors and other detection devices at an easily accessible location for maintenance. Locate clear of exit signs, light fixtures and other obstructions. Coordinate final location with Owner.
- F. Coordinate and preform final software configuration and programming of system integration with Owner.
- G. Provide two 18-4 cables from the main controller panel to the prior designated future portable connection location and labeled in plain English on both ends. These spares cables are to be left above the ceiling.
- H. Provide one dedicated POPIT module for each device installed on the project including but, not limited to glass break detectors. Double door contacts may share one POPIT module

- I. All POPIT modules on project shall be mounted above drop ceiling in easily accessible area or as directed otherwise by Owner. POPIT modules shall be installed inside a 4"x4" junction box with a cover to be mounted on the wall nearest to the device the POPIT Module is associated with and at an easily accessible location. All boxes shall be labeled with the appropriate corresponding point number contained within and related door security ID number. Do not use architectural door numbers indicated on plans.
- J. Integrate the security system to the District Police Station monitoring system. Provide all hardware and cabling as required. Coordinate with Owner for programming requirements.
- K. All keypads, sirens, and POPEX modules shall have dedicated homeruns from each device to the master control panel. Do not daisy chain keypads or sirens. Daisy chaining of modules is permitted if location serves multiple areas of coverage.
- L. All POPIT modules and power supplies are required to be correctly located and identified on the as-built drawings delivered to Owner at substantial completion of project.
- M. All POPEX modules and power supplies shall be installed in IDF closets for that area of coverage with easy accessibility and a dedicated SDI2 homerun to the master control panel not to exceed 500ft.
- N. All device power runs shall be fused and clearly labeled in plain English at each main power source.
- O. Testing and expansion of existing systems prior to construction:
 - 1. Provide complete operational test of existing intrusion detection system prior to any demolition or construction with the presence of the Owner. 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. Any non-functional items will be noted and addressed by CFISD Security. Once system is returned to 100-percent functional status and verified by CFISD Security, contractor will assume all responsibilities for any damage and repairs during the entire construction period.
 - 3. Testing of the existing system shall include all areas and all buildings served by the existing system.
- P. 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.

3.2 SYSTEM OPERATION

- A. When an alarm condition is detected by any of the alarm initiating devices, the following functions shall occur:
 - 1. The system keypad's interior audible device shall sound until silenced by using proper security code or after system time out.
 - 2. A custom system alarm message shall be displayed on the LCD display. This display will show the alarm device location in plain English. Location and partition custom messages shall be field programmable.

3. The remote signaling tie connection shall be activated at the Owner's approved central security monitoring location and/or other Owner designated location.
 4. Printer shall provide printed copy of events recorded in logger. Install adjacent to security panel.
- B. The Intrusion Detection System shall monitor the following and signal/transmit a trouble condition for the following items. Provide dedicated POPIT modules for each item/location to give detailed item description and location information. Coordinate with the respective trades involved. Coordinate programming and testing of module with owner:
1. Provide monitoring of each walk-in cooler/freezer high temperature alarm(s) at the freezer/cooler control panel(s). Provide a dedicated POPIT module interface for each walk-in freezer/cooler system to provide a trouble alarm at the IDS should freezer/cooler encounter high temperature condition.
 2. Provide monitoring of each emergency shower location. Provide a dedicated POPIT module interface for each individual emergency shower to provide a trouble alarm at the IDS when the emergency shower is activated or upon water flow.
 3. The Intrusion Detection System shall monitor the Emergency Power System. Provide two dedicated POPIT modules for interface to provide a trouble alarms at the IDS upon any of the following conditions:
 - a. A loss of utility power notification shall be sent to the District Police Department when any automatic transfer switch sends a start command to the generator(s) due to a primary source (normal/utility) power failure. The IDS shall not notify the District Police Department for normally scheduled generator exercises that are successfully completed.
 - b. Any generator system trouble/alarm including but not limited to a failure to start notification shall be sent by the IDS if the generator exhibits a fail to start alarm either during a pre-programmed generator exercise or a primary source (normal/utility) power failure.

3.3 SYSTEM ZONING AND PARTITIONING

- A. The system shall employ intelligent initiating devices and interface devices capable of being recognized and enunciated at the main system keypad and devices partition keypad.
- B. All zoning/device locations shall be field programmable.
- C. Input control zones shall be coordinated with the Owner prior to final programming.
- D. Two weeks prior to substantial completion provide the Owner with a point list to use as a reference to assign LCD display test and to assign partitions to points, programming by contractor.

3.4 WIRING

- A. All wiring shall be in accordance with the National Electrical Code, Local Codes, and article 760 of NFPA Standard 70. All wiring sizes shall conform to recommendations of the equipment manufacturer, and as indicated on the engineered shop drawings.
- B. No line voltage AC wiring or any other wiring shall be run in the same conduit as access control or intrusion detection wiring.

- C. Wiring shall not be exposed in finished or in public areas shall be installed in an approved conduit/raceway system where it would otherwise be exposed. Wiring may be exposed above accessible ceilings (except where permitted by NEC and the local authority having jurisdiction).
- D. Tag all cables or conductors at each end.
- E. Systems utilizing open wiring techniques above accessible ceilings with low smoke plenum cable shall provide conduit in all other inaccessible locations, inside concealed walls, in all mechanical/electrical rooms, or other areas where wiring might be exposed or subject to damage.
- F. 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 traversing the respective box as well as the number of terminations required.
- G. Local Area Network (LAN) ethernet cabling shall be provided to the main control communicator by the structured cabling contractor. Provide one data drop to the main controller panel.
- H. Provide 20 feet of cable service loop at each field device for future repositioning.
- I. Provide all mapping and software configuration required to operate system as per manufacturer's recommendations.

3.5 CABLE PATHWAYS

- A. Cable Support:
 - 1. All wire not installed inside conduit or a designated cable tray system shall be installed in a dedicated cable support system for the entire run of each cable. Including, but not limited to service loops.
 - a. Approved Cable Support Product: PANDUIT® Corporation J-MOD™ modular support system (sized appropriately for the number of wires being installed. Reference the manufacturer's specifications for the suggested maximum cables per support size.
 - 2. The approved cable support system shall be attached directly to the building steel at a serviceable height. In the event that the building steel is not within five feet of the finished ceiling, the contractor shall provide a dedicated threaded rod extending within five feet of the finished ceiling and mount the J-MOD™ support hook to the treaded rod.
 - 3. J-MOD™ cable support shall be installed at a maximum of five feet on centers.
 - 4. All cable installed shall be attached to the J-MOD™ support system with plenum rated Velcro and a plenum rated Velcro tie shall be installed between each J-MOD™ cable support to keep wires neatly bundled throughout the entire run. Plastic cable ties shall only be used inside the control panels as required to manage the wires within each type of panel.
 - 5. Cable not installed in conduit shall not be attached directly to the building steel or supported in any other method than that specified above.
 - 6. It is the responsibility of the installing contractor to coordinate with all other trades on the project to ensure that the cable pathway of this system does not interfere with the installation of the other trades and to prevent the installed product of other trades from putting strain on the installed system wiring.
- B. Conduit / Raceway:

1. All wire shall be installed in an approved conduit/raceway system (except where permitted by NEC and the local authority having jurisdiction). Maximum conduit fill shall not exceed 40-percent per NEC.
2. Conduit and raceway system shall be installed as specified under the general electrical section of the specifications, and per NEC.
3. Minimum conduit size shall be ¾-inch.
4. Systems utilizing open wiring techniques with low smoke plenum cable shall provide conduit in all inaccessible locations, inside concealed walls, at all mechanical/electrical/communication rooms, or other areas where wiring might be exposed or subject to damage.
5. All conduit ends shall have a protective bushing to prevent cable damage prior to pulling cable. Cutting bushing to install around installed cables will not be accepted resulting in new conduit installation and new off-reel cable installation.

3.6 COMMISSIONING THE SYSTEM

- A. The installing contractor shall be responsible for verifying that each component of the system is fully operational and in conformity with the specifications. Ensure that all elements function together as a system in accordance with the specifications. Existing elements of the system that are to remain shall preform at or better than their pre-construction condition.
- B. A state licensed, and factory trained technical representative of the manufacturer shall supervise the final control panel connections and testing of the system. Upon completion of the acceptance tests, the Owner and/or its 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 items found not properly installed or non-functioning shall be replaced or repaired and retested.
- D. The installing contractor shall provide a complete written report on the functional test of the entire system. A copy of the test report shall be provided with maintenance manuals. The test report shall be signed and dated by the licensed security alarm superintendent responsible for supervising the final system test and checkout.
- E. The installing contractor's intrusion detection 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 alarm control panel.
- F. The testing and acceptance shall be performed within 30 days after the intrusion detection system installation is completed. The test shall be performed by a minimum of two qualified intrusion detection system technicians acceptable to the authority having jurisdiction. The test which is a comprehensive 100 percent inspection and test of all intrusion detection system equipment shall include the following:
 1. IDS control equipment: a visual and functional test of the IDS 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. IDS alarm peripheral devices; All IDS peripheral devices shall be functionally tested, and the location and testing information recorded for each device.
 8. Manual initiating devices:
 - a. Each manual alarm station at each keypad shall be functionally tested for alarm operation.
 - b. Each manual alarm station at each keypad 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.
 - 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. Reporting: Upon completion of the initial verification audit, a report shall be sent to the Architect/Engineer indicating that all IDS 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.
- G. It is the intent of these specifications and of the Architect/Engineer that a continued program of system maintenance be provided by the Owner. It is mandatory that the installing Contractor provide such services and make available these services to the Owner upon completion of the project.

3.7 EQUIPMENT IDENTIFICATION

- A. Each piece of equipment shall be provided with a permanently engraved or embossed or silk screen 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.

3.8 SPARE PARTS AND TOOLS

- A. Spare Parts:
1. Six spare fuses of each size used in the system
 2. Six spare detectors of each type in the system

3. Two copies of the final software programmed into the IDS.
 4. 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.
- B. Parts list: Furnish a list, in duplicate, of all other parts and accessories the manufacturer of the system recommends being stocked for maintenance.

3.9 KEYS

- A. Keys and locks for all equipment shall be identical. Provide not less than six keys of each type required. Identify keys by an appropriate number stamped on each key or on a metal tag attached thereto. Provide a key numbering chart in each operation and maintenance manual furnished.

3.10 GRAPHIC FLOOR PLANS

- A. Provide color coded floor plan detailed with room names, graphic room numbers and adequate information to direct people to the IDS devices in alarm with non-fading floor plan media.
- B. Each plan shall clearly relate the room numbers on the annunciator to the area description on the floor plan. All IDS devices located to correspond with the annunciator.
- C. The floor plan shall be solvent welded in acrylic plastic.
1. Mount in an extruded aluminum frame next to the main intrusion alarm control panel.
- D. Post minimum 11x17 size drawing, color laminated As-Built of system identifying all devices, key pads, panels and partitions on the wall near main control panel.

3.11 ADDITIONAL REQUIREMENTS

- A. Ensure all areas of the egress corridors are covered with motion detectors.
- B. Provide all accessories required for off-site monitoring. Coordinate with Owner for CFISD Police Department monitoring.
- C. Alarm circuit power supplies and circuiting shall be designed and installed to accept an additional five (5) POPITs and motion detection devices for future expansion. The initial design shall not exceed 70% of the rated power supply and circuit capability.
- D. Provide surface mount door contacts on all outside doors, roof hatches, and roof access doors.
- E. Do not place guard covers over motion detectors.
- F. Home run all wiring devices to the control panel or zone expander; an addressable loop system is not acceptable.
- G. Alarm systems must have a dedicated 120 VAC circuit on an emergency power panel.
- H. Intrusion detection shall be one system for entire building, armed and disarmed from any keypad in the building.
- I. Expansion of existing systems: Prior to construction

3.12 SUBSTANTIAL COMPLETION

- A. Final acceptance of the Intrusion Detection System by the Owner, local code authorities and Occupancy Permit has been issued.

3.13 TRAINING

- A. Provide training course to all security personnel assigned by Owner's Representative. The training shall include a course syllabus and hands-on participation. Training shall be conducted on a system identical to the one being installed on this project. The system shall be able to perform all system operations and simulate all types or forms of alarm conditions.
- B. Provide a video of the training program to the Owner's Representative to be used for periodic refresher course, training of the local security department and for training of new employees.
- C. The training course shall include, in addition to the above, a system overview, and a review of the operation and maintenance manual.
- D. The instructor shall be factory trained and shall be thoroughly familiar with all parts of the installation on which instruction is to be given. The instructor shall be trained in operating theory as well as in practical operation and maintenance work.

3.14 SOFTWARE

- A. Provide two electronic copies of the final programming and program software to the Owner's Security Supervisor after final approval.

END OF SECTION 28 23 06

SECTION 28 46 00

FIRE DETECTION AND ALARM SYSTEM

1 GENERAL

1.1 SECTION INCLUDES

- 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, fire alarm control panel, 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.
 - 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 specification. The Contractor shall provide all fire alarm and initiation devices required for a complete system acceptable to all governing authorities. Provide proper spacing and coverage of all devices.

1.2 RELATED SECTIONS

- A. Division 22, 23 and 26
- B. Sprinkler Systems
- C. Food Service
- D. Elevators

1.3 CODES / STANDARDS / REFERENCES (LATEST EDITIONS)

- A. National Fire Protection Association (NFPA):
 - 1. NFPA 13 Systems, Installation
 - 2. NFPA 17 Dry Chemical Extinguishing Systems
 - 3. NFPA 70 National Electrical Code
 - 4. NFPA 72 National Fire Alarm and Signaling Code.
 - 5. NFPA 80 Fire Doors and Fire Windows
 - 6. NFPA 90A Standard for the Installation of Air Conditioning and Ventilating Systems.
 - 7. NFPA 92A Smoke Control Systems
 - 8. NFPA 101 Life Safety code.
 - 9. NFPA 105 Smoke Control Door Assemblies

- 10. 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, 9th Edition.
 - 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. Uniform Federal Accessibility Standards (UFAS).
- D. Factory Mutual P7825 Approval Guide
- E. American National Standards Institute (ANSI).
- F. National Electrical Manufacturer's Association (NEMA).
- G. Institute of Electrical and Electronic Engineers (IEEE).
- H. Electronic Industries Association (EIA-232-C): Interface between Data Terminal Equipment and Data Communication Equipment Employing Serial Binary Data Interchange.
- I. Requirements of American Disabilities Act (Public Law 101-336).
- J. Local Accessibility Standards
- K. State Fire Marshall or Requirements of Local Authorities having Jurisdiction
- L. State Insurance Code
- M. International Building Code Adopted by Local Authority Having Jurisdiction
- N. Local & State Building Codes
- O. In addition to 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.
- B. Manufacturer's product shall have been in satisfactory operation on three installations of similar size, type and design as this project, for approximately 3 years.
- C. Manufacturer shall submit at the time of bid a list of installations where the products have been in operation.
- D. 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.

- E. The entire Fire Detection and Alarm System shall be installed by an authorized representative of the Fire Alarm Manufacturer 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.
- F. 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.
- G. 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.
- H. Furnish evidence there is an experienced and effective service organization, which carries a stock of repair parts for the system to be furnished.
- I. 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.
- J. 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.
- K. 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 as required by the Texas Board of Professional Engineers.
- L. The installing contractor shall provide 24-hour, 365 days per year emergency service with factory trained, state licensed service technicians.
- M. Material shall be new and in perfect condition when installed.
- N. 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.
- O. Quality Control Assurance:
 - 1. All components of the fire alarm system shall be products of an Underwriters Laboratories, Inc. listed fire alarm manufacturer, and shall bear the UL Label. Partial listing shall not be acceptable.
 - 2. All components of the fire alarm systems shall use the most current technology available.
 - 3. Only new parts shall be installed at the time of initial installation and to repair the system during the warranty period. No reconditioned parts shall be used.
 - 4. All devices shall be tested and certified that they meet or exceed the "Service Life Expectancy Rating" as outlined by UL and NFPA.

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.
- B. Contractor shall schedule a pre-construction meeting with Owner/Architect regarding the Fire Detection and Alarm System.

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. Contractor shall meet with Owner's Fire Alarm System representative prior to submission of formal/final shop drawings to Architect to allow the Owner and Architect to review a preliminary draft copy of the submittal to verify compliance with the specifications and any detailed requirements of the project. After the draft submittal has been reviewed by the Architect / Owner / Engineer, and formal shop drawings have been reviewed by Architect and returned to the Contractor, the required pre-construction meeting shall take place with Owner / Architect / Engineer.
- B. Before the final set of 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 authorities having jurisdiction (AHJ).
- C. All preliminary and as-built design drawings and supporting documentation shall include: Floor Plan Drawings, riser diagrams, control unit wiring diagrams, point to point wiring diagrams, and typical wiring diagrams as described herein.
 - 1. Name of Owner and Occupant
 - 2. Date
 - 3. Location, including street address.
 - 4. Provide a complete written, item-by-item, line-by-line, specification review stating compliance or deviation in full description.
 - 5. Device Legend
 - 6. Input/output programming matrix

7. Licensed Designer Information – Registered Professional Engineer or Alarm Planning Superintendent (APS)
8. Battery calculations
9. Notification appliance circuit voltage drop calculations
10. Floor Plan
 - a. Floor identification
 - b. Point of compass
 - c. Correct graphic scale
 - d. All walls and doors
 - e. All partitions extending to within 15 percent of ceiling height
 - f. Room descriptions
 - g. Fire alarm device / component locations
 - 1) Signal notification devices
 - 2) Initiation devices
 - 3) Smoke control systems
 - 4) Initiation of automatic extinguishing equipment
 - 5) Doors that unlock or close automatically
 - 6) Zone verification for detection devices
 - 7) Fire/Smoke damper control
 - 8) Fire alarm panel location
 - 9) Fire alarm annunciators
 - 10) Control valves to Fire Protection System
 - 11) Duct smoke detectors
 - 12) Supervisory devices
 - 13) Elevator location
 - 14) Elevator recall system location
 - h. Location of fire alarm primary power connections
 - i. Location of monitor/control interfaces to other systems
 - j. Riser locations
 - k. Methods for compliance with NFPA 72 24.3.13 for survivability (emergency voice systems) as required in NFPA 72 12.4 where applicable.
 - l. Ceiling height and ceiling construction details
 - m. Fire alarm system riser diagram
 - 1) General arrangement of the system, in building cross-section
 - 2) Number of risers
 - 3) Type and number of circuits in each riser
 - 4) Type and number of fire alarm components/devices on each circuit, on each floor or level
11. Control unit wiring diagrams shall be provided for all control equipment, power supplies, battery chargers, and annunciators and shall include the following:
 - a. Identification of control equipment depicted
 - b. Location(s)
 - c. All field wiring terminals and terminal identification
 - d. All indicators and manual controls, including the full text of all labels
 - e. All field connections to supervising station signaling equipment, releasing equipment, and fire safety control.
 - f. Typical Wiring Diagram shall be provided for all initiating devices, notification appliances, remote light emitting diodes (LEDs), remote test stations, and end-of-line and power supervisory devices.
12. Complete system bill of material of all hardware components.
13. Detailed system operational description. Any specification differences and deviations shall be clearly noted and marked.
14. Submittal sheets sequentially numbered with the format: sheet number of number total. For example: 1 of 3.
15. Complete set of manufacturer's operating instructions, circuit diagrams and the

- information necessary for proper installation, operation and maintenance.
16. 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.
 17. Fire detection and alarm system's panel configuration complete with peripheral devices, batteries, power supplies, and interconnection diagrams.
 18. Submit sound and visual level to confirm that number and location of signaling devices will provide required sound and visual levels throughout the building.
 19. 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 OPERATIONAL INSTRUCTIONS

- A. Provide a typeset printed or a laser jet printed instruction card mounted behind a lexan plastic or glass cover in a stainless steel or aluminum frame. Install the frame in a conspicuous location observable from the Fire Alarm Control Panel (FACP). The card shall show those steps to be taken by an operator when a signal is received as well as the functional operation of the system under all conditions, normal, alarm, and trouble. The instructions shall be approved by the Architect/Engineer before being posted.

2 PRODUCTS**2.1 ACCEPTABLE MANUFACTURERS**

- A. Manufacturers acceptable contingent upon Products' compliance with the specifications:
 - 1. Edwards EST4 - Local Strategic Partner

2.2 SYSTEM DESCRIPTION

- A. System shall be a completely multiplexed addressable 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. All addressable loops shall have loop isolation protection devices to maintain partial fire alarm system integrity should a fault occur. A loop isolation device shall not exceed a maximum of 20 devices.
- 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 75 percent capacity of 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. Plenum rated 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. The FACP shall be capable of communicating with the types of addressable devices specified below. It shall display only those primary controls and displays essential to operation during a fire alarm condition. Keyboards or keypads shall not be required to operate the system during fire alarm conditions. Panel shall support a minimum of 500 addressable points.
- B. The fire alarm control panel (FACP) shall be fully enclosed in a lockable steel enclosure as specified herein. All operations required for testing or for normal care and maintenance of the system shall be performed from the front of the enclosure. If more than a single unit is required to form a complete control panel, the unit enclosures shall match exactly. The system shall operate at 24 VDC.
- C. Panel shall be large enough to accommodate all components and also to allow ample gutter space for interconnection of all panels as well as all field wiring. Each enclosure and each component shall be identified by an engraved red laminated phenolic resin nameplate. Lettering on the nameplate shall not be less than 1" high. Individual components and modules within the cabinets shall be identified by engraved laminated phenolic resin nameplates.
- D. A local audible device shall sound during alarm, trouble, or supervisory conditions. This audible device shall sound differently during each condition to distinguish one condition from another without having to view the panel. This audible device shall also sound during each key press to provide an audible feedback to ensure that the key has been pressed properly.
- E. The following primary controls shall be visible through a front access panel:
 - 1. Minimum 3-lines, minimum 40 alphanumeric characters per line display.
 - 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. Additional control buttons as directed by Owner.
- F. Under normal condition, the front panel shall display a "SYSTEM IS NORMAL" message and the current time and date.
- G. Should an abnormal condition be detected, the appropriate LED (Alarm, Supervisory or Trouble) shall flash. The panel audible signal shall pulse for alarm conditions and sound steady for trouble and supervisory conditions.
- H. The alphanumeric display shall provide the following information relative to the abnormal condition of a point in the system.
 - 1. 40-character custom location label.
 - 2. Type of device (i.e. smoke, pull station, water flow).
 - 3. Point status (i.e. alarm, trouble).

4. Addressed device physical location to correspond to the actual graphic room numbers. Where devices are located in hallways, corridors, or large spaces, the location shall include the hallway, corridor, or large space and in addition reference to the nearest room or other physical object recognizable by the Owner. Example (smoke detector, alarm, Corr 123 by Rm 789), exact format and abbreviations as directed by Owner to fit the panel display format.
- I. Alarm conditions shall be displayed on the alphanumeric display. The top line of 40 characters shall be the point label and the second line shall be the device type identifier. The system alarm LED shall flash on the control panel until the alarm has been acknowledged. Once acknowledged, this same LED shall latch on. A subsequent alarm received from another zone shall flash the system alarm LED on the control panel. The alphanumeric display shall show the new alarm information.
- J. Each independently supervised circuit shall include a discrete readout to indicate disarrangement conditions per circuit.
- K. Acknowledgment for each abnormal condition shall be provided. Acknowledge keys shall not be pass code protected. Acknowledge keys shall be protected by the locked enclosure only. After all points have been acknowledged, the LEDs shall glow steady and the audible device be silenced. The total number of alarms, supervisory and trouble conditions shall be displayed, along with a prompt to review each list chronologically. The end of the list shall be indicated by the message, "END of LIST".
- L. Pressing the appropriate acknowledge button shall display the first unacknowledged condition in the appropriate list (either alarm, supervisory or trouble), and shall require another acknowledge button for each subsequent alarm condition. Press to acknowledge shall only silence the displayed point.
- M. Alarm silencing:
 1. Should the "Alarm Silence" button be pressed, all audible alarm signals shall cease operation.
 2. Visual signals shall not be extinguished during alarm silence inhibit mode.
- N. System reset:
 1. The "System Reset" button shall be used to return the system to its normal state after an alarm condition has been remedied. The alphanumeric display or reset LED shall step the user through the reset process with simple English Language messages.
 2. Should an alarm condition continue to exist, the system shall remain in an abnormal state. System control relays shall not reset. The audible device and the alarm LED shall be on.
 3. Should the alarm silence inhibit function be active, the System Reset and alarm silence key shall be ignored.
- O. Additional function keys, or their equivalent, shall be provided to access status data and control the function for the following points:
 1. HVAC - Bypass
 2. Indicating appliance circuits bypass
 3. Auxiliary relays points bypass
 4. All other input/output points.
 5. Additional control buttons as directed by Owner.
- P. The following status data or their equivalent shall be available:
 1. Primary state of point.

2. Device, PID and card type information.
 3. Current priority of outputs.
 4. Disable/enable status.
 5. Verification tallies of initiating devices.
 6. Automatic/manual control status of output points.
 7. Acknowledge status.
 8. Relay status.
- Q. LED supervision: Where provided, all slave module LEDs shall be supervised for burnout or disarrangement. Should a problem occur the alphanumeric display shall display the module and LED location numbers to facilitate location of that LED.
- R. System trouble reminder: should a trouble condition be present within the system and the audible trouble signal silenced, the trouble signal shall resound at pre-programmed time intervals to act as a reminder that the fire alarm system is not 100% operational. Both the time interval and the trouble reminder signal shall be programmable.
- S. The fire alarm control panel features shall include, but not be limited to:
1. Setting of time and date.
 2. LED testing.
 3. Alarm, trouble, and abnormal condition listing.
 4. Enabling and disabling of each monitor point separately.
 5. Activation and deactivation of each control point separately.
 6. Changing operator access levels.
 7. Walk test enable.
 8. Running diagnostic function.
 9. Displaying software revision level.
 10. Displaying historical logs.
 11. Displaying card status.
 12. Point listing.
 13. For maintenance purposes, the following lists, or their equivalent, shall be available from the system program and/or the point lists menu:
 - a. All points list by address.
 - b. Monitor point list.
 - c. Signal list.
 - d. Auxiliary control list.
 - e. Feedback point list.
 - f. LED/switch status list.
 - g. Additional control buttons as directed by Owner.
 14. Fire Drill:
 - a. Fire drill activation switch shall activate all audio/visual devices only. Fire drill shall not enter into the alarm sequence of operation, shall not close smoke or fire/smoke dampers, shall not deactivate any HVAC systems, kitchen hoods, etc.
 - b. Activation of any trouble or alarm condition shall supercede the evacuation drill.
 - c. Fire drill shall be canceled by the system reset key, alarm silence, or drill key.
 15. Scrolling through menu options or lists shall be accomplished in a self-directing manner. These controls shall be located behind an access door.
 16. The alphanumeric display shall have an alpha numeric, back-lighted LCD, LED, or gas plasma display. The display shall support numeric and both upper and lower case letters. Lower case letters shall be used for soft key titles and prompting the user. Upper case letters shall be used for system status information. A cursor shall be visible when entering information.

17. The system shall be capable of being tested by one person. The actuation of the "enable walk test" program at the fire alarm control panel shall activate the "Walk Test" mode of the system, which shall cause the following to occur:
 - a. The remote monitoring circuit connection shall be bypassed.
 - b. Control relay functions shall be bypassed.
 - c. The control panels shall show a trouble condition.
 - d. The panel shall be capable of selecting either: the alarm activation of any initiation device causing the audible signals to activate for two seconds or the alarm activation of any initiation devices causing the audible signals to code a number of pulses to match the zone number.
 - e. The panel shall automatically reset itself after signaling is complete.
 - f. Any momentary opening of an initiating or indicating appliance circuit wiring shall cause the audible signals to sound for 4 seconds indicating a trouble condition.
 - g. The control panel shall be capable of supporting up to 8 separate testing groups whereby one group of points may be in a testing mode and the other (non-testing) groups may be active and operate as programmed per normal system operation. After testing is considered complete, testing data may be retrieved from the system in chronological order to ensure device/circuit activation.
 - h. Should the walk test feature be on for an inappropriate amount of time, it shall revert to the normal mode automatically.
18. Provide three (3) access levels with level 3 being the highest level. Level 1 action shall not require a pass code. Pass codes shall consist of up to ten (10) digits. Changes to pass codes shall only be made by Level 3 authorized personnel.
 - a. When entering a pass code, the digits entered shall not be displayed. All key presses shall be acknowledged by a local audible sound and/or visual "*" in the 80-character display.
 - b. When a correct pass code is entered, the new access level shall be in effect until the operator manually logs out or the keypad has been inactive for ten (10) minutes.
 - c. Should an invalid code be input, access shall be denied.
 - d. Access to a level shall only allow the operator to perform all actions within that level plus all actions of lower levels, not higher levels.
 - e. The following keys/switches, or their equivalent shall have access levels associated with them:
 - Set time/date.
 - Manual control
 - Disable/enable
 - Clear historical alarm log
 - Clear historical trouble log
 - Walk test
 - Change alarm verification
 - f. The following keys/switches shall not be pass code protected and shall be protected by the lockable enclosure:
 - Alarm Silence
 - System Reset
 - Acknowledge
19. The fire alarm system shall allow for loading and editing special instructions and operating sequences as required. The system shall be capable of being reprogrammed to accommodate system expansion and facilities changes in operation. All software operations shall be stored in a non-volatile programmable memory within the fire alarm control panel. Loss of primary and secondary power shall not erase the instructions stored in memory.
20. Resident software shall allow for full configuration of initiating circuits so that

additional hardware shall not be necessary to accommodate changes in, for instance, sensing of normally open contact devices to sensing of normally closed contact devices, or from sensing of normally open contact devices to sensing a combination of current limited and non-current limited devices on the same circuit and being able to differentiate between the two, or changing from a non-verification circuit to a verification circuit or vice-versa.

21. Resident software shall also allow for configuration of indicating appliance and control circuits so that additional hardware shall not be necessary to accommodate change in, for instance changing a non-coded indicating appliance circuit to a coded circuit.
22. The main fire alarm panel shall have the resident ability to store a minimum of 600 system events in chronological order of occurrence. Event history shall include all system alarms, troubles, operator actions, unverified alarms, circuit/point alterations, and component failures. Events shall be time and date stamped. Events shall be stored in non-volatile buffer memory. Access to history buffer shall be secured via 5-digit password security code. The system shall have the capability of recalling alarms and trouble conditions in chronological order for the purpose of recreating an event history. Loss of primary or secondary power shall not erase the events stored in the memory. Each recorded event shall include the time and date of that event's occurrence.
 - a. The following Historical Alarm log events shall be stored:
 - Alarms
 - Alarm acknowledgment
 - Alarm silence
 - System reset
 - Alarm historical log cleared
 - b. The following historical trouble log events shall be stored:
 - Trouble conditions
 - Supervisory alarms
 - Trouble acknowledgment
 - Supervisory acknowledgment
 - Alarm verification tallies
 - Walk tests results
 - Trouble historical log cleared
23. Alarm verification shall be by device, whereby only verification from the same device will confirm the first activation and cause the alarm sequence to occur.
24. The control panel shall have the capability to display the number of times (tally) a device has gone into a verification mode. Should this verification tally reach a pre-programmed number, a trouble condition shall occur.
25. The control panel shall have a dedicated supervisory service LED and a dedicated supervisory service acknowledge key. Pressing the supervisory service acknowledge key shall silence the supervisory audible signal while maintaining the supervisory service LED "ON" indicating the off-normal condition.
26. Activation of an auxiliary bypass key shall override the selected automatic functions.
27. The system shall have keys that will allow the operator to display all alarms, troubles, and supervisory service conditions including the time of each occurrence.
28. RS-232-C output: the fire alarm control panel shall be capable of operating remote generic consumer type printers; output shall be ASCII from an EIA RS-232-C connection with an adjustable baud rate. Each RS-232-C port shall be capable of supporting and supervising a remote display and printer. Data amplifiers shall be used to increase data line distance when required.
29. Panel shall be sized to accommodate all required equipment. Panel shall be equipped with locks and transparent door, providing freedom from tampering yet

allowing full view of the various displays and controls.

- T. The fire alarm control panel shall have a 25% spare initiating point and battery capacity for future use.
- U. The power supply 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 five (5) 110cd visual devices in the future. Individual design loading shall not exceed 70% of power supply and system wiring capacity.
 - 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, 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.
- V. Digital Fire Alarm Communicator:
 - 1. Two line primary and secondary telephone line connections
 - 2. Automatically seizes telephone line.
 - 3. Automatic verification between panel and receiving station.
 - 4. Transmits common trouble and supervisory conditions.
 - 5. Dialer status LED.
 - 6. Multiple communication formats including Ademco Contact ID.
 - 7. Dual tone multi-frequency (DTMF) or Pulse modes.
 - 8. Programming password protected.
 - 9. UL approved.
- W. IP Internet and Digital Cellular Communicator:
 - 1. UL 864 listed
 - 2. Supervise IP Ethernet connection every 90-seconds or less
 - 3. Upload/Download capable
 - 4. Transmit all signals and information from the DTMF communicator
- X. Detector sensitivity shall be programmable from the control panel from the following sensitivities: 0.5, 1.0, 1.5, 2.0, 2.5, 3.0 and 3.7% obstruction. Detectors shall be able to be programmed to alert a trouble signal at a lower obstruction and shall report an alarm if the smoke density increases to a predetermined set point. Control Panel and Detectors shall be capable of "Day-Night" automatic sensitivity adjustments.
- Y. Control Switches:
 - 1. Acknowledge/step Switch
 - 2. Signal Silence Switch
 - 3. System Reset Switch
 - 4. System Test Switch
 - 5. Lamp Test
- Z. Automatic Detector Test: The system shall include a special automatic detector test feature, which permits reading and adjustment of the sensitivity of all intelligent detectors from the main control panel. An automatic detector test shall occur

automatically fourteen times each twenty-four hour period or be initiated manually from the FACP as desired. In addition, the automatic test feature shall also permit the functional testing of any "intelligent" detector or addressable interface device individually from the main control panel. Automatic detector test sequencing shall be terminated upon receipt of an alarm condition. Detector test shall report all unprogrammed devices installed and report all programmed devices not installed.

AA. Emergency voice alarm communication system:

1. The emergency voice and tone communication system shall be a pre-built system and shall only require two wires from a polarity reversal circuit or a dry contact for activation. It shall supervise the NO dry contact (if used) and provide a form C trouble relay activation in the event of a system fault. The Voice Communication System shall incorporate minimum 50 watts true RMS amplifiers for both tone and speech amplification. The system shall have a load capacity of up to 100 watts. Optionally, the Voice Communication System shall be capable of providing 50 watts of audio with full backup. The Voice Communication System shall be capable of operating as a stand-alone system or follow the activation of the fire alarm/suppression system. The Voice Communication System shall include a regulated power supply and shall be capable of charging and housing its own batteries. There shall be no need to calculate the load requirements or draw any energy from the fire alarm/suppression system. The Voice Communication System shall come with one speaker supervisory zone as a standard and shall be capable of supervising any combination of up to 11 speaker and/or strobe monitoring modules.
2. A full set of control switches including an all call, tone interrupt, trouble silence and reset shall be available at the Voice Communications System. The Voice Communications System control panel shall also have a green POWER ON LED, a red ALARM LED, a yellow BROWN OUT LED and a yellow SYSTEM TROUBLE LED.
3. The Voice Communication System shall be able to detect a short on any speaker or strobe zone during the normal and alarm mode. The shorted zone shall be isolated from the system and a dedicated LED on the supervised zone shall indicate the short circuit condition. The system shall produce an audible and visual signal indicating that a trouble condition has occurred. Similarly, an open circuit shall create a trouble condition and corresponding LED annunciation at the affected zone and at the main control module. Zones that are not shorted or opened shall remain operational.
4. The Voice Communications System shall be able to detect a brownout condition on the AC supply. In the brownout condition the Voice Communication System shall activate a dedicated LED and an audible trouble signal. Ground faults shall activate the system trouble LED and the audible trouble signal, as well as specific LEDs indicating negative and positive ground faults.
5. The Voice Communication System shall be field configurable for 25 or 70.7 volt RMS audio output via program jumpers.
6. The Voice Communication System shall have a digital message player / recorder. The digital message player / recorder shall be capable of storing alert and evacuation tones as well as an emergency voice message. It shall be possible to modify the digital message and tones in the field using a built-in acoustic microphone or headphone jack connected to an audio device. There shall be no need for the burning of eproms in order to program the digital message player / recorder. The digital message player / recorder shall be supervised by the Voice Communication System. The Voice Communications System shall provide a backup evacuation tone in the event of a digital message player / recorder failure.
7. An alarm condition shall cause an audible signal and a red LED to activate. A Voice Communication System with a digital message player / recorder shall

produce an ALERT tone followed by an emergency voice message, and in turn followed by an ALARM tone. The number of tone repetitions shall be configurable by the setting of DIP switches on the digital message player / recorder.

8. The sheet metal enclosure shall include a hinged deadfront allowing easy access to all the Voice Communication System components for the purposes of wiring, setting the system configuration and servicing. A door with a key lock shall be part of the Voice Communication System enclosure.

2.4 FIELD DEVICES

- 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 of the electronic flashing xenon strobe type and operate on 24 VDC. The strobe light shall be capable of producing 75 candelas 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. If required to be mounted in student toilets / restrooms, and student locker / dressing rooms shall have a protective cover. All wall mounted visual devices installed in gymnasiums, corridors, kitchen preparation and serving areas, vocational shops, athletic/drill team training rooms, and where wall mounted in cafeterias, corridors and commons areas, shall have a protective cover; STI Stopper #STI1221E Series. Provide enviro kit for locations where dampness, water or dust is present.
- C. Combination Alarm Signal and High Intensity Visual Signals:
 1. Strobe lights shall be of the electronic flashing xenon strobe type and operate on 24 VDC. The strobe light shall be capable of producing 75 candelas 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 combination audio / visual devices mounted in student toilets / restrooms, and student locker / dressing rooms shall have a protective cover. All wall mounted combination audio/visual units installed in gymnasiums, corridors, kitchens, preparation and serving area, vocational shops, athletic/drill team training rooms, and where wall mounted in cafeterias, corridors and commons areas, shall have a protective cover; STI Stopper #STI1220E Series. Provide enviro kit for locations where dampness, water or dust is present.
 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 with or without protective cover. Sound levels for alarm signals shall not exceed 110 dba at the minimum hearing distance from the audible appliance.
- D. Exterior Audible / Visual Signal:
 1. Provide semi-flush mounted, molded of high impact red thermoplastic and listed for exterior weatherproof locations.

- E. Combination Voice Signal and High Intensity Visual Signals:
1. Strobe lights shall be of the electronic flashing xenon strobe type and operate on 24 VDC. The strobe light shall be capable of producing 75 candelas 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. If required to be wall mounted in student toilets, gymnasiums, corridors, student locker / dressing rooms, kitchens, vocational shops, athletic / drill team training rooms, cafeterias, commons areas, provide wire guard protective cover. Provide enviro kit for locations where dampness, water or dust is present.
 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 xenon 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 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 in gypboard or plaster ceilings, provide 2x2 lay-in grid with UL enclosure, tile bridge supports when recessed in lay-in ceiling tiles Capacitor for line supervision.
- G. Surface mounted speakers 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. Raco #911 Series Life Safety Appliance back box and adapter, or appliance manufacturer back box.
- 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.
- I. 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 and programmed for alarm verification.
 - 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.
- J. 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 and programmed for alarm verification.
- K. 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 specified 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.
- L. Addressable Carbon Monoxide Detection:
1. System sensor #CO1224 with addressable identification of the CO Detector's alarm and trouble contact status. UL listed to Standard 2075 Standard for Gas and Vapor Detectors and Sensors.
 2. Unit to be powered by the fire alarm system non-resettable 24 VDC supervised power supply.
 3. Electro-chemical CO detection.
 4. Integral 85db local alarm with local hush/test switch for silence or test.
 5. Alarm contacts and trouble contacts for detector trouble, loss of power, and end of life.
- 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.
 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 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 (fire suppression hoods, water flow, fire pump, AHU shut-down points, 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.

2.5 VESDA – VERY EARLY WARNING ASPIRATING SMOKE DETECTION SYSTEM

- A. Approved Manufacturers:
 - 1. System Sensor (FASAST) – Detection devices for Cooler / Freezer areas 200 square feet or larger, atriums / high ceiling areas with difficult access.
 - 2. Xtralis (VESDA) – Detection devices for Cooler / Freezer areas 200 square feet or larger, atriums / high ceiling areas with difficult access.
- B. A Very Early Warning Smoke Detection System similar to the VESDA VLI System shall be installed throughout the cooler and freezer storage areas 200 square feet and larger, and as an alternative to beam type detectors at high ceiling areas with difficult access.. The system shall consist of highly sensitive LASER-based Smoke Detectors with aspirators connected to networks of sampling pipes, intelligent filtration arrangement with fail-safe operation, sub-sampling probe (inertial separator), built-in clean air zero capability, local USB configuration port and Ethernet networking port. VESDA detection system shall be networked with the specified Notifier Fire Alarm Control Panel.
- C. Design Requirements
 - 1. The system shall consist of an air sampling pipe network to transport air to the detection system, supported by calculations from a computer-based design modeling tool.
 - 2. It shall be tested and approved to cover up to 2,000m² (20,000 sq.ft).
 - 3. It shall have a built-in simple user interface indicating alarm and fault status and include a reset / disable button.
 - 4. It shall provide absolute smoke detection.
 - 5. It shall be approved to provide very early warning smoke detection and provide four alarm levels corresponding to Alert, Action, Fire 1 and Fire 2. These levels shall be programmable and able to be set at sensitivities ranging from 0.05-20% obs/m (0.016–6.4% obs/ft.).
 - 6. The detector shall be specifically designed for industrial applications.
 - 7. It shall consist of a highly sensitive LASER-based smoke detector with in-field clean air zero capability, aspirator, intelligent filter and secondary filter.
 - 8. It shall be modular, with field replaceable detection chamber, aspirator, intelligent filter and secondary filter.
 - 9. It shall have four pipe inlets for sample air.
 - 10. It shall incorporate per pipe ultrasonic flow monitoring and provide staged airflow faults.

11. It shall have a built-in and field replaceable intelligent filter placed after the flow monitoring circuitry.
12. Intelligent filter shall:
 - a. Dilute the sampled air for prolonged detector life.
 - b. Combine sample air from all pipe inlets.
 - c. Divide sampled air into filtered clean air and unfiltered air before mixing them together.
 - d. Use HEPA filter with more than 99% efficiency for filtered clean air i.e. removing more than 99% of contaminant particles of 0.1microns or larger, to provide clean air for dilution.
 - e. Use a mesh/screen for the unfiltered air for protection against lint type of particles.
 - f. Be fail-safe and supervised for correct operation with built-in capability to alert for when replacement is required.
 - g. Maintain consistent detector sensitivity over time.
 - h. Have ultrasonic airflow monitoring of the unfiltered sampled air through the intelligent filter.
13. It shall have a field replaceable aspirator after the intelligent filter where the diluted sampled air flows through the aspirator prolonging its life.
14. The aspirator shall be a purpose-designed rotary vane air pump. It shall be capable of allowing for multiple sampling pipe runs up to 360m (1,200ft) in total, (4 pipe runs per detector) with a transport time per applicable local codes.
15. It shall have a sub-sampling probe (inertial separator) after the aspirator for reduced dust intake in to the detection chamber.
16. It shall have a secondary foam filter after the sub-sampling probe (inertial separator) where the sub-sampled air flows through the foam filter prolonging detection chamber life. The foam filter shall be capable of filtering particles in excess of 20 microns from the sampled air.
17. It shall have a field replaceable smoke detection chamber which stores the calibration values with the chamber assembly.
18. It shall have capability for in-field clean air zero to provide absolute smoke detection.
19. It shall have capability to measure blockages in the air path in to or out of the detection chamber.
20. It shall have an enclosure rating of IP54.
21. The detector shall allow for direct wall mounting or using a supplied mounting plate.
22. It may be inverted as required in specific applications.
23. It shall be self-monitoring for filter contamination.
24. It shall be configured via local USB port with Ethernet port for remote monitoring.
25. It shall have Fire and Fault relay outputs in addition to three configurable relays. The relays shall be software programmable to the required functions and must be rated at 2 AMP at 30 VDC.
26. It shall have at least one general purpose input (GPI).
27. It shall have Power In and Power Out connections to allow powering more than one detector from one power supply.
28. Optional equipment may include a dedicated Xtralis VSM graphics package.
29. It shall report any fault on the unit by using configurable fault relay outputs or via PC based configuration and monitoring system.
30. The detector shall have built-in event and smoke logging. It shall store smoke levels, alarm conditions, operator actions and faults. The date and time of each event shall be recorded. Each detector (zone) shall be capable of storing up to 18,000 events.

- D. Programming Requirements
Using either USB or Ethernet port the detector shall allow programming of:
1. IP address and related fields to support Ethernet based networking
 2. Four smoke threshold alarm levels
 3. Time delays
 4. Configurable relay outputs for remote indication of detector conditions
 5. Holidays and day/night changeover times
 6. Major and minor airflow fault limits
 7. Aspirator speed
 8. General purpose input function
 9. Alarm and fault latching
- E. Sampling Pipe
1. The sampling pipe shall be smooth bore. Normally, pipe with an outside diameter (OD) of 25mm or 1.05" and internal diameter (ID) of 21mm or ¾" should be used.
 2. The pipe material should be suitable for the environment in which it is installed. VESDA pipe material shall be UL 1887 Plenum rated CPVC).
 3. All joints in the sampling pipe must be air tight and made by using solvent cement, except at entry to the detector.
 4. The pipe shall be identified as Air Sampling/Aspirating Smoke Detector Pipe along its entire length at regular intervals not exceeding the manufacturer's recommendation or that of local codes and standards.
 5. All pipes shall be supported at not less than 1.5m (5ft) centres, or that of the local codes or standards.
 6. The far end of each trunk or branch pipe shall be fitted with an end-cap and made air-tight by using solvent cement. Use of an end-cap will be dependent on ASPIRE2 calculations.
- F. Sampling Holes
1. Sampling holes shall not be separated by more than allowed for conventional point detectors as required by 30 feet as local codes and standards. Intervals may vary according to calculations. For NFPA the maximum allowable distance is 30ft.
 2. Each sampling point port shall be identified in accordance with Codes or Standards.
 3. Provide per manufacturer's recommendations and standards in relation to the number of sampling points and the distance of the sampling points from the ceiling or roof structure and forced ventilation systems.
 4. Sample port size shall be as specified by ASPIRE2 calculations.
- G. Detection Alarm Levels:
The laser based ASD system shall have four (4) independently programmable alarm thresholds. The four alarm levels may be used as follows:
- Alarm Level 1 (Alert)
Activate a visual and audible alarm in the fire risk area.
- Alarm Level 2 (Action)
Activate the electrical/electronic equipment shutdown relay and activate visual and audible alarms in the Security Office or other appropriate location.
- Alarm Level 3 (Fire 1)
Activate an alarm condition in the Fire Alarm Control Panel to call the Fire Monitoring Service and activate all warning systems.
- Alarm Level 4 (Fire 2)
Activate a suppression system and/or other suitable countermeasures.

The alarm level functions as listed are possible scenarios. Program as directed by Owner to the best utilization of these facilities for each application and the requirements of local A.H.J.

- H. Initial Detection Alarm Settings
 - 1. Alarm Level 1 (Alert) 0.2% obs/m (0.064% obs/ft.)
 - 2. Alarm Level 2 (Action) 0.3% obs/m (0.096% obs/ft.)
 - 3. Alarm Level 3 (Fire 1) 0.40% obs/m (0.128% obs/ft.)
 - 4. Alarm Level 4 (Fire 2) 2.0% obs/m (0.64% obs/ft.)
- I. Initial (factory default) Alarm Delay Thresholds
Initial (factory default) settings for the alarm delay threshold shall be:
 - 1. Alarm Level 1 (Alert) 10 seconds
 - 2. Alarm Level 2 (Action) 10 seconds
 - 3. Alarm Level 3 (Fire 1) 10 seconds
 - 4. Alarm Level 4 (Fire 2) 10 seconds
- J. Fault Alarms: The Detector Fault relay shall be connected to the appropriate alarm zone on the Fire Alarm Control Panel (FACP) in such a way that a Detector Fault would register a fault condition on the FACP. The Minor Fault and Isolate relays shall also be connected to the appropriate control system. Provide as required by local Codes, Standards or Regulations.
- K. Power Supply and Batteries: The system shall be powered from a regulated supply of nominally 24V DC. The battery charger and battery shall comply with the relevant Codes, Standards or Regulations. Typically 24 hours standby battery backup is required followed by 30 minutes in an alarm condition.
 - 1. UL 1481 Listed -provided the power supply and standby batteries have been appropriately sized / rated to accommodate the system's power requirements.
 - 2. Provide 120-volt 20-amp circuit from the life safety branch panel to each power supply.

2.6 AUXILIARY EQUIPMENT MONITORING

- A. The fire alarm system shall monitor the status of the following equipment when provided 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

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 ALPHA-NUMERIC DISPLAY ANNUNCIATORS

- A. 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 alphanumeric 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

2.9 REMOTE PAGING UNIT

- A. Remote all-call paging unit or to activate one of the pre-recorded messages over the speaker circuits.

2.10 PRINTER AND PRINTER STAND

- A. A high impact dot matrix printer shall be provided. The printer shall provide hard-copy printout of all changes in status of the system and shall time-stamp such printouts with the current time-of day and date. The printer shall be wide carriage with 80-characters

per line and shall use standard pin-feed paper. The printer shall communicate with the control panel using as interface complying with EIA standard RS-232. Printer shall be capable of operating on parallel or serial outputs. Power to the printer shall be 120VAC at 60Hz. The printer shall print all status information including status, address, event history and programmed custom ID message.

1. High speed, bi-directional.
2. Serial or parallel interface.
3. Front panel interface.
4. Supports modems for remote installation.
5. LED status indicators.
6. RS-232 direct cable supervised.
7. Printer self test mode.
8. 9-Pin, impact, dot matrix printer with minimum speed of 232 characters per second.

B. Printer Stand:

1. Steel and laminate construction
2. Two shelves for paper storage
3. 28H x 26W x 20 Inches deep
4. Locking casters

3 EXECUTION

3.1 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. 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.
- F. 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.

- G. 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.
- H. 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.
- I. 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.
- J. Provide remote alphanumeric display annunciators in the administrative area in constantly attended area and additional annunciators where indicated on the drawings as directed by Owner / Architect.
- K. Provide remote paging units adjacent to each remote alphanumeric display annunciator for voice alarm systems.
- L. 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.
- M. Provide combination speaker strobes. Provide strobe only alarms when additional speaker placement will compromise voice intelligibility. Provide horn/strobes in coolers and freezers.
- N. Detectors shall be installed per NFPA 90A and be listed with the fire alarm control panel.
- O. Auxiliary Equipment Monitoring Wiring and connection to equipment shall be the responsibility of the fire alarm contractor.
- P. Power for magnetic door holders shall be wired through fire alarm relay.
- Q. Smoke detectors shall be mounted to a 4-inch octagon box with hanger bar or with box secured to building structure.
- R. Provide power via 120-volt, 20-Amp dedicated circuits with lock-on provisions at the respective circuit breaker for the main fire alarm control panel, each panel extender and each 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. Label 120V circuit origination (i.e.: "120-Volt Circuit ELA-3")
- S. Provide smoke detectors in the following locations:
 - 1. All paths of egress and adjoining spaces within the same HVAC 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, library office and library ancillary areas.
 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 men's and women's restroom/toilet
 9. At each administrative work room or copy room.
 10. At each student toilet / restroom. Provide STI protective cover. Do not locate over plumbing fixtures or near partitions.
 11. At each special needs, life skills, adaptive behavior, developmental classrooms or similar designated areas without food preparation or cooking equipment.
- T. Provide heat/thermal detectors in the following locations:
1. At each electrical room, telecommunications/data room, elevator machine room and mechanical room subject to un-treated or un-filtered outside air.
 2. At each janitor's/custodial closets and laundry rooms.
 3. At each commercial kitchen and adjoining storage rooms; at each food preparation area.
 4. At each employee break room/lounge.
 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.
- U. Provide carbon monoxide detection and smoke detection devices in all areas designated as day-care for minors.
- V. Provide duct smoke detectors in all air handling units with air volumes of 2,000 cfm or larger.
- W. Provide duct smoke detectors on outside air units only as required by local Code and / or A.H.J.
- X. Provide VESDA 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.
- Y. Provide manual pull stations at each exterior exit and at each exit from all floors. Provide one manual pull station at the central reception area as directed by Owner.
- Z. 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.
- AA. Provide audio and visual alarm devices in all areas normally occupied by students or minors and all common use areas.

3.2 CABLE AND BOXES INSTALLATION

- A. All fire alarm wiring to be red. All fire alarm circuits shall be identified at each termination and at each 25 feet between terminations. Minimum 18 AWG wire size for data communications, minimum 14 AWG wire size for alarm circuits.
- B. 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.
- C. 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.
- D. 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.
- E. All cables within a rack, console or junction box shall be grouped according to the signals being carried to reduce signal contamination.
- F. 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.
- G. Supply and install all fittings and accessories whether or not they are specified, required for proper, safe and reliable operation of the system.
- H. 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%.
- I. Minimum conduit size shall be 3/4" EMT with insulated bushings. Install conduit per engineered shop drawings. All conduit terminations in all boxes shall have insulated bushings.
- J. 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.
- K. 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.
- L. All junction boxes containing fire alarm wiring are to be painted red and labeled.
- M. All plenum wiring is to be installed parallel and perpendicular to the building structure. Cable shall be bundled with plenum rated cable zip ties on a maximum of 2'-6". Install cable 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.
- N. 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.

- O. 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.
- P. 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.
- Q. No other wiring shall be run in the same conduit as fire alarm wiring.

3.3 FINISHES

- A. Main Fire Alarm Panel color shall be approved by Owner / Architect.

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, or sprinkler flow switch shall cause the location of 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 alphanumeric display shall indicate all applicable information associated with the alarm condition including: zone, device type, device location, and time of alarm. Location and zoning messages shall be custom field programmed to respective premises.
 - c. Any remote or local annunciator LED's associated with the alarm 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. 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.
- g. De-activate all HVAC systems.
 - h. De-energize the kitchen hood supply/exhaust fans as required by local authority having jurisdiction.
 - i. Close all related smoke dampers.
 - j. Close all related smoke/fire dampers.
 - k. Release all magnetic door hold open devices.
 - l. Release the electric strike, unlocking, but not unlatching, locked doors controlled by an access control system.
 - m. Release Counter Shutters and hold-open devices on all fire and smoke doors.
 - n. Open all security grilles with emergency egress.
 - o. Activate to close all related fire and smoke doors and shutters.
 - p. Activate signaling connection to the elevator as required by the local authority having jurisdiction.
 - q. Signal the building automation system and security 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.
 - r. Activate automatic recall operation of elevators as required by local authority having jurisdiction.
 - s. 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 send an alarm signal to the control panel and also 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 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 (drill) switch shall operate the alarm indicating appliances 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 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.
- B. All addressable devices shall be labeled with point and module number. Provide label maker style label on base of device. Verify exact requirements with Owner.

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 two, or 5% of building 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 two copies of the final software programmed into the fire alarm system.
- D. One box of printer paper.
- 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. Provide not less than six keys of each type required. Identify keys by an appropriate number stamped on each key or on a metal tag attached thereto. Provide a key numbering chart in each operation and maintenance manual furnished.

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

- A. Provide two (2) color coded floor plan detailed with project name, 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.
- 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. Indicate location of all end-of-line resistors.
- C. The floor plan shall be solvent welded in acrylic plastic.
 - 1. Mount in an extruded aluminum frame next to the main fire alarm control panel and annunciator in main office. Minimum size 30x42 inches. Coordinate exact location with Architect / Owner.
 - 2. Provide a minimum 1 inch x 17 inch graphic print of building showing all rooms by graphic room numbers. Print shall show all detectors, major equipment and active detection devices. Print shall be framed in an extruded aluminum frame (24"x36") with clear plastic cover. Graphic shall be prepared in AutoCad version 2011 or newer. Data file (xxx.dwg) of graphic shall be provided as a part of the project.
- 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 OPERATING INSTRUCTIONS

- 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. Provide Fire Alarm System Operating Instructions for the following items including, but not limited to:
 - 1. Alarm Signal
 - a. How to open panel door
 - b. What to read and follow the instruction on display
 - c. How to acknowledge alarm
 - d. How to silence the signals
 - e. How and when to reset the system
 - f. How to return system to normal operation
 - 2. Trouble / Supervisory

- a. How to open panel door.
 - b. What to read and follow the instruction on display
 - c. How to acknowledge trouble condition
 - d. Appropriate personnel to respond
- C. Provide laminated instructions in extruded aluminum frame. Mount adjacent to the Fire Alarm Control Panel and remote annunciator panel(s) for ready reference.

3.11 ADDITIONAL REQUIREMENTS

- A. The contractor is to ensure all areas of the building are covered with visual and audio alarm devices for occupant notification of a fire alarm, including remote portable or temporary buildings.
- B. Coordinate door hold devices with door and door hardware.
- C. Provide interface with and coordinate shunt-trip circuit breakers and control devices with kitchen hood fire control systems and elevator equipment.
- D. Alarm circuit power supplies and circuiting shall be designed and installed to accept an additional five (5) 110cd visual devices for future expansion. The initial design shall not exceed 70% of the rated power supply and circuit capability.
- E. Install system event printer as directed by Owner/Architect.
- 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.
- G. Provide one dedicated alarm circuit for (future) portable (temporary) building(s) to the nearest main building egress exit discharge to the designated portable building location. Provide 100 feet of cable coiled and marked "FACP-ALARM-PORTABLES" above an accessible ceiling.
- H. Provide one dedicated addressable initiating device circuit with a minimum capacity of 50 devices for (future) portable (temporary) building(s) to the nearest main building egress discharge to the designated portable building location. Provide 100 feet of cable coiled and marked "FACP-INITIATING PORTABLES" above an accessible ceiling.
- I. Provide printer and printer stand at main FACP; exact location as directed by Owner / Architect.

3.12 COMMISSIONING THE SYSTEM

- A. The installing contractor shall be responsible for verifying that each 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 NICET II minimum and factory trained technical representative of the manufacturer 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. Field testing shall include voice intelligibility as

required by the latest edition of NFPA 72. Any items 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 and an electronic Excel and printed copy submitted to the Architect, Engineer and Owner.

- D. The installing contractor shall provide a complete written report in electronic form and printout of the functional test and intelligibility test of the entire system. A copy of the test report shall be provided with the Maintenance and Operation Manuals. 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 witnessed 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

- b. area's voice alarm signaling devices shall be tested for intelligibility. 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 is to 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.

3.13 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, test reports, operating and maintenance manuals, maps and as-built drawings shall be submitted in electronic format to and accepted by the Architect / Owner prior to date of substantial completion.
- C. Acceptance by County or Local Fire Marshall.

3.14 WARRANTY

- A. The fire alarm system, 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. Major components including but not limited to the main fire alarm panel, sub-panels, panel extenders, power supplies and remote annunciators. 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. Any equipment replaced shall be complete with full factory warranty for that part beginning on the date of installation.
- 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 no earlier than 30 days prior to the end of the warranty period and correct any and all items to bring the system to an approved status at no cost to the Owner. Clean all smoke detectors and replace all defective parts 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.
- G. All manufacturer's warranties which extend past final completion shall be fully transferred to the Owner.

3.15 TRAINING

- A. Provide training course to all fire personnel assigned by Owner's Representative. The training shall include a course syllabus and hands-on participation. Training shall be conducted on a system identical to the one being installed on this project. The system shall be able to perform all system operations and simulate all types or forms of alarm conditions.
- B. Provide a video of the training program to the Owner's Representative to be used for periodic refresher course, training of the local fire department and for training of new employees.
- C. The training course shall include, in addition to the above, a system overview, and a review of the operation and maintenance manual.
- D. The instructor shall be factory trained and shall be thoroughly familiar with all parts of the installation on which instruction is to be given. The instructor shall be trained in operating theory as well as in practical operation and maintenance work.

END OF SECTION 28 46 00

SECTION 28 48 00

EMERGENCY RADIO COMMUNICATION ENHANCEMENT SYSTEM (BDA SYSTEM)

1 GENERAL

1.1 RELATED WORK

- A. The following, in their entirety and as applicable, shall apply to this section. Including any associated drawings.
 - 1. Conditions of the Contract
 - 2. Division 1
 - 3. Division 26
 - 4. Division 27
 - 5. Division 28

1.2 DESCRIPTION

- A. General:
 - 1. Provide a Public Safety Radio Distributed Antenna System (DAS), designed to provide in-building, 2-way radio coverage for all radio frequencies used by local first responder agencies, giving users the ability to receive and transmit radio signals from their portable radio units within the building.
The DAS components specified in this document include:
 - a. Bi-Directional Amplifiers (BDA)
 - b. Donor Antennas
 - c. Coverage Antennas
 - d. Coax Cable
 - e. Coax Connectors
 - f. Splitters
 - g. Combiners
 - h. CouplersThese devices shall be used as part of a system, to be designed by a DAS integrator, experienced with design-build projects for in-building, public safety, amplification systems. Quantities and locations of antennas shall be as determined by the equipment selected and the DAS integrator's design.
 - 2. The system shall comply with the minimum requirements of UL60950 In-building 2-Way Emergency Radio Communication Enhancement Systems, NFPA 72 2019 Edition, NFPA 1221 2019 Edition, NFPA 1225 2022 Edition and IFC 2015, as referenced.
 - 3. The entire system shall meet the requirements of the Fire Department, the Building Department and all other agencies and authorities having jurisdiction (AHJ).
 - 4. The work in this section shall include the responsibility for all permit requirements with the AHJ. Where filings require engineer's signature, documents shall be submitted for his review and signature. This responsibility shall include furnishing of required quantities of floor plans, descriptive notes and/or specifications, wiring diagrams, shop drawings and amendment forms.
 - 5. Early completion of the in-building emergency radio communication enhancement system will be required as to permit a Certificate of Occupancy to be obtained in a timely manner
 - 6. Any permits necessary for the installation of the work shall be obtained prior to the commencement of the work. All permit costs and inspection fees shall be

- included.
7. The in-building emergency radio communication enhancement system shall use a UL60950, NFPA 72, NFPA 1221, NFPA 1225 and IFC 2018 compliant signal booster and equipment.
 8. These documents are conceptual in nature. It shall be the responsibility of the approved installer to furnish a complete and functional system, including the items shown on the drawings, in the specifications, and items not designated in either. The installer's shop drawings and product data submittals shall represent a complete system and documents accepted do not relieve the installer from being required to provide any materials, equipment, or labor to furnish a complete and functional system as recognized by the Project's Technology Consultant and the Owner.
- B. Design requirements:
1. In-building emergency radio communication enhancement systems for emergency responders are an integral component of the life safety equipment of a building or structure. The primary function is to provide reliable emergency responder communications at the required signal strength within the specified areas.
 2. Critical Areas such as emergency command center, fire pump room, stairwells, corridors, elevator lobbies, standpipe cabinets, sprinkler sectional valve locations and similar critical areas shall be provided with 100% floor area radio coverage.
 3. General building areas shall be provided with 95% radio coverage, or as specified by AHJ.
 4. The In-building emergency radio communication enhancement systems must provide the following signal strengths:
 - a. Downlink - Minimum signal strength of -95 dBm throughout the coverage area.
 - b. Uplink - Minimum signal strength of -95 dBm received at the AHJ Radio System.
 - c. OR As otherwise required by the AHJ
 5. The system shall be complete with all components and wiring required for compliance with all applicable codes and regulations, and for its operations described hereinafter.
 6. An approved manufacturer or a qualified and approved vendor shall perform an RF Survey to determine locations of components which are required for proper operation as well as to supply, install, test and certify the performance of the complete system. Vendor qualifications must be acceptable to the AHJ.
 7. Design shall include iBwave software-simulated radio propagation modeling with heat maps showing predicted signal coverage levels within the building. The iBWave design shall be done by iBWave certified personnel.
 8. All tests shall be conducted, documented, and signed by a person in possession of an FCC General Radio Telephone Operators License. All testing personnel shall be certified and authorized by the signal booster manufacturer in the installation and operation of their equipment. Personnel qualifications must be acceptable to the AHJ.
 9. The system design shall be based on the line of Public Safety Signal Boosters UL60950, NFPA 72, NFPA 1221, NFPA 1225, IFC and FCC certified to establish standards of quality for materials and performance. The naming of a specific manufacturer or a catalog number does not waive any requirement or performance of individual components described in the specifications.
 10. Assembly and installation of all components of the Emergency Responder Radio Communication Enhancement System shall comply with all applicable sections of the National Electrical Code.
 11. Survivability from attack by fire shall meet requirements of NFPA 72, NFPA 1221,

- NFPA 1225, IFC or as required by the local jurisdiction.
12. The system must comply with all applicable sections of the FCC rules. Signal booster shall have FCC certification prior to installation.
13. Antenna isolation shall be maintained between the donor antenna and all inside antennas (DAS) to a minimum of 20dB under all operating conditions

1.3 QUALITY ASSURANCE

- A. Acceptable manufacturers:
 1. The equipment/products described herein and furnished per these specifications shall be the product of one manufacturer or must be able to obtain the full warranty of the combined solution. All references to model numbers and other detailed descriptive data is intended to establish standards of design performance, and quality, as required. The contractor shall not deviate from the part numbers listed. Any deviation from specified part numbers will result in the removal of non-specified materials and reinstallation of approved materials at no cost to the project.
 2. The approved manufacturers shall provide a complete End-to-End solution with the minimum product and performance warranty of one (1) year
 3. Only products listed in Part 2 of this specification, or approved in compliance with the project manual's approval requirements, will be accepted
- B. Installer Qualifications:
 1. The System Installer shall be licensed and shall meet all applicable regulations of the State Department of Labor insofar as they apply to this type of system. The proposer shall be a firm normally employed in the communications industry and shall provide a reference list of ten (10) large-scale projects and contact names confirming successful Structure Cabling System installations.
 2. The System Installer shall be a certified, local area, integrator of the manufacturer's product and must be able to provide the manufacturer's maximum available warranty for the solution on the entire SCS. The contractor's certification must have been obtained and held within 75 miles of the project's location.
 3. The installing contractor must have a full-time employed individual with a valid FCC issued general radio operator's license. License shall be provided in the product submittals.
 4. All individuals installing the DAS must be employees of the certified installer and at least 25% of the installing staff shall have undergone a training class given by the manufacturer. Current certification indicating the successful completion of the training course shall be available upon request at the project and submitted in the contractor's product submittals.
 5. The proposing contractor and the installing contractor must be the same company. No subcontractor to the proposing DAS contractor will be allowed for any portion of the DAS scope of work.
- C. Low Voltage Meeting Requirements:
 1. The successful Contractor shall attend a mandatory pre-construction meeting with the project's consultant individuals deemed necessary by the Owner's representative prior to the start of the work. No work shall begin prior to this meeting.
 2. The successful contractor shall attend a mandatory bi-weekly meeting to discuss the project progress to help aid coordination with the Owner and Other contractors.
 3. Prior to the installation of any items required for this scope of work the contractor must provide a purchase order with a detailed material list for all

materials to be installed. The purchase order is not required to show cost, but part numbers must be provided. The purchase order will be reviewed during one of the regularly scheduled low voltage meetings.

- D. Acceptance: The Owner's representative reserves the right to reject all or a portion of the work performed, either on technical or aesthetic grounds.

1.4 SUBMITTALS AND CLOSE-OUT DOCUMENTS

- A. Contractor shall provide product data submittals, shop drawing submittals, and close-out documents as designated in Division 1 and Division 27 submittal requirements.
- B. Submittals:
 - 1. At a minimum, the submittals shall consist of the following: The installing contractor and/or equipment supplier shall provide complete and detailed shop drawings and include:
 - a. Wiring and interconnection schematics.
 - b. Complete point-to-point wiring diagrams.
 - c. Riser diagrams.
 - d. Complete floor plan drawings locating all system devices.
 - e. Factory data sheets on each piece of equipment proposed.
 - f. Detailed system operational description. Any specification differences and deviations shall be clearly noted and marked.
 - g. Complete system bill of material, quantities not required.
 - h. Line by line specification review stating compliance or deviation.
 - 2. Product Data Submittals and shop drawings shall be submitted separate from one another and independent of any other system submittals. Submittals combines with other system submittals will be rejected without review.
- C. Close-Out Documents: Reference Division 27 Electronic Communications O&M Manuals specification for close-out document instructions.

2 PRODUCTS

2.1 GENERAL

- A. Acceptable Manufacturers
 - 1. Advanced RF Technologies Inc
 - 2. RSI
 - 3. RF Technologies
 - 4. Comba
 - 5. Approved Equal
- B. Materials shall be as listed or shall be approved equivalent products of other manufacturers meeting the intent and quality level of the TIA/EIA specifications.
- C. Testing: All installed cabling shall be tested 100% good after installation by the Contractor. All final test results shall be delivered to owner at completion of project. Refer to closeout requirements.
- D. Ratings: All products shall be new and brought to the job site in the original manufacturer's packaging. Electrical components (including innerduct) shall bear the Underwriter's Laboratories label. All communications cable shall bear flammability testing ratings as follows:
 - CM Communications Cable

CMP Plenum Rated Communications Cable
CMR Riser-Rated Communications Cable

- E. Initial Cable Inspection: The Contractor shall inspect all cable prior to installation to verify that it is identified properly on the reel identification label, that it is of the proper gauge, containing the correct number of pairs, etc. Note any buckling of the jacket that would indicate possible problems. Damaged cable or any other components failing to meet specifications shall not be used in the installation.
- F. Cable Lubricants:
 - 1. Lubricants specifically designed for installing communications cable may be used to reduce pulling tension as necessary when pulling cable into conduit.
 - 2. Approved Products
 - a. Twisted-pair cable: Dyna-Blue
 - b. American Polywater
- G. Fire Wall Sealant:
 - 1. Any penetration through firewalls (including those in sleeves) will be resealed with an Underwriter Laboratories (UL) approved sealant.
 - 2. Approved Products
 - a. 3M or
 - b. Pre-approved equal

2.2. TECHNICAL SPECIFICATIONS AND PERFORMANCE REQUIREMENTS

- A. The system specified shall be based upon line of Public Safety UL60950, NFPA72, NFPA 1221, NFPA 1225, IFC compliant signal boosters
- B. The signal booster shall be a Class A Public Safety type as designated by the FCC or as required by the AHJ.
- C. The secondary power supplies, battery chargers and system monitoring shall be fully compliant with NFPA 72, NFPA 1221, NFPA 1225, and IFC. The signal booster shall have both the primary and the secondary power supplies within a waterproof, type-4 approved enclosure.
- D. All signal boosters and other active system components must have FCC certification prior to installation. The equipment FCC ID must be shown on the product datasheets and technical submittals. The ID must also be displayed on the product as required by the FCC.
- E. The signal booster shall be pre-set by the equipment manufacturer for the frequencies specified by the AHJ. Field tuning of RF filters and duplexers is not allowed.
- F. Signal Boosters shall have oscillation suppression circuitry to protect the public safety radio system in case of system malfunction or other causes. The oscillation suppression circuit shall not disable the system operation. Systems that automatically disable the signal booster upon oscillation detection shall not be allowed.
- G. Signal Boosters shall have uplink noise suppression function to eliminate uplink noise while in standby (i.e. no radio transmission from within a building). Systems that produce any measurable level of uplink noise while in standby shall not be allowed.
- H. Signal Booster gain shall be rated at minimum of 80dB and the gain shall be adjustable in a minimum of 30dB range. System gain shall be set and documented at the time of the

final system test.

- I. Maximum Propagation delay of the signal booster system shall be 14 μ s (microseconds) or as specified by AHJ.
- J. The signal booster system shall include built-in automatic supervision of malfunctions of the signal booster and battery system as per NFPA 1221 NFPA 72 and IFC. Non-OEM equipment add-ons and modifications to comply with this specification shall not be allowed.
- K. As required by code and the local AHJ, the system shall be monitored and shall include automatic supervision signals for malfunctions of the in-building emergency responder communications enhancement system that are annunciated by the fire alarm system in accordance with NFPA 72.
System supervisory signals shall include the following:
 - 1. Signal source malfunction
 - 2. Active RF-emitting device failure
 - 3. Low-battery
 - 4. Active system component failure
 - 5. Power supply supervisory signals, consisting of the following
 - a. Loss of normal AC power
 - b. Failure of battery charger
 - 6. Integrity of communications link between the fire alarm system and the in-building emergency responder communications system
- L. A dedicated supervised monitoring annunciation panel shall be provided within the emergency command center next to the fire alarm panel / annunciator or other location as designated by AHJ to annunciate the status of all signal booster locations. The monitoring panel shall provide visual and labeled indication of the following for each signal booster:
 - 1. Normal AC power
 - 2. Loss of normal AC power
 - 3. Battery charger failure
 - 4. Low-battery capacity
 - 5. Signal source malfunction
 - 6. Active RF-emitting device malfunction
 - 7. Active system components malfunction
- M. External filters, duplexers, power supplies or other non-OEM additions or modifications of the original equipment shall not be allowed. All duplexers shall be built-in and FCC certified with the signal booster as a complete and fully integrated FCC-certified and UL-Listed unit.
- N. All signal booster components shall be contained in a type-4 approved waterproof enclosure. All enclosures shall be painted red with external labeling as required by the AHJ.

2.3 MATERIAL AND EQUIPMENT LIST

- A. All materials and equipment necessary for a complete, functional, and code compliant, turnkey system shall be provided, installed, and warranted by the installing contractor.
- B. Broadband high isolation Donor Antenna – antenna shall feature a multi-band design accommodating all applicable Public Safety frequencies in a single pole-mounted antenna. Antenna azimuth pattern shall be as proposed by the manufacturer to meet the

performance specifications of the system as installed. Antenna shall be rated for outdoor use.

- C. Coverage Antenna – Omnidirectional – antennas shall feature a multi-band design, accommodating multiple frequency bands in a single ceiling-mounted antenna. Beam width: horizontal 110 degrees directional, vertical 90 degrees nominal. Antenna shall be rated for indoor use.
- D. Bi-Directional Amplifiers (BDA) – BDA shall be of a modular design and use digital filtering to mitigate interference. Unit shall be standard 19" rack or wall mountable. Each RF amplifier shall be capable of adjusting and controlling power levels. Units shall be IP-addressable and be monitored/controllable via a web-based application.
- E. Cables – shall be as recommended by the equipment manufacturer and shall be compatible with the installed equipment. Cables shall be listed as required by the pathway and compatible with the environments in which they are installed.
- F. Miscellaneous Equipment – Splitters, Combiners, Couplers, Jumpers, and Connectors to be utilized with the system shall be by a manufacturer recognized by the manufacturer of the major system components.

3 EXECUTION

3.1 GENERAL

- A. Fire Wall Penetrations: The contractor shall avoid penetration of fire-rated walls and floors wherever possible. Where penetrations are necessary, they shall be sleeved with metallic conduit and resealed with an Underwriter Laboratories (UL) approved sealant. Contractor shall also seal all floor, ceiling and wall penetrations in fire or smoke barriers and in the wiring closet.
- B. Allowable Cable Bend Radius and Pull Tension: In general, communications cable cannot tolerate sharp bends or excessive pull tension during installation. Refer to the cable manufacturers allowable bend radius and pull tension data for the maximum allowable limits.
- C. Cable Lubricants: After installation, exposed cable and other surfaces must be cleaned free of lubricant residue.
- D. Pull Strings: Provide pull strings in all new conduits, including all conduits with cable installed as part of this contract. Pull test is not to exceed 200 pounds. Data and video cables can be pulled together with pull strings.
- E. Conduit Fill shall not exceed 40%.
- F. Damage:
 - 1. The Contractor shall replace or rework cables showing evidence of improper handling including stretches, kinks, short radius bends, over-tightened bindings, and cable sheath removed too far.
 - 2. The Contractor shall replace any damaged ceiling tiles that are broken during cable installation.
- G. Clean Up: All clean up activity related to work performed will be the responsibility of the Contractor and must be completed daily before leaving the facility.

3.2 STATION WIRING INSTALLATION

- A. General: All cable must be handled with care during installation so as not to change performance specifications. There shall not be any exposed/unsheathed cable at any termination location.
- B. Exposed Cable:
 - 1. All cabling shall be installed inside walls or ceiling spaces whenever possible. Exposed cables and/or cables routing through mechanical rooms, electrical rooms, or restrooms shall be installed inside conduits, unless noted otherwise on the project drawings.
 - 2. Additional exposed cable runs will require Owner approval and will only be allowed when no other options exist.
 - 3. All cable routing through conduits and sleeves shall maintain a 40% maximum conduit fill ratio.
- C. Placement: All cabling and associated hardware shall be placed so as to make efficient use of available space. All cabling and associated hardware shall be placed so as not to impair the Owner's efficient use of their full capacity.
- D. Cable Routes:
 - 1. All cabling placed in ceiling areas must be in conduit, or approved cable support with Velcro cable wrap at each location. Cable supports shall be permanently anchored to building structure or substrates. Provide attachment hardware and anchors designed for the structure to which attached and that are suitably sized to carry the weight of the cables to be supported. Do not route cable through webbing of structural steel. Cabling must be supported in dedicated supports intended to support cabling as described in this section. Contractor shall adhere to the manufacturer's suggested fill ratio for each size cable support installed.
 - 2. Attaching cable to pipes or other mechanical items is not permitted. Communications cable shall be rerouted so as to provide a minimum of 18 inches spacing from light fixtures, sources of heat, power feeder conduits and EMI sources. Cabling shall not be attached to ceiling grid support wires. Cable runs shall be routed down the corridors; parallel or perpendicular to building structure. Multiple cables to be bundled together at and between each cable support installed.
 - 3. Contractor shall be responsible for coordinating with other trades on the project so that the installed cable pathway does not interfere with the installation of other systems to insure that mechanical ducts, pipes, conduits, or any other above ceiling systems are not putting unnecessary stress on any portion of the install SCS.

3.3 INSTALLATION REQUIREMENTS

- A. Installation of all components of the
- B. Communication Enhancement System shall comply with all applicable sections of the National Electrical Code NFPA-70, NFPA-72, NFPA 1221, NFPA 1225, IFC or as required by the local AHJ.
- C. The primary power source shall be supplied from a dedicated twenty (20) ampere branch circuit and shall be connected to the buildings emergency power and comply with NFPA-70 National Electrical Code, NFPA 72, NFPA 1221, and NFPA 1225.
- D. The signal booster shall be equipped with a secondary source of power. The secondary

source of power shall be a battery system with a dedicated battery charger powered by a separate, dedicated twenty (20) ampere branch circuit. The secondary power supply shall power on automatically when the primary power source is lost. The secondary source of power shall be capable of operating the emergency responder radio coverage enhancement system for a period of at least 24 hours. The battery system shall automatically charge in the presence of external power input. Battery charger and all other electronic components must be fully enclosed in a waterproof Type-4 approved enclosure. Batteries shall be enclosed in a separate, vented Type-3R approved enclosure. External UPS (Uninterruptable Power Supplies) are not acceptable.

- E. RF Coaxial Cable shall be a listed, CMP plenum. Non-plenum cable can be used when installed in a metallic raceway. The cable classification shall be clearly marked on the outer surface of the cable regular intervals.
- F. Provide at each Donor Antenna an exterior dielectric enclosure in which a ground busbar and surge arrester are mounted. Bond busbar to ground distribution system. Make all donor antenna mounts/masts and associated components, accessories, and hardware electrically continuous and bond to ground. Bond surge protection to ground distribution system.
- G. Grounding conductors shall be provided from all racks, cabinets, and control panels. It shall be the responsibility of the integrator to follow good engineering practice to provide minimum cross-talk and maximum signal-to-noise ratios and reduce interference in the radio systems.

3.4 ACCEPTANCE AND TEST PROCEDURES

- A. Acceptance testing for an in-building radio system is required upon completion of installation.
- B. The coverage testing shall be done in accordance with NFPA 72, NFPA 1221, NFPA1225, IFC and as required by the local AHJ
- C. All tests shall be conducted, documented, and signed by a person in possession of a current FCC General Radio Operator License.
- D. All test records along with system diagrams, iBWave design, equipment specifications, user manuals, RF link budget calculations, battery backup calculation and other design data shall be submitted upon completion of the project, and as required by the AHJ.

END OF SECTION 28 48 00

SECTION 28 55 00

RF SURVEY FOR IN-BUILDING EMERGENCY RESPONDER RADIO COVERAGE(ERRC) AND TESTING OF EXISTING ERRC ENHANCEMENT SYSTEMS (EERCES)

1 GENERAL

1.1 WORK INCLUDED

- A. The purpose of this specification is to establish the requirements and standards for surveys for public safety radio signal strength in buildings as required by the NFPA, IBC, IFC and local AHJ. This specification is only for a RF survey. If an existing ERRCES is on premise and is operational, provide verification and documentation of the existing ERRCES as specified.
 - 1. This survey is required as part of the contract documents and shall be implemented as specified in this specification unless indicated or specified otherwise.
 - 2. This survey is required for in all buildings with basements, all buildings four stories and taller, and all buildings with an aggregate total building area of 50,000 square feet or more; this survey may still be required for other buildings that do not meet these structural requirements.
 - 3. This survey may not be required if the local AHJ has pre-determined that an Emergency Responder Radio Coverage Enhancement System (ERRCES) is not required for the subject building(s). If a survey is not required by the AHJ, notify the Architect, Engineer, Owner prior to scheduling the survey.
 - 4. The survey requirements specified in this section are intended to be slightly more stringent than minimum IBC and IFC requirements. This is to help mitigate radio coverage deficiencies that could be caused by future minor variations in building use configurations and changing atmospheric conditions.
- B. Where the subject building(s) do not have an existing ERRCES, this survey shall be for ERRC measurements and compliance evaluation only, it is not intended as a requirement for designing nor a requirement for providing an ERRCES.
- C. Where the subject building(s) have an existing and operational ERRCES, this survey shall include a full yearly functionality test of the existing ERRCES hardware, antennae, wave guides, cabling, wiring, and connectivity as required by the local AHJ, IBC, IFC, and NFPA. This survey shall then be able to be used for the required yearly inspection and testing report of the existing ERRCES. If deficiencies of an existing ERRCES are observed or detected during field signal measurement, the contractor shall document those deficiencies and report them to the Owner in writing within two Owner's business days of completion of the testing so that the Owner can take immediate remedial action. Corrections and modifications to existing ERRCES are not part of this specification section requirements.
- D. Technical information for this survey shall be obtained from the local AHJs pertaining the specific technical information and requirements for the emergency responder communications coverage system. This information shall include but not be limited to the various frequencies required, the location of radio antennae sites, the effective radiated power of the AHJ radio antennae sites, the maximum propagation delay in microseconds,

the applications being used, and other supporting technical information that would be necessary for an ERRCES design and to fully test an existing ERRCES.

- E. Surveys for new construction shall be performed after the building is fully dried in, with interior wall construction and all exterior wall glazing completed, and prior to start of installation of electrical wiring. It is the intent that this survey be completed as soon as practical, results reported to the Owner and analyzed, and if required or specified as part of the contract documents or if it is to be provided by others, a radio antenna/repeater system can be designed, installed, fully operational, and commissioned without delaying the scheduled contract date for certificate of occupancy (CO) or the AHJs final inspection and approval for full Owner and public occupation of the building.
- F. Conduct surveys using a RF Spectrum Analyzer, a calibrated system-compatible radio or another suitable instrument with traceable certificate of calibration to analyze the RF signal strength of Emergency Responder Radio Signal into the building and determine if amplification of the signal is required or that if existing, the existing ERRCES is functioning properly and providing the proper radio coverage. All test equipment shall have been calibrated within the previous 12-months of the date(s) of testing. Both inbound and outbound signal strength shall be determined, measured, calculated, and documented as required by code. General weather conditions and time of day during the test shall be documented as part of the survey report.

1.2 SURVEY CRITERIA

- A. The required Public Safety Radio Signal Level inside the Owner's facility shall be as required by code, ordinance, AHJ, and as specified.
- B. Survey shall be performed by an FCC licensed technician holding a current General Radiotelephone Operator License (GROL). Where required by the local AHJ, the licensed operator shall be registered with the AHJ as an ERRC Special Inspector (or equivalent designation given by the AHJ) with in-building emergency radio system certification issued by a nationally recognized organization, school, or the emergency radio system manufacturer of the equipment being tested where an existing ERRCES is being tested, or certification by the ERRCES if a new ERRCES is specified elsewhere to be installed as part of the contract documents.

1.3 REGULATIONS

- A. Codes, regulations, and standards shall be the latest published standards. The latest national published standards listed below shall supersede any local standard unless doing so would violate the intent of the local code requirements.
 - 1. NFPA 1 – Fire Code
 - 2. NFPA 70 – National Electrical Code
 - 3. IFC 510- Emergency Responder Radio Coverage
 - 4. NFPA 101, Life Safety Code, and all local amendments and requirements.
 - 5. NFPA 72 National Fire Alarm and Signaling Code
 - 6. FCC 47 CFR Telecommunications
 - 7. FCC 47 CFR 90.219 Use of Signal Boosters
 - 8. IFC - International Fire Code
 - 9. Local or State Fire Codes
 - 10. ADA "Americans with Disabilities Act" and any local or state or local accessibility standards and amendments.

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11. FCC's OET 65 Standards "Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields"
12. FCC Rules Part 22 Public Mobile Services, Part 90 and Part 101
13. NFPA 1221- Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems
14. IBC - International Building Code
15. UL 2524 - Standard for In-building 2-Way Emergency Radio Communication Enhancement Systems
16. NFPA 3000 (PS) - Standard for an Active Shooter/Hostile Event Response (ASHER) Program and if present, Owner's specific ASHER Program. Note: Although currently considered by the NFPA as a Provisional Standard (PS), the issued NFPA 3000 shall be considered part of this specifications as if it were a fully accredited document to NFPA standards. If the building Owner has established an ASHER Program, it too shall be considered part of this specification section requirements.

1.4 DEFINITIONS

A. Definitions:

1. Area: A enclosed space in a building consisting floor to ceiling walls with doors.
2. ASHER Program: Active Shooter Hostile Event Response Program. Program elements developed by the building's Owner to determine the necessary functions and actions related to preparedness, response, and recovery from an active shooter/hostile event response.
3. BDA: Bi-Directional Amplifier. A device used to amplify band-selective or multi-band RF signals in the uplink, to the base station and in the downlink from the base station to subscriber devices for enhanced signals and improved coverage.
4. BER: Bit Error Rate is the number of bit errors per unit time
5. DAS: Distributed Antenna System
6. ERRCES / ERRCS: Emergency Responder Radio Coverage Enhancement System / Emergency Responder Radio Coverage System. A two-way radio communication system installed to assure the effective operation of radio communications systems for fire, emergency medical services, or law enforcement agencies within a building or structure. A system used by firefighters, police, and other emergency services personnel.
7. FCC: Federal Communications Commission
8. Grid or test grid: The individual specified and/or code required imaginary spaces inside the building used for radio coverage testing. Typically a grid space consist of a square space with equal or almost equal side dimensions where the radio signal levels are measured at the center of each grid space to verify radio coverage. Grid spaces can consist of individual areas or rooms meeting the maximum size requirements.
9. GROL- FCC General Radiotelephone Operators License
10. OET 65 Standards: FCC's Bulletin 65 provides Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields.
11. Public Safety/First Responder: Public Safety or First Responder agencies that are charged with the responsibility of responding to emergency situations. These include, but are not limited to law enforcement departments, fire departments, and emergency medical companies. Typically, there may be multiple agencies for each type of responder, including those administered by the building Owner.
12. RSSI: Received signal strength indicator RSSI is a relative measurement of the power present in a received radio signal.

13. Zone: The individual partitioned grid specified and/or code required imaginary space(s) inside large buildings. Typically, each zone shall be no more than 50,000 square feet and shall be contiguous on the same building floor. Zones are further sub-divided into smaller grid spaces so that radio signal levels can be measured at the center of each grid space to verify radio coverage. A zone can be an individual wing of a building or separate floors of a building that do not exceed 50,000 square feet each. Zones can be created for separate test report areas to ensure individual grid test spaces are not excessive in physical area size and detrimental to the accuracy and resolution of the test data measurement point locations. Each zone must pass the radio coverage test for the entire building to pass the test. Zones can exceed 50,000 square feet as long as the maximum allowable grid space size is not exceeded.

3 EXECUTION

3.1 EXECUTION

- A. Testing Procedures and Parameters
1. The test shall be conducted using a calibrated portable radio authorized by the local AHJ, and of the latest brand and model used by the agency talking through the agency's radio communication system.
 2. Testing shall include all critical areas required by the NFPA 1221 and others included in the list below. Critical areas shall be provided with a minimum 99-percent floor area radio coverage in each specific area. Critical areas include but are not limited to the following areas:
 - a. Fire command centers
 - b. Fire pump rooms
 - c. Exit stairs
 - d. Exit passageways
 - e. Elevator lobbies
 - f. Areas of rescue or refuge
 - g. Areas with or spaces adjacent to standpipe cabinets
 - h. Areas with or spaces adjacent to sprinkler sectional valve locations
 - i. Areas with or spaces adjacent to bleeding control kits.
 - j. Areas with or spaces adjacent to Automatic External Defibrillators (AEDs) for public use.
 - k. Areas designated for persons with special needs or areas for specifically designated for persons who are not ambulatory including those in wheelchairs but require physical assistance by others to evacuate the building.
 - l. Specific bullet resistant areas or spaces designated by the Owner or designated in the Owner's ASHER Program as a bullet resistant panic and safe room/areas or spaces.
 - m. Front lobby areas and/or building administrative areas with direct wired microphone or wired telephone handset access to the building's mass notification or building wide communication system when such system is existing or to be installed as part of this project.
 - n. Areas and/or building administrative areas with public safety radio base stations used for direct communications with Owner's police or security personnel.
 - o. Other areas deemed critical by the AHJ.
 3. Testing grid spaces, areas, and zones shall be as required by the local AHJ and/or as specified in this specification. The more stringent requirements of the

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local code, AHJ, or those specified or indicated elsewhere in the contract documents shall apply. Specific requirement for the test grids, areas, and zones shall be follows:

- a. Testing shall be based on a minimum of 20 approximately equal size grid spaces per floor or zone with a maximum of 2,500 square foot per test space. Failure of more than one test space shall be considered a test failure.
 - b. In the event that only two test spaces fail the 20-space grid test above, the same floor/zone shall be divided into 40 approximately equal size grid spaces or a maximum of 1,250 square feet per space and re-tested. Failure of only one or only two nonadjacent test spaces on that floor or zone shall result in a non-failure for that floor or zone. Failure of three or more spaces shall result in a test failure for that floor or zone. Failure of two adjacent test spaces shall result in a test failure of that floor or zone.
4. If there is an existing EERCES and there are grid space test failures resulting in a failed test, notify the Owner in writing immediately about the failed spaces after the completed test and identify the specific areas of the building that are not compliant. The final test result formal submittal data may be submitted at a later date as specified. Contractor may provide recommendations for alterations or modifications to the existing system to the Owner/Architect/Engineer so that the deficiencies can be addressed by the Owner as soon as possible and corrective measures taken by the Owner. Make corrective measures or modifications to the existing system only if specifically instructed by the Owner in writing.
 5. Two-way radio communications shall be verified by testing the two-way communication to and from the outside of the building from a single point approximately at the center of each test grid space or room area. Retesting from a different point inside the same grid space or room area is prohibited if the first point selected fails the test. The initial failure shall be recorded as a failed test grid space or area.
 6. Signal strength for a non-failure shall be sufficient to meet the requirements of the applications being utilized by public safety for emergency operations through the coverage area as required by the AHJ.
 7. The minimum inbound signal strength shall be sufficient to provide usable voice communications throughout the coverage area as required by the AHJ. The inbound signal level shall be sufficient to provide not less than -95 dBm for analog systems or a Delivered Audio Quality (DAQ) of 3.0 for digital systems or an equivalent Signal-to-Interference-Plus-Noise-Ratio (SINR) applicable to the technology of either analog or digital signals.
 - 8.. The minimum outbound signal strength shall be sufficient to provide usable voice communications throughout the coverage area as required by the AHJ. The outbound signal level shall be sufficient to provide not less than -95 dBm for analog systems or a Delivered Audio Quality (DAQ) of 3.0 for digital systems or an equivalent Signal-to-Interference-Plus-Noise-Ratio (SINR) applicable to the technology of either analog or digital signals.
 9. Buildings with existing EERCES: Verify the following, include the requested information report deficiencies to the Owner as part of the ERRC report.
 - a. Verify the existing EERCES is fully monitored by the building fire alarm system as required by NFPA 1221 and NFPA 72.
 - b. If there is an existing remote EERCES annunciator, verify all annunciators and indicators required by NFPA 1221 are operational and functioning properly.
 - c. The gain values of all existing EERCES amplifiers shall be measured and documented for comparison for future annual testing of the EERCES.

- d. A spectrum analyzer or other suitable test equipment shall be used to verify spurious oscillations are not being generated by existing signal booster(s).
- e. Verify that the isolation between the donor antenna and all inside antennas is maintained to a minimum of 20dB above system gain.

3.2 SURVEY REPORT SUBMITTALS

- A. Submit summary findings and detailed test report data within 14-days of notice to proceed.
- B. Buildings not in compliance with the ERRC testing: Indicate areas of the building deficient in ERRC. Provide general recommendations of the necessary equipment and means required to bring the building into full ERRC compliance for Owner review in the summary findings. This specification section is only intended for survey, report, and recommendation information only and is not intended for detailed design, modification, or corrective measures. The report data submittal shall be complete in such that it would be useful to assist in a detailed design of a ERRCES. Submit additional report data as indicated below.
- C. Building in compliance with required ERRC: Include a copy of the inspection report to be issued to the AHJ(s) in the format required by the AHJ(s) and submit the report to the AHJ(s) as part of the building permitting process.
- D. Report data submittals shall include but are not be limited the following:
 - 1. Include a copy of survey contractor's AHJ and FCC required licenses to perform the survey.
 - 2. Where there is an existing ERRCES, include an updated ERRCES technical document and yearly report which the Owner shall keep on file as required by NFPA 1221. Technical documents shall include but may not be limited to the following information typically provided by the AHJ(s):
 - a. Frequencies required by the AHJ(s) for the existing in-building enhancement system (EERCES).
 - b. Location and effective radiated power (ERP) of radio sites used by the public safety radio enhancement system (ERRCES).
 - c. Maximum propagation delay in microseconds.
 - d. List of specifically approved ERRCES components.
 - e. Other supporting technical information necessary for the existing system maintenance, or future modifications.
 - 3. Confirmation that the ERRC for the building that is subject of the report has been determined to meet the minimum coverage requirement as defined by the IBC/IFC, this survey specification section's requirements, and the local AHJ requirements.
 - 4. Include a scaled drawing of the building with RF measurements of each floor or zone of the building which indicates relative RF field strength for each frequency band of interest. Minimum drawing size 11x17-inch, maximum 30x42-inch.
 - 5. The drawings shall indicate clearly the areas that have passed or failed based on the more restrictive of the above parameters or those specifically required by the AHJ.
 - 6. When required by the AHJ, inspection reports by AHJ approved third-party inspector in the format required by the AHJ.

END OF SECTION 28 55 00

6. For detention pond, coordinate with Civil details and notes for sod locations.
7. Roll sodded areas in two directions perpendicular to each other. Repair and reroll areas with depressions, lumps or other irregularities.
8. Fertilize sod areas (dependant on time of year).
9. Water sodded areas immediately after sod laying to obtain moisture penetration through sod into top four (4") inches of soil.

3.03 CLEAN UP

As planting operations proceed, all rope, wire, empty containers, rocks, clods and all other debris shall not be allowed to accumulate, but shall be removed daily and the site kept as tidy as possible at all times. After planting operations are finished, all paved areas shall be cleaned by sweeping and washing if necessary. Contractor shall continue to clean up construction debris and rocks as exposed and unearthed as a result of this work.

3.04 PROTECTION

Planting areas shall be protected during installation at all times against trespassing and damage of all kinds until acceptance of the project by the Owner.

3.05 INSTALLATION MAINTENANCE

- A. Contractor shall maintain the entire limit of landscape work during the course of landscape installation leading up to and including satisfactory completion of all punch list items.
- B. Installation maintenance shall begin immediately after seeding/hydromulching or sodding. Installation maintenance includes all watering operations (permanent irrigation, temporary irrigation and hand watering). Contractor is responsible for temporary and/or hand watering for seeding/ hydromulch establishment with a uniform grass stand.
- C. Seeding/Hydromulch must achieve full growth with bare areas less than 12" in any direction.
- D. Installation maintenance shall include watering, weeding, mowing and edging once a week, reseeding, removal of dead materials, repairs of soil settlements, dips and depressions, fertilizing and applying sprays or chemicals as necessary to keep the grass free of insects and disease.
- E. Once accepted after Substantial Completion punchlist review, the Contractor shall continue to maintain all landscape items including turf, trees, shrubs, groundcover and all underground irrigation for a period of 90 days starting at the date of Punch List completion. See Exterior Landscape Maintenance section

3.06 INSPECTION AND ACCEPTANCE

- A. Substantial Completion notice will be issued only after Owner and Landscape Architect inspect and approve all required planted work including grass areas.
- B. Acceptance will be determined after all punchlist items generated during walks are completed. This also requires all plant material to be alive and healthy and grass areas established.
- C. Acceptance notice will be issued only after Owner and Landscape Architect inspect and approve all planting work as in accordance with Contract Documents but exclusive of replacement of plant materials under the Warranty Period.

3.07 OWNER RESPONSIBILITY

Owner shall take responsibility of the landscape areas by maintaining, monitoring and repairing as needed the irrigation system to ensure the irrigation system remains in working order. Owner shall also fertilize, mow and maintain the landscape in a good and healthy condition with best practices and industry standards for landscape maintenance.

**SECTION 31 00 00
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. Grading Excavation and Fill is included in Section 31 23 00.
- B. Trenching and Backfill for Utilities is included in Section 33 05 28.

1.3 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM)
 - 1. ASTM C33 - Specification for Concrete Aggregates.
 - 2. ASTM D1557- 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 contained in Section 01 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 in accordance with SHSU prior to commencing work.
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 312300.
- B. Common soil shall be as specified in Section 312300.
- C. Crushed Stone
 1. Crushed stone shall conform to Texas Department of Transportation Class 57 stone gradation.
- D. 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:

<u>Sieve Size</u>	<u>Percent Finer by Weight</u>
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 00

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.
- C. 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.
- D. 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 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 "Tygar" 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 (OUTSIDE STRUCTURAL PAD)

- A. Pipe bedding and backfill requirements for sanitary sewers shall be as specified in Section 333100, Sanitary Sewage Systems. Bedding and backfill shall be cement stabilized sand for sanitary sewers.
- B. Pipe bedding and backfill requirements for storm sewers shall be as specified in Section 334100, Storm Sewage Systems. Bedding and backfill shall be cement stabilized sand for storm sewers.
- C. Pipe bedding and backfill for water distribution systems shall be in accordance with the Water Main Bedding and Backfill standard detail provided in the drawings. Within pipe zone: provide bank sand bedding to a minimum of 6" above top of pipe. Backfill under pavement shall be cement stabilized sand (1.5 sack of cement per cubic yard of sand), compacted to 95% standard proctor density.
- 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. Provide compacted, suitable fill for electrical and gas lines outside the building slab.
- G. 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 21 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. 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 STRAW 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 of rock 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 ties. 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

- E. Contractor shall give the Owner and laboratory reasonable notice before beginning any pours (at least 24 hours).
- F. The laboratory shall supply a daily report of concrete and materials testing and inspection to the Architect, Engineer, Design/Builder, Contractor and Owner.
- G. Concrete batched away from the job and delivered in mixer or agitator trucks shall conform to requirements of ASTM C94.
- H. Authority and Duties of Laboratory Personnel: Inspectors shall inspect the materials and the manufacture of concrete as specified and shall report to the Owner's Representative, Contractor, Architect and the Engineer the progress thereof. Also, when it appears that the material furnished and the work performed by the Contractor fail to fulfill the specification requirements and contract, the inspector shall direct the attention of the Contractor to such failure or infringement. Such inspection shall not relieve the Contractor of any obligation to furnish acceptable materials or to provide the concrete quality in the structure that is in strict accord with plans and specifications. The inspectors are not authorized to revoke, alter, relax, enlarge, or release any portion of the work, but in case of any dispute arising between the inspector and the Contractor as to materials furnished or in the manner of performing the work the inspector shall have the authority to reject materials or suspend the work until the question at issue can be referred to the Engineer. The inspector shall not act as foreman or perform other duties for the Contractor. In no case shall any advice or omission on the part of the inspector relieve the Contractor of responsibility for completing the work in accordance with the plans and specifications and the fulfillment of the contract. The work will be inspected as it progresses, but failure to reject any defective work or materials shall not in any way prevent later rejection when such defect is discovered or obligate the Engineer for final acceptance. Any expense incidental to the investigation and determination of actual quality of any questionable material shall be borne by the Contractor.
- I. Sampling and Testing:
 - 1. All materials shall be sampled, tested in accordance with appropriate ASTM Standards, and approved before inclusion in any work on this project.
 - 2. Samples for testing shall be furnished by the Contractor.
 - 3. Rejected material shall be immediately removed from the site.
 - 4. Reinforcing steel shall be tested by heat in shops and by random sampling in the field when required by the Architect/Engineer or Owner.

1.3 SUBMITTALS

- A. Shop Drawings: The Contractor is to include as a part of his expense the cost of completely dimensioned concrete shop drawings embracing plans and details, bending diagrams, steel order list, placing diagrams, which service shall be furnished by a structural engineer licensed in the State of the project. No portion of the contract documents shall be reproduced and submitted as shop drawings. The shop drawings shall include the following:
 - 1. Necessary Floor Plans – fully dimensioned plans with all depressions, rises, reinforcing steel, to include placement and accessories.

2. Miscellaneous Items – All other reinforced concrete items shall be drawn at such scale as to give full dimensions, details and reinforcing with accessories as required.
- B. All reinforcing shall be detailed, ordered, and fabricated in accordance with the latest ACI Manual of Standard Practice for Detailing Concrete Structures and the CRSI Manual of Standard Practice.
- C. Submit Shop Drawings to the Architect for review, prior to release to field. Fabrication of reinforcing steel shall not be started until Drawings have been reviewed and stamped.
- D. Prior to the placement of any concrete, design mixes for each type of concrete shall be submitted and approved by the testing laboratory. Mix designs shall include all required and shall include each type of aggregate and admixture to be used.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Concreting shall not be started during rain, sleet or snow and shall not be continued during such weather after having been started except long enough to come to a suitable cutoff point. Concrete placed during rain shall have the cement content increased in the amount of one sack of cement per cubic yard of concrete. All forms and earth forms shall be free of ice and frozen surfaces.
- B. No concrete shall be poured unless temperature is 40 degrees and rising or unless special precautions are taken (approved by the Architect). Adequate equipment shall be provided for heating the concrete materials and protecting the concrete during freezing and near freezing weather. All concrete shall have a temperature of between 50 degrees and 90 degrees F when depositing, and shall be maintained within this temperature range for at least 72 hours or for as much time as is required to insure the proper rate of curing. No salt or other chemicals shall be added to prevent freezing. The covering or other method used for temperature protection shall remain in place 24 hours after artificial heat is discontinued. The recommended Practice for Cold Weather Concreting” (ACI 306) and the “Recommended Practice for Hot Weather Concreting” (ACI 305) shall be accepted as good practice.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. All materials shall be subject to approval. Any change of materials specified shall be submitted for approval and such change, if acceptable, shall be used only when specifically authorized in writing.
- B. Cement shall conform to the following specifications:
 1. Coarse and fine aggregate shall conform to requirements of ASTM C33 or Federal Specification SS-S-281a.
 2. All coarse aggregates shall be crushed limestone.
 3. The maximum size of coarse aggregate shall not be larger than 1", 1/5 of the narrowest dimension between forms of the member for which the concrete is to be used, nor larger than 3/4 the minimum clear spacing between reinforcing bars. Coarse aggregate for all concrete exposed to the weather shall be crushed limestone with a #57 gradation.

4. Absorption in coarse aggregate shall not exceed 5%.
 5. The fineness modulus for fine aggregate used shall not vary more than 0.2 from the approved sample without approval. Fineness modulus to be 2.9.
- C. All concrete shall be normal weight unless specifically noted otherwise.
1. Normal weight concrete shall be approximately 145 to 155 pounds per cubic foot.
 2. Lightweight concrete shall not exceed 110 pounds per cubic foot and shall be made of normal and normal weight fines.
- D. Water shall be clean, fresh, and free from injurious amounts of oils, acids, alkali or organic material or other substances that may be deleterious to concrete or steel.
- E. Non-shrink grout shall be factory pre-mixed non-shrink, non-metallic grout containing mineral aggregate and shall require only the addition of water at the site. Grout shall be "EUCO NS" (non-metallic) as manufactured by the Euclid chemical company. "Masterflow 713" (non-metallic) as manufactured by Master Builders or approved equal. The grout shall conform to ASTM C-1107 and CRD-621, "Corps of Engineers Specifications for Non-Shrink Grout," and shall be tested in accordance with ASTM C827.
- F. Waterstops shall be 9" Dumbbell type, Model No. 751 as manufactured by Greenstreak, at locations shown on drawings.

2.2 QUALITY AND PROPORTIONING

- A. It shall be the Contractor's responsibility to furnish concrete which will conform to the quality and strength specified.
- B. Strengths, unless otherwise indicated on plans or in specifications or in the table below, shall be 3000 psi minimum 28-day compressive strength.
- | | | |
|----|-------------------|----------|
| 1. | Exterior Concrete | 4000 psi |
|----|-------------------|----------|
- C. Proportioning shall follow the limiting factors in the following table:
- | | |
|----|---|
| 1. | Proportioning on the basis of field experience shall conform to Section 5.3 of ACI 318-89 or the maximum water/cement ratio in Section 5.4 of ACI 318-89. |
|----|---|
- D. Proportioning and design mixes shall be established to produce average strengths higher than specified by the amounts specified in Chapter 5 of ACI 318-95.
- E. Admixtures:
1. Calcium Chloride shall not be used.
 2. An approved air-entraining agent (ASTM C260) shall be added at the mixer with accurate dispenser to produce entrained air 4-6% by volume in all concrete subject to weathering conditions.
 3. An approved water-reducing agent equal to those manufactured by mixer with an accurate dispenser.

4. These and other admixtures shall be used only with specific approval. Tests for design mixes shall be made with the admixtures included.
 5. Fly ash shall not be permitted.
- F. The concrete shall be of such consistency and composition that it can be worked readily into the corners and angles of the forms and around reinforcement without permitting materials to segregate or free water to collect on the surfaces. Within the limiting requirements the Contractor shall adjust the consistency of the concrete as may be necessary to produce mixtures which will be placeable with reasonable methods of placing and compacting. The Contractor shall maintain on the job at all times adequate extra cement to be used at the rate of $\frac{1}{2}$ sack cement per cubic yard concrete for each 2" slump increase for corrections due to wetness desired or obtained. No water shall be added to concrete except under the direct supervision of the engineer or his appointed representative. Under no circumstances will the addition of more than 2 gallons of water per cubic yard of concrete be allowed at the site.
- G. Measurement of Materials:
1. Cement shall be measured by the sack or half-sack unless cement is weighed for each batch.
 2. Aggregates shall be proportioned separately by weight with proper compensation for weight of moisture; weighing equipment shall be accurate within 1%.
 3. Water shall be measured by an approved device capable of accurate measurement to one pint.
- H. Concrete shall be from a single source for each major pour.

2.3 REINFORCEMENT

- A. Refer to Section 032100 for requirements for reinforcement.

2.4 EXPANSION MATERIALS

- A. Verify compatibility of joint filler with sealant specified.
- B. All expansion joints on grade shall be pre-formed non-extruding resilient type, bituminous or bonded cork (ASTM D994 or ASTM D1751).
- C. Other expansion joints may comply with ASTM D1752 – "Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction." Manufacturer's certification and material submittal are required.

2.5 CURING, SEALING AND HARDENING COMPOUNDS

- A. Liquid Curing and Sealing Compounds – General requirements
1. Curing Compounds: Comply with ASTM C 309, Type 1, Class B.

- a. Non-yellowing formulation where subject to ultra violet light.
 - b. Curing and Sealing Compound: Where indicated, providing curing and sealing formulation with long-lasting finish that is resistant to chemicals, oil, grease, deicing salts, and abrasion.
2. Curing and Hardening Compound: Free of waxes, resins or oils; meet water retention requirements of ASTM C 309; penetrate concrete to change free lime to calcium silicate forming a permanently dense, hard surface.
3. The curing compound shall have test data from an independent laboratory indicating a maximum moisture loss of 0.030 grams per square cm. When applied at a coverage rate of 300 square feet per gallon. Manufacturer's certification is required.
 - a. Provide L&M "dress & Seal 30" or Master Builders "Masterseal 66."
 - b. Dissipating Resin Curing Compound: The compound shall be a dissipating resin type compound, conforming to ASTM C309, Type I, "Kurez DR" by The Euclid Chemical Company or approved equal. The film must chemically break down in a two to four week period after application.
4. Curing compounds shall not be used on any surface against which additional concrete or other cementitious material are to be bonded.

2.6 VAPOR RETARDERS (BARRIERS)

- A. An approved vapor barrier shall be placed as called for in the Contract Documents. Supply a vapor barrier that complies with one of the following:
 1. ASTM E 1745, Class A: A three-ply, nylon- or polyester-cord reinforced, high-density polyethylene sheet; laminated to a nonwoven geotextile fabric, 30 mils (0.76 mm) thick.
 2. ASTM E 1745, Class B: A five-ply nylon- or polyester cord-reinforced, high-density polyethylene sheet; 10 mils (0.25 mm) thick.
 3. ASTM E 1745, Class C: One of the following materials, or polyethylene sheet, ASTM D 4397, not less than 10 mils (0.25 mm) thick:
 - a. Nonwoven, polyester-reinforced, polyethylene coated sheet; 10 mils (0.25 mm) thick.
 - b. Three-ply, nylon- or polyester-cord-reinforced, laminated, high-density polyethylene sheet; 7.8 mils (0.18 mm) thick.
4. Submittal is required.

PART 3 – EXECUTION

3.01 INSPECTION

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to the proper and timely completion of the Work. Do not proceed until satisfactory conditions have been corrected.

3.02 CONDUITS, HANGERS, SUPPORTS, ANCHORS, ETC.

- A. The Contractor shall see that all necessary bolts and anchors of all other trades employed on this structure including conduits, sockets, inserts, sleeves, etc., will be placed by their respective trades or shall himself place them to details before concreting a given section of work. He shall see that these items do not interfere with the reinforcement.
- B. No aluminum conduit or product containing aluminum or any other material detrimental to concrete shall be embedded in concrete.
- C. All openings in slabs, beams, columns, and footings, which are not shown on the structural plans, must be approved by the Engineer. The maximum diameter of embedded pipes or conduit shall be 1/3 times the slab or wall thickness. The minimum center-to-center spacing of embedded pipes or conduits shall be three times the outside diameter. For pipes or conduits of different diameters, the minimum edge-to-edge spacing shall be two times the smaller diameter.
- D. All pipes and conduits providing flow able material conveyance which penetrate beams, footings, or walls shall be provided with sleeves of an appropriate size and material to provide movement for expected settlements or deflections.

3.3 PREPARATION

- A. Concrete placing shall not be started until all necessary preparations have been completed and approval has been given. Preparations shall consist of completing all form work involved, placing all reinforcing steel, pipes, conduits, sleeves, hangers, anchors, fastening devices, waterproofing and such other work to be built into the concrete in the section to be poured, and any other preparations herein required for the concreting operations. Free water and any mud or debris shall be removed from forms and excavations to be occupied by concrete. Approved equipment shall be available on the job site for heating and/or protecting the concrete whenever freezing temperatures are likely to occur within the curing period. Ice or chilled water may be required to control concrete temperature in hot weather to below 90 degrees F.
- B. Slabs-on-grade shall be placed on a properly leveled and thoroughly compacted sub grade, equal to 93% maximum dry density. All subsoil's for slabs shall be approved before placing concrete.
- C. Approved equipment shall be provided for heating concrete materials and/or protecting the concrete whenever freezing temperatures are likely to occur within curing period.

3.4 INSTALLATION

- A. Concrete shall be conveyed from the mixer or transporting vehicle to the place of final deposit as rapidly as practicable by methods which will prevent segregation or loss of materials or displacement of the reinforcing steel and which will avoid rehandling. For ready-mix concrete in an agitator truck, the elapsed time from mixer to placement shall not exceed 1-1/2 hours.

- B. Concrete shall be deposited as nearly as practicable in its final position and shall have the qualities required. Concrete shall be deposited continuously in layers or sections of such thickness that no concrete will be deposited on concrete which has hardened sufficiently to cause seams or planes of weakness. If sections cannot be placed continuously, proper construction joints shall be provided.
- C. Concrete during and immediately after depositing shall be thoroughly compacted and worked around reinforcing and embedded fixtures and into all parts of forms by means of spades, rods and approved mechanical vibrators. For thin walls or inaccessible portions, concrete shall be worked into place by vibrating or other approved method: Care shall be taken so as not to work concrete to the point where segregation occurs.

3.5 CONSTRUCTION AND CONTROL JOINTS

- A. All horizontal and vertical construction joints shall be intentionally roughened to a full $\frac{1}{4}$ " \pm amplitude or have a continuous 2"x 4" keyway along the joint at contractor's option.
- B. Provide reinforcing dowels to match the member reinforcing at the joint, unless noted otherwise.
- C. Unless indicated otherwise, slabs-on-grade shall have construction or control joints spaced not to exceed 30 times the slab thickness in any direction. All discontinuous control or construction joints shall be reinforced with two (2) #4 x 48". See structural details. Construction joints shall not exceed a distance of 15'-0" O.C. in any direction.
- D. Control joints shall be installed in slabs-on-grade so the length-to-width ratio of the slab is not more than 1.25:1. Control joints shall be completed within 12 hours of concrete placement. Control joints may be installed by:
 - 1. Saw Cut to a depth of $\frac{1}{4}$ the thickness of the slab.
 - 2. Tooled joints shall be made to a depth of $\frac{1}{4}$ the thickness of the slab.
- E. Control joints in visually exposed walls, unless noted otherwise (shall line up with masonry and architectural joints, see drawings):
 - 1. Vertical control joints at 10'-0" O.C.
 - 2. Reinforcing shall be continuous through control and construction joints, unless noted otherwise.
 - 3. Control joints in foundation walls shall line up with masonry control joints.
- F. Control joints shall be installed in suspended slabs over steel decking by saw cutting along all interior grid lines. Joints centered above the purlins shall be $\frac{3}{4}$ " deep and shall have #4x5'-0" at 16" O.C. reinforcing placed perpendicular to (and centered on) the purlin. Joints centered above the girders shall be $\frac{3}{4}$ " deep and shall have #4x16'-0" O.C. reinforcing placed perpendicular to (and centered on) the girder. The #4 bar reinforcing centered above the grid lines shall be in addition to the specified WWF, which is continuous throughout the suspended slabs over steel decking. Reinforcing shall be placed 1" below the top of the slab.

3.6 FINISHING

- A. Rough Form Finish: For formed concrete surfaces not exposed-to-view in the finish work or by other construction, unless otherwise indicated. This is the concrete surface having texture imparted by form facing material used, with tie holes and defective areas repaired and patched and fins and other projections exceeding $\frac{1}{4}$ " in height rubbed down or chipped off.
- B. Smooth Form Finish: For formed concrete surfaces exposed-to-view, or surfaces that are covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, damp proofing, painting or other similar system. This is as-cast concrete surface obtained with selected form facing material, arranged orderly and symmetrically with a minimum of seams. Repair and patch defective areas with fins or other projections completely removed and smoothed.
- C. Smooth Rubbed Finish: Provide smooth rubbed finish to scheduled concrete surfaces, which have received smooth form finish treatment, not later than one day after form removal. Moisten concrete surfaces and rub with carborundum brick or other abrasive until a uniform color and texture is produced. Do not apply cement grout other than that created by the rubbing process.
- D. Related Unformed Surfaces: At tops of walls, horizontal offsets surfaces occurring 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.
- E. Scratch Finish: Apply scratch finish to monolithic slab surfaces that are to receive concrete floor topping or mortar setting beds for tile, terrazzo, stone and other bonded applied cementitious finish flooring material, and as otherwise indicated. After placing slabs, plane surface to a tolerance not exceeding $\frac{1}{2}$ " in 10' when tested with a 10' straightedge. Slope surfaces uniformly to drains where required. After leveling; roughen surface before final set, with stiff brushes, brooms or rakes.
- F. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as hereinafter specified, and slab surfaces which are to be covered with membrane or elastic waterproofing, membrane or elastic roofing, and as otherwise indicated. After screening, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating when surface water has disappeared or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Check and level surface plane to a tolerance not exceeding $\frac{1}{4}$ " in 10' when tested with a 10' straightedge. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth granular texture.
- G. Trowel Finish: Apply trowel finish to monolithic slab surfaces to be exposed-to-view, and slab surfaces to be covered with resilient flooring, paint or other thin film finish coating system. After floating, begin final trowel finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and with trowel marks, uniform in texture and appearance, and with a surface plane tolerance not exceeding $\frac{1}{8}$ " in 10' when tested with a 10' straightedge. Grind smooth surface defects, which would telegraph through applied floor covering system.

- H. Non-Slip Broom Finish: Apply non-slip broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated. Immediately after trowel finishing, slightly roughen concrete surface by brooming with fiber bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect and Owner's Representative before application. See Section 321613 – Concrete Curbs and Curb and Gutter.
- I. Chemical-Hardener Finish: Apply chemical-hardener finish to interior concrete floors where indicated. Apply liquid chemical-hardener after complete curing and drying of the concrete surface. Dilute liquid hardener with water, and apply in 3 coats; first coat, 1/3-strength; second coat, 1/2-strength; third coat, 2/3-strength. Evenly apply each coat and allow 24 hours for drying between coats. Apply proprietary chemical hardeners, in accordance with manufacturer's printed instructions. After final coat of chemicalhardener solution is applied and dried, remove surplus hardener by scrubbing and mopping with water.

3.7 CONCRETE SURFACE REPAIRS

- A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removal of forms, when acceptable to Architect. Cut out honeycomb, rock pockets, voids over 1/4" in any dimension, and holes left by tie rods and bolts, down to solid concrete but, in no case to a depth of less than 1". Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water and brushcoat the area to be patched with specified bonding agent. Place patching mortar after bonding compound has dried.
- B. For exposed-to-view surfaces, blend white Portland cement and standard Portland cement so that, when dry, patching mortar will match color surrounding. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.
- C. Repair of Formed Surfaces: Remove and replace concrete having defective surface if defects cannot be repaired to satisfaction of Architect. Surface defects, as such, include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets; fins and other projections on surface; and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes, fill with dry pack mortar, or precast cement cone plugs secured in place with bonding agent.
- D. Repair concealed formed surfaces, where possible, that contain defects that affect the durability of concrete. If defects cannot be repaired, remove and replace concrete.
- E. Repair of Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface plane to tolerances specified for each surface and finish. Correct low and high areas as herein specified. Test unformed surfaces sloped to drain for trueness of slope, in addition to smoothness, using a template having required slope.
- F. Repair finished unformed surfaces that contain defects, which affect durability of concrete. Surface defects, as such, include crazing, cracks in excess of 0.01" wide or which penetrate to reinforcement of width, spalling, pop-outs, honeycomb, rock pockets, and other objectionable conditions.
- G. Correct high areas in unformed surfaces by grinding, after concrete has cured at least 14 days.

- H. Correct low areas in unformed surfaces during, or immediately after completion of surface finishing operations by cutting out low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Proprietary patching compounds may be used when acceptable to Architect.
- I. Repair defective areas, except random cracks and single holes not exceeding 1" diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts and expose reinforcing steel with at least $\frac{3}{4}$ " clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding compound. Mix patching concrete of same material to provide concrete of same type or class as original concrete. Place, compact and finish to blend with adjacent finish concrete. Cure in same manner as adjacent concrete.
- J. Repair isolated random cracks and single holes not over 1" in diameter by dry-pack method. Groove top of cracks and cut-out holes to sound concrete and clean of dust, dirt and loose particles. Dampen cleaned concrete surfaces and apply bonding compound. Mix dry pack, consisting of one-part Portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing. Place dry pack after bonding compound has dried. Compact-dry-pack mixture in place and finish to match adjacent concrete. Keep patched area continuously moist for not less than 72 hours. Use epoxy-based mortar for structural repairs, where directed by the testing laboratory.
- K. Repair methods not specified above may be used, subject to acceptance of Architect.

3.8 CONCRETE CURING AND PROTECTION

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. 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 7 days. Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least 7 days in accordance with ACI 301 procedures. Avoid rapid drying at end of final curing period.
- B. Curing Methods: Perform curing of concrete by moist curing, by moisture-retaining cover curing, by curing compound, and by combinations thereof, as herein specified.
- C. Provide moisture curing by following methods:
 - 1. Keep concrete surface continuously wet by covering with water.
 - 2. Continuous water-fog spray.
 - 3. Covering concrete surface with specified absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4" lap over adjacent absorptive covers.
- D. Provide moisture-cover as follows:
 - 1. Cover concrete surfaces with moisture retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3" and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

- E. Provide curing compound to slabs as follows:
 - 1. Apply specified curing and sealing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours). Apply uniformly in continuous operation by power-spray or roller in accordance with manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - 2. Do not use membrane curing compounds on surfaces which are to be covered with coating material applied directly to concrete, liquid floor hardener, waterproofing, damp proofing, membrane roofing, flooring, painting, and other coatings and finish materials, unless otherwise acceptable to Architect.
- F. Curing Formed Surfaces: Cure formed concrete surfaces, by moist curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.
- G. Curing Unformed Surfaces: Cure unformed surfaces, such as slabs, floor topping, and other flat surfaces by application of appropriate curing compound. Final cure concrete surfaces to receive liquid floor hardener or finish flooring by use of moisture-retaining cover, unless otherwise directed.

3.09 MISCELLANEOUS

- A. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

END OF SECTION 32 13 73.19

SECTION 32 12 16
ASPHALTIC CONCRETE PAVEMENT

PART 1 – GENERAL**1.1 SECTION INCLUDES**

- A. Surface courses of compacted mixture of coarse and fine aggregates and asphaltic material.

1.2 MEASUREMENT AND PAYMENT

- A. Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in this Section is included in the total Stipulated Price.

1.3 REFERENCES

- A. ASTM C 33 - Standard Specification for Concrete Aggregates.
- B. ASTM C 131 - Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
- C. ASTM C 136 - Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
- D. TxDOT Tex-126-E - Molding, Testing, and Evaluation of Bituminous Black Base Material.
- E. TxDOT Tex-106-E - Method of Calculating the Plasticity Index of Soils.
- F. TxDOT Tex-203-F - Sand Equivalent Test.
- G. TxDOT Tex-204-F - Design of Bituminous Mixtures.
- H. TxDOT Tex-207-F - Determination of Density of Compacted Bituminous Mixtures.
- I. TxDOT Tex-208-F - Test for Stabilometer Value of Bituminous Mixtures.
- J. TxDOT Tex-217-F - Determination of Deleterious Material and Decantation Test for Coarse Aggregates.
- K. TxDOT Tex-227-F - Theoretical Maximum Specific Gravity of Bituminous Mixtures.

1.4 SUBMITTALS

- A. Submittals shall conform to requirements of TSUS Construction Project Division 1 Specifications.
- B. Submit certificates that asphaltic materials and aggregates meet requirements of Article 2.1, Materials, of this Section.
- C. Submit proposed design mix and test data for each type and strength of surface course in Work.
- D. Submit manufacturer's description and characteristics of mixing plant for approval.
- E. Submit manufacturer's description and characteristics of spreading and finishing machine for approval.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Coarse Aggregate

1. Gravel or crushed stone, or combination thereof, that is retained on No. 10 sieve, uniform in quality throughout and free from dirt, organic or other injurious matter occurring either free or as coating on aggregate. Aggregate shall conform to ASTM C 33 except for gradation. Furnish rock or gravel with Los Angeles abrasion loss not to exceed 40 percent by weight when tested in accordance with ASTM C 131.

B. Fine Aggregate

1. Sand or stone screenings or combination of both passing No. 10 sieve. Aggregate shall conform to ASTM C 33 except for gradation. Use sand composed of sound, durable stone particles free from loams or other injurious foreign matter. Furnish screenings of same or similar material as specified for coarse aggregate. Plasticity index of that part of fine aggregate passing No. 40 sieve shall be not more than 6 when tested by Tex-106-E. Sand equivalent shall have a minimum value of 45 when tested by Tex-203-F.

- C. Composite Aggregate:** Conform to following limits when graded in accordance with ASTM C 136.

GRADATION OF COMPOSITE AGGREGATE	
Sieve Size	Percent Passing
1/2"	100
3/8"	85 to 100
#4	50 to 70
#10	32 to 42
#40	11 to 26
#80	4 to 14
#200	1 to 6*
*2 to 8 when Test Method Tex-200-F, Part II (Washed Sieve Analysis) is used.	

- D. Asphaltic Material: Moisture-free homogeneous material which will not foam when heated to 347 degrees F, meeting following requirements:

VISCOSITY GRADE				
TEST	AC-10		AC-20	
	Min.	Max.	Min.	Max.
Viscosity, 140E F stokes	1000	± 200	2000	± 400
Viscosity, 275E F stokes	1.9	-	2.5	-
Penetration, 77E F, 100 g, 5 sec.	85	-	55	-
Flash Point, C.O.C., F.	450	-	450	-
Solubility in trichloroethylene, percent	99.0	-	99.0	-
Tests on residues from thin film oven tests:				
Viscosity, 140E F stokes	-	3000	-	6000
Ductility, 77E F, 5 cms per min., cms	70	-	50	-
Spot tests	Negative for all grades			

1. Material shall not be cracked.
2. Engineer will designate grade of asphalt to use after design tests have been made. Use only one grade of asphalt after grade is determined by test design for project.

2.2 EQUIPMENT

- A. Mixing Plant: Weight-batching or drum mix plant with capacity for producing continuously mixtures meeting specifications. Plant shall have satisfactory conveyors, power units, aggregate handling equipment, hot aggregate screens and bins, and dust collectors. Provide equipment to supply materials adequately in accordance with rated capacity of plant and produce finished material within specified tolerances. Following equipment is essential:
1. Cold aggregate bins and proportioning device.
 2. Dryer.
 3. Screens.
 4. Aggregate weight box and batching scales.
 5. Mixer.
 6. Asphalt storage and heating devices.
 7. Asphalt measuring devices.
 8. Truck scales.

- B. Bins: Separate aggregate into minimum of four bins to produce consistently uniform grading and asphalt content in completed mix.

2.3 MIXES

- A. Employ a certified testing laboratory to prepare design mixes. Test in accordance with Tex-126-E or Tex-204-F and Tex-208-F.

- B. Density and Stability Requirements:

Percent Density		Percent	HVEEM Stability Percent
<u>Min.</u>	<u>Max.</u>	<u>Optimum</u>	<u>Not Less Than</u>
94.5	97.5	96	35

- C. Proportions for Asphaltic Material: Provide 4 to 8 percent of mixture by weight. Aggregate by weight shall not contain more than 1.0 percent by weight of fine dust, clay-like particles, or silt when tested in accordance with Tex-217-F, Part II.

PART 3 – EXECUTION**3.1 EXAMINATION**

- A. Verify compacted base course is ready to support imposed loads.
- B. Verify lines and grades are correct.

3.2 PREPARATION

- A. Prime Coat: Do not apply a tack coat until primed base has cured to satisfaction of Engineer.
- B. Tack Coat: Where the mixture will adhere to the surface on which it is to be placed without use of a tack coat, tack coat may be eliminated if approved by Engineer.
- C. Prepare subgrade in advance of asphaltic concrete paving operation.

3.3 PLACEMENT

- A. Do not place asphaltic mixture when air temperature is below 50 degrees F and falling. Mixture may be placed when air temperature taken in shade and away from artificial heat is above 40 degrees F and rising.
- B. Haul prepared and heated asphaltic concrete mixture to the project in tight vehicles previously cleaned of foreign material. Mixture shall be at temperature between 250 degrees F and 325 degrees F when laid.
- C. Spread material into place with approved mechanical spreading and finishing machine of screening or tamping type. Use track-mounted finish machine to place base course directly on earth subgrade.
- D. Surface Course Material: Surface course 2 inches or less in thickness may be spread in one lift. Spread lifts in such manner that, when compacted, finished course will be smooth, of uniform density, and will be to section, line and grade as shown. Place construction joints on surface courses to coincide with lane lines or as directed by Engineer.

- E. Place courses as nearly continuously as possible. Pass roller over unprotected ends of freshly laid mixture only when mixture has cooled. When work is resumed, cut back laid material to produce slightly beveled edge for full thickness of course. Remove old material which has been cut away and lay new mix against fresh cut.
- F. When new asphalt is laid against existing or old asphalt, existing or old asphalt shall be saw cut full depth to provide straight smooth joint.
- G. In restricted areas where use of paver is impractical, spread and finish asphalt by mechanical compactor. Use wood or steel forms, rigidly supported to assure correct grade and cross section. Carefully place materials to avoid segregation of mix. Do not broadcast material. Remove any lumps that do not break down readily. Place asphalt courses in same sequence as if placed by machine.

3.4 COMPACTION

- A. Begin rolling while pavement is still hot and as soon as it will bear roller without undue displacement or hair cracking. Keep wheels properly moistened with water to prevent adhesion of surface mixture. Do not use excessive water.
- B. Compress surface thoroughly and uniformly, first with power-driven, 3-wheel, or tandem rollers weighing from 8 to 10 tons. Obtain subsequent compression by starting at side and rolling longitudinally toward center of pavement, overlapping on successive trips by at least one-half width of rear wheels. Make alternate trips slightly different in length. Continue rolling until no further compression can be obtained and rolling marks are eliminated. Complete rolling before mixture temperature drops below 175 degrees F.
- C. Use tandem roller for final rolling. Double coverage with approved pneumatic roller on asphaltic concrete surface is acceptable after flat wheel and tandem rolling has been completed.
- D. Along walls, curbs, headers and similar structures, and in locations not accessible to rollers, compact mixture thoroughly with lightly oiled tamps.
- E. Compact binder course and surface course to density not less than 93 percent of the maximum possible density of voidless mixture composed of same materials in like proportions.

3.5 TOLERANCES

- A. Furnish templates for checking surface in finished sections. Maximum deflection of templates, when supported at center, shall not exceed 1/8 inch.
- B. Completed surface, when tested with 10-foot straightedge laid parallel to center line of pavement, shall show no deviation in excess of 1/8 inch in 10 feet. Correct any surface not meeting this requirement.

3.6 FIELD QUALITY CONTROL

- A. Testing will be performed under provisions of applicable TSUS Construction Project Division 01 Specifications
- B. Minimum of one core will be taken at random locations per 1000 feet per lane of roadway or 500 square yards of base to determine in-place depth and density.

ASPHALTIC CONCRETE PAVEMENT

SECTION 32 12 16

- C. In-place density will be determined in accordance with Tex-207-F and Tex-227-F from cores or sections. Other methods of determining in-place density, which correlate satisfactorily with results obtained from roadway specimens, may be used when approved by Engineer.
- D. Contractor may, at his own expense, request three additional cores in vicinity of cores indicating nonconforming in-place depths. In-place depth at these locations shall be average depth of four cores.
- E. Fill cores and density test sections with new compacted asphaltic concrete.

3.7 NONCONFORMING PAVEMENT

- A. Recompact pavement sections not meeting specified densities or replace them with new asphaltic concrete material. Replace with new material sections of surface course pavement not meeting surface test requirements or having unacceptable surface texture. Patch asphalt pavement sections in accordance with procedures established by Asphalt Institute.
- B. Remove and replace areas of asphalt found deficient in thickness by more than 10 percent. Use new asphaltic base of thickness shown on Drawings.
- C. Replace nonconforming pavement sections.

3.8 UNIT PRICE ADJUSTMENT

- A. Unit price adjustments shall be made for in-place depth determined by cores as follows:
 - 1. Adjusted Unit Price shall be ratio of average thickness as determined by cores to thickness bid upon, times unit price bid.
 - 2. Adjustment shall apply to lower limit of 90 percent and upper limit of 105 percent of unit price.
 - 3. Average depth below 90 percent may be rejected by Engineer.

3.9 PROTECTION

- A. Do not open pavement to traffic until 12 hours after completion of rolling, or as shown on Drawings.
- B. Maintain asphaltic concrete pavement in good condition until completion of Work.
- C. Repair defects immediately by replacing asphaltic concrete pavement to full depth.

END OF SECTION 32 12 16

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.
 - b. Item 360, CONCRETE PAVEMENT.
- B. Formwork Tolerances
 - 1. Formwork tolerances shall be as specified in ACI 316 R, Chapter 5.
- C. Finishing Tolerance
 - 1. 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.
 - 1. 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

1. Metal forms, as indicated in ACI 316 R, Chapter 5.

B. Welded Steel Wire Fabric

1. Plain wire fabric, as specified in Section 032100 - Concrete Reinforcement of these Specifications.

C. Reinforcing Steel Bars

1. As specified in Section 032100 - Concrete Reinforcement of these Specifications.

D. Dowel Bars

1. 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

1. 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

1. As specified in Section 321373.19 – Cast-in-Place Concrete of these Specifications.

G. Membrane Forming Curing Compound

1. 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

1. 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

1. 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
1. 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

1. 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

1. 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

2. 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 PAVING 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 TSUS Construction Project Division 1 Specifications 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 01.
- 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 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.
- B. Use recycled rubber for expansion joints.

2.3 JOINT SEALING COMPOUND

- A. Conform joint sealants to one of sealant classes described in this section.
- B. For recycled rubber expansion joints: provide a bond breaker tape between sealant and rubber expansion joint spacer.
- C. Conform hot-poured rubber-asphalt compound to ASTM D 3405.
- D. 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

4. 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.
 5. Provide cold-extruded type for vertical or sloping joints.
 6. Provide self-leveling type for horizontal joints.
- E. 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.
1. 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) * 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. Provide smooth dowel transfers with joint plates.
- 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.
- B. The dowels at expansion joints should be placed at 12-inch centers and consist of the following:
 - 1) 5-inch concrete pavement
 - a. 5/8-inch diameter, 12-inches long with 5-inch embedment.
 - 2) 6-inch concrete pavement
 - a. 3/4-inch diameter, 14-inches long with 6-inch embedment.
 - 3) 7-inch concrete pavement
 - a. 7/8-inch diameter, 14-inches long with 6-inch embedment.

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.
- B. Provide a maximum control joint spacing of 12.5 feet for 5-inch pavements and a maximum control joint spacing of 15 feet for 6-inch or thicker pavements.

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

- A. Seal joints only when surface and joints are dry, ambient temperature is above 50 degrees F and less than 85 degrees F and weather is not foggy or rainy.
- B. Use joint sealing equipment in like new working condition throughout joint sealing operation and be approved by 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.
- C. Clean joints of loose scale, dirt, dust and curing compound. The term joint includes wide joint spaces, expansion joints, dummy groove joints or cracks, either preformed or natural. Remove loose material from concrete surfaces adjacent to joints.
- D. Fill joints neatly with joint sealer to depth shown. Pour sufficient joint sealer into joints so that, upon completion, surface of sealer within joint will be 1/4 inch above level of adjacent surface or at elevation as directed.

3.11 PROTECTION

- A. Maintain joints in good condition until completion of Work.
- B. Replace damaged joints material with new material as required by this Section.

END OF SECTION 32 13 19

SECTION 32 13 73.19
SITWORK CAST-IN-PLACE CONCRETE

PART 1 – GENERAL**1.1 DESCRIPTION**

- A. This Section includes furnishing materials and installation of cast-in-place concrete as indicated on the Drawings and/or specified herein.
- B. Full cooperation shall be given to other trades to install embedded items. Suitable templates insert and sleeves shall be provided for setting items not placed in the forms.
- C. All concrete work shall conform to the requirements of ACI 318-95 and CRSI Standards, unless specifically noted otherwise.

1.2 QUALITY ASSURANCE

- A. Prior to starting concrete operations, the Contractor shall name his source of supply for concrete materials and shall submit representative samples and reports of quality tests for approval.
- B. The Owner will engage the services of a recognized independent testing laboratory to perform the following services, (in accordance with ASTM E 329-77):
 - 1. Design the concrete mixtures specified, make quality tests of materials, inspect the proportioning and mixing of all concrete for this project.
 - 2. Slump Test, ASTM C-143, shall be taken as often as required to provide the specified consistency to concrete.
 - 3. Cast and test of at least 6 cylinders for each day's pour or for each 100 cubic yards or fraction thereof. Cylinders shall be cured and tested in accordance with ASTM specifications for control tests. Cylinders shall be tested at 7 and 28 days. The Contractor shall provide insulated storage room with heat when necessary to store control cylinders, and a protected, fenced-in space for storage of field cylinders, which approximates the condition of curing of the concrete being sampled.
- C. In the event that concrete fails to meet strength requirements of these Specifications, the Engineer may require at no additional cost to the Owner, tests in accordance with the "Standard Methods of Securing, Preparing and Testing Specimens of Hardened Concrete for Compressive and Flexural Strengths", ASTM C42, or order load tests in accordance with Chapter 20 of the ACI Building Code 318-95, to be made on the portions of the structure containing questionable concrete. Suitable appliances and methods of loading and measuring shall be provided by the Contractor. The portions of the structure which are found by the Architect/Engineer to contain defective concrete shall be removed and reconstructed in a satisfactory manner at the Contractor's expense. Concrete strength tests are to conform to Chapter 4 of the ACI Building Code 318-95.
- D. The laboratory shall have free access to material stockpiles, batching and mixing plants, and job site. The Contractor shall provide adequate assistance to the laboratory in securing specified samples for tests.

**SECTION 32 84 00
LANDSCAPE IRRIGATION SYSTEM**

PART 1 GENERAL

1.01 SCOPE OF THE WORK

- A. Work Included: Perform all work necessary and required for construction of the project as indicated. Such work includes but is not limited to the following:
 - 1. Furnishing and installing a complete irrigation system for the landscape portion of the project from a new municipal water source and meter; backflow preventer, isolation valve, master valve, flow meter, electric valves, irrigation bodies, heads and nozzles, wiring, controller and rain sensor and all related pipe and joints for a 2-wire system.
 - 2. Contractor is responsible for all registrations, inspections, licenses, permits and fees to complete the irrigation system.
 - 3. Furnish and install the controller and rain sensor.
 - 4. Furnish and install backflow prevention device, insulation and protective vandal cover.
 - 5. Furnishing and installing schedule 40 P.V.C. sleeves.
 - 6. Sprinkler lines shown on the drawings are diagrammatic. Existing conditions may require minor adjustments.
 - 7. Coordination with electrical power and related equipment for controller power circuit breaker.
 - 8. Coordinate controller connection and verify proper connection
- B. Related Work in Other Sections but not limited to:
 - 1. Section 32 91 00 Topsoil
 - 2. Section 32 90 00 Landscape Planting

1.02 QUALITY ASSURANCE

- A. Contractor to attend a pre-installation meeting and participate in installation meetings with Owner's Representative.
- B. Contractor shall continuously maintain a competent superintendent, satisfactory to the District with the authority to act for him in all matters pertaining to the work and in compliance with supervisory rules established by TCEQ.
- C. The Contractor shall have a minimum of 5 years experience installing irrigation systems of comparable size, specialty and complexity and have suitable financial means to meet the responsibilities and obligations of this project.

1.03 SUBMITTALS

- A. At minimum of 14 days prior to beginning work, submit for approval items from the materials list and plan legend; including manufacturer's catalog cuts, specifications, but NOT operating instructions.
- B. At a minimum include, valves of all types, sprinklers, swing joints, nozzles, controller, rain sensor, wire and wire connectors, pipe, fittings, valve boxes, glues and primer, etc. Quantities of materials and equipment need not be included.
- C. Name and Irrigation License number for Irrigation Contractor.

1.04 INSPECTION OF CONDITIONS

Examine related work and surfaces before starting work of this Section. Report to the Landscape Architect, in writing, conditions which will prevent the proper provision of this work. 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 to be done at no additional cost by Owner.

1.05 "AS-BUILT" IRRIGATION DRAWINGS

- A. Contractor shall furnish Record Drawings of the complete irrigation system in accordance with the General and Special Conditions. 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. The drawings shall be to scale and show irrigation meter with meter number, actual location of all valve types (zone, quick coupler, isolation, etc), controller and rain sensor, all irrigation piping and shall be shown on the prints by dimensions from easily identified permanent features, such as buildings, curbs, fences, walks or property lines and legend. Drawings shall show approved substitutions, if any, of material including manufacturer's name and catalog number. All information noted on the print shall be transferred to the plan by Contractor and all indications shall be recorded in a neat, orderly way. The record plan shall be turned over to the Owner at or before the Final Acceptance of the project and as part of the close-out documents.

1.06 CODES, RULES AND SAFETY ORDERS AND STANDARDS

- A. All work and materials to be in full accordance with latest rules and regulations of safety orders of the Division of Industrial Safety; the Uniform Plumbing Code published by the Western Plumbing Officials' Association; and other applicable laws of regulations, including Waller County and the City of Waller Plumbing Code and TCEQ. Nothing in these drawings or specifications is to be construed to permit work not conforming to these codes. Should the Construction Documents, or instructions, be at odds with the aforementioned rules and regulations, notify Landscape Architect and get his instructions before proceeding with the work affected.
- B. Furnish and maintain all warning signs, shoring, barricades, red lanterns, etc., as required by the Safety Orders of the Division of Industrial and local ordinances.
- C. Requirements of GENERAL CONDITIONS, and DIVISION NO. 1 apply to all work in this section.
 - 1. Published specifications, standards, tests or recommended methods of trade, industry, or governmental organizations apply to work of this section where cited abbreviations noted below.

American Society of Testing Materials (ASTM).

1.07 INTENT OF THE DRAWINGS

- A. Due to the scale of drawings, it is not possible to indicate all offsets, fittings, sleeves, etc., which may be required. The Contractor shall carefully investigate the structural and finished conditions affecting all of his work and plan his work accordingly, furnishing such fittings, etc., as may be required to meet such conditions. Drawings are generally diagrammatic and indicative of the work to be installed. The work shall be installed in such a manner as to avoid conflicts between irrigation systems, planting, civil structures and architectural features.
- B. The word Architect or Engineer as used herein shall refer to the Owner's authorized representative or the Landscape Architect.
- C. All work called for on the drawings by notes or details shall be furnished and installed whether or not specifically mentioned in the specifications.
- D. Existing trees to remain are indicated on drawings. Irrigation lines are diagrammatic and drawn for clarity. Avoid existing trees to main with trenching and then only when unavoidable, hand trench within the drip line of all existing trees to remain.
- E. The Contractor shall not willfully install the irrigation system as shown on the drawings when it is obvious in the field that obstructions, grade differences or discrepancies in area dimensions exist that might not have been considered in engineering. Such obstructions or differences should be brought to

the attention of the Owner's authorized representative. In the event this notification is not performed, the irrigation contractor shall assume full responsibility for any revisions necessary.

1.08 PERMITS AND FEES

- A. Obtain all permits and pay required fees to any governmental agency having jurisdiction over the work. Arrange inspections required by local agencies and ordinances during the course of construction as required.
- B. Contractor is responsible for all registrations, inspections, licenses, permits and fees to complete the irrigation system.
- C. Failure to obtain reviews may require contractor to re-excavate system at his expense.

1.09 APPROVAL

- A. Wherever the terms "approve", "approval", or "approved" are used in the Specifications, they mean review by Landscape Architect or District Project Manager in writing.

1.10 WORK SCHEDULE

- A. Submit a proposed work schedule to Landscape Architect at least 10 days prior to start of work under this Section. After approval, no modification shall be made to this schedule without written authorization by Landscape Architect.

1.11 SUBSTITUTIONS

- A. No substitutions without written approval of the Landscape Architect prior to bidding.
- B. Installation of any approved substitution is Contractor's responsibility. Any changes required for installation of any approved substitution must be made to the satisfaction of Landscape Architect and without additional cost to Owner. Any substitution of materials shall be submitted two days prior to bid date in writing, complete with spec sheets to Landscape Architect.
- C. Approval by Landscape Architect of substituted equipment and /or dimensional drawings does not waive these requirements.

1.12 PROTECTION OF EXISTING CONDITIONS

- A. Contractor shall acquaint himself with all site conditions. Should utilities or other work not shown on the plans be found during excavations, Contractor shall promptly notify Architect for instructions as to further action. Failure to do so will make Contractor liable for any and all damage thereto arising from his operations subsequent to discovery of such utilities not shown on plans.
- B. Contractor shall take necessary precautions to protect site conditions and plants to remain. Should damage be incurred this Contractor shall repair damage to its original condition or furnish and install equal replacement at his expense.

1.13 COORDINATION

- A. Coordinate and cooperate with other Contractors to enable the work to proceed as rapidly and efficiently as possible.

1.14 PRODUCT HANDLING, DELIVERY AND STORAGE

- A. Deliver irrigation system components in manufacturer's original undamaged and unopened containers with labels intact and legible.
- B. Deliver plastic pipe in bundles, packaged to provide adequate protection of pipe ends either threaded, bell or plain.
- C. Store and handle material to prevent damage and deterioration.

- D. Protect work and materials under this Section from damage during construction and storage. Protect polyvinyl chloride (PVC) pipe and fittings from direct sunlight. Do not use any pipe or fitting that has been damaged or dented.

1.15 SAMPLES

- A. Landscape Architect reserves the right to take and analyze samples of materials for conformity to specifications at any time. Contractor shall furnish samples upon request by Landscape Architect. Rejected materials shall be immediately removed from the site and replaced at Contractor's expense. Cost of materials not meeting specifications shall be paid by Contractor.

1.16 INSPECTION

- A. Submit written requests for inspection to Landscape Architect at least 5 days prior to anticipated inspection.
- B. Preliminary review of completed installation will be made by Landscape Architect prior to back filling of trenches and during hydrostatic testing.
- C. Work may be periodically observed throughout installation. Impromptu reviews may occur at any time during the project.
- D. Final review shall be made in conjunction with the final review of lawn, shrub and tree planting.

PART 2 – MATERIALS

2.01 GENERAL

- A. Materials throughout the system shall be new and in perfect condition and the best of their kind and class. Any material overages at the completion of the installation are the property of the Contractor and are to be removed from the site.
- B. Each major component of equipment shall have the manufacturer's name and serial number permanently attached.
- C. The same manufacturer shall be used for each specific application of valves, fittings, heads, etc.
- D. All equipment shall be listed approved or rated by a nationally recognized testing and rating bureau of recognized manufacturer's association responsible for setting industry standards. All electrical equipment shall be U.L. listed.

2.02 SLEEVING

- A. Install sleeves beneath paved areas for irrigation pipe and wiring bundle.
- B. All sleeving to be Sch 40 pipe.
- C. Sleeving diameter: 6" PVC Sch 40. Minimum wire sleeve size to be 2" unless indicated otherwise.
- D. All pipe in sleeve to be glued.

2.03 WATER SOURCE

- A. Water source is a municipal water line, see civil plans to tap location.
- B. Install new irrigation dedicated water meter.

2.04 BACKFLOW PREVENTION ASSEMBLY with protective fiberglass box

- A. Install as shown on drawings and details.
- B. Locations shown on drawings.

2.05 PIPE

- A. All piping mainline:
 - 1. Three inch diameter and smaller to be polyvinyl chloride (PVC), Schedule 40 and shall conform to ASTM D 1784 and D2466.

- 2. Use solvent weld pipe for mainline.
- B. All laterals:
 - 1. Polyvinyl chloride (PVC) 1120-1220, SDR 21.0 Class 200 and shall conform to ASTM 2241-73 except ½ inch shall be class 315.
 - 2. Bell ended pipe preferred.
- C. Identification: All piping shall be continuously and permanently marked with the following:
 - 1. Manufacturer's name or trademark, size, schedule, and type of pipe, working pressure at 73 degrees F. and National Sanitation Foundation approval.
- D. Provide pipe homogeneous throughout and free from visible cracks, holes, foreign materials, blisters, wrinkles and dents.
- E. Pipe sizes referenced in the construction documents are minimum sizes and may be increased at the option of the Contractor at no cost to the Owner.
- F. All pipe damaged or rejected because of defects shall be removed from the site at the time of rejection.

2.06 FITTINGS

- A. All threaded fittings shall be Sch 80 PCV pipe.
- B. Use only Teflon type tape on plastic threads.
- C. Fittings for Swing Joints:
 - 1. Shall be three street ells and rigid Schedule 80 PVC threaded as manufactured by Lasco or Spears and shall conform to ASTM 2287.

2.07 THRUST BLOCKS - NA

- A. Use thrust blocks for fitting on pipe utilizing rubber gasket pipe or 3" dia PVC and larger.
- B. Use 3,000 PSI concrete
- C. Use 2-mil plastic to encapsulate the fitting or valve.
- D. Size thrust blocks per piping manufacturer's recommendations for pipe size and soil type.

2.08 ISOLATION VALVES

- A. NIBCO bronze ball valve, threaded, two-piece, full port, bronze trim, blowout proof stem. T-585-70-SSHN (1/2"-2") and T-580-70-SSHN (2 ½" – 3").
- B. Install in a separate rectangular valve box.

2.09 ELECTRIC CONTROL VALVES

- A. All parts shall be serviceable without removing valve from line. A minimum of 18" of pipes between zone valve and the next fitting on either side of zone valve.
- B. Valve shall be held normally closed by internal pressure with manual bleed screw.
- C. Remote control valves as shown on drawing legend and details.
- D. Valve markers / id tags to be used. Write zone location number for each zone valve on inside of box cover lid with permanent marker.

2.10 QUICK-COUPLING VALVES

- A. Valve to be as shown on drawing legend and details with "O-Ring" style swing joint installed in valve box.
- B. PVC S-80 double swing joint with rebar
- C. Ball valve (PVC) – line size between mainline and QCV.
- D. Furnish two valve keys fitted with swivel hose ells matching what is installed.

2.11 MASTER VALVE /FLOW SENSOR

- A. As indicated in Legend

2.12 IRRIGATION CONTROLLER & RAIN SENSOR

- A. As shown on drawing legend and details.
- B. The rain sensor shall be mounted in a location that will be vandal resistant and is able to gather the necessary data without interference. Coordinate with Owner and Project Manager prior to mounting.

2.13 CONTROL WIRE

- A. Wire: Use American Wire Gauge (AWG). Solid copper wire, U.L. approved for direct burial in ground. Minimum gauge: #14. #12 UF for runs over 1000 lf. Common ground wire shall be white. Jacketed pair wire approved wire for 2 wire system (when 2 wire system specified).
- B. Splicing Materials: 3M-DBR/Y-6 wire connector with waterproof sealant. Wire connector to be of plastic construction.
- C. Color: Each wire color shall be continuous over its entire length.
- D. Wire markers: pre-numbered or labeled with indelible non-fading ink made of permanent non-fading material.
- E. 120 volt power supply for controller shall be furnished to controller location by the Electrical Contractor.

2.14 POWER WIRE

- A. Electric wire from the power source to the controller shall be solid or stranded copper. Type UF single conductor cable, UL approved for direct underground burial. Power wires shall be black, white and green in color.
- B. Conduit: PVC Sch 40
- C. Splices: Use approved connectors.
- D. Follow all local and state codes.

2.15 VALVE BOXES

- A. For Valves :
 - 1. Electric and Gate valves: Valve boxes shall be heavy duty plastic 14" inch by 19" inch by 12 inch depth (with extensions as needed), black with black or green cover. Valve box shall be Carson Series 1419, flush solid, with bolt down feature or RainBird Professional Series.
 - 2. Quick coupler valves: Valve boxes shall be heavy duty plastic 14" inch by 19" inch by 12 inch depth (with extensions as needed), purple with purple cover per TCEQ. Valve box shall be Carson Series 1419, flush solid, with bolt down feature or RainBird Professional Series.
- B. Splice boxes:
 - 1. Control wire splice boxes shall be heavy duty plastic 10" inch diameter by 10" inch or 18" inch deep, black with black or green T cover solid and bolt down feature, Carson Series 910 or RainBird

2.16 SWING JOINTS

- A. Swing joint shall be 4 fitting swivel ells on both ends; 6" and 12" lengths with ½" and ¾" threads and pressure rated to 150PSI with a 2 yr warranty by Hunter or approved equal.

2.17 SPRINKLER HEADS

- A. Sprinkler heads mounted on pre-assembled swing joints.
- B. Contractor to provide Owner with two extra sprinkler heads and nozzles of each type specified and used.
- C. Heads to be shown in drawing legend and details.

2.18 DRIPPER TUBING and ASSEMBLY -NA

- A. Operation Indicator – pop-up head
- B. Tubing – to be a manufactured product as specified per legend
- C. Dripper Control Zone valve with air relief – per legend

2.19 BACKFILL

Provide imported bank sand for backfill to complete work. Sand shall be clean sand free of stones or debris. Sand placed a minimum of 6" inches directly around pipe in trench.

2.20 GLUE

A two step process, use primer and solvent cement to conform to ASTM Standard D2564. Christy's purple primer and red hot blue glue or approved equal.

PART 3 – EXECUTION

3.01 INSPECTION AND REVIEWS

- A. Site
 - 1. The Contractor acknowledges that he has examined the site, plans and specifications and the submission of a bid/proposal shall be considered evidence that examination has been made.
 - 2. Verify construction site conditions and note irregularities affecting work of this section. It shall be the contracting installer's responsibility to report to the Owner's authorized representative any deviations between drawings, specifications and the site. Failure to do before the installing of equipment and resulting replacing and/or relocation of equipment shall be done at the Contractors expense.
- B. Utility Locations
 - 1. The exact location of all existing utilities and structures and underground utilities are not indicated on the drawings. Their locations shall be determined by the Contractor; by utility marking services and consulting Civil, Architectural and MEP plans as required.
 - 2. Arrange for and coordinate with local authorities the location of all underground utilities.
 - 3. Repair any underground utilities damaged during construction. Make repairs at no additional expense to the Owner.
 - 4. The Contractor shall protect existing structures, plants, trees, utility services and be responsible for their replacement if damaged.
- C. Pre-Construction Meeting
 - 1. During the Pre-Con meeting, Contractor shall call attention to any issues he has discovered.
 - 2. The Owner and his representatives shall address questions so all parties are aware of issues, solutions and coordination involving other trades.

3.02 LAYOUT

- A. Layout work as accurately as possible to drawings. Drawings are diagrammatic to the extent that swing joints, offsets and all fittings are not shown.
- B. Install all mainline pipe and components inside of property lines.
- C. Full and complete coverage is required. Contractor shall make any necessary minor adjustments to layout required to achieve full coverage of irrigated areas at no additional cost to Owner.
- D. Where connections to existing stubouts are required, make necessary adjustments in layout to connect should stubs not be located exactly as shown. Adjust layout as necessary to install around existing work.
- E. Where piping is shown to be under paved areas but running parallel and adjacent to planting area, intention is to install piping in planted areas. Do not install directly over another line in same trench or through root ball area of trees.
- F. 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 damage or rejected because of defects shall be removed from the site at the time of said rejection.

3.03 EXCAVATING AND TRENCHING

- A. Perform all excavations as required to installation of work included under this Section, including shoring of earth banks, if necessary. Restore all surfaces, existing underground installation, etc., damaged or cut as a result of the excavations, to their original condition.
- B. Should utilities not shown on the plans be found during excavations, Contractor shall promptly notify Architect for instructions as to further action. Failure to do so will make Contractor liable for any and all damage thereto arising from his operations subsequent to discovery of such utilities. Indicate such utility crossings on the Record Drawings promptly.
- C. Trenches shall be of sufficient depth to provide minimum cover from finish grade as follows:
 - 1. Over PVC pipe on pressure side of irrigation control valve, control wires and quick-coupling valves: 18 in.
 - 2. Over pipe on non-pressure side of irrigation control valve: 12 in.
 - 3. Over control wire (in conduit): 10 in. unless local or state requirements dictate a deeper burial depth.
 - 4. All PVC pipe under paving shall be bedded with minimum of 6 in. of sand backfill on all sides and have 24 in. cover.
- D. Backfill only after lines have been reviewed.

3.04 BORING UNDER EXISTING PAVEMENTS

- A. The boring shall proceed from a pit provided for the boring equipment and workmen. Excavation for pits and installation shall be as described under "Excavation and Trenching." The location of the pit shall not interfere with existing plant materials or structures to remain.
- B. Holes shall be bored mechanically. Where holes required are larger than two inches, the bore shall be completed using a pilot hole. The two inch hole shall be bored the entire length of the crossing and shall be checked on the opposite end for line and grade. If acceptable, this hole shall serve as the centerline for the larger hole to be bored. Lateral and vertical tolerance is limited to one inch in ten feet, provided that the variation be regular and occur in only one direction.
- C. The use of water or other fluids in connection with the boring operation will be permitted only to lubricate cutting. Jetting shall not be permitted. (In unconsolidated soil formations, a gel-forming colloidal drilling fluid consisting of at least 10% of high-grade processed bentonite may be used to consolidate cuttings, seal the hole walls and furnish lubrication for subsequent removal of cuttings and installation of the pipe.
- D. Excavation material will be placed near the top of the working pit and disposed of as required.

3.05 WATER METER INSTALLATION

- A. New irrigation meter to be utilized. See Civil for water tap area. Coordinate with MUD District or City or County for their preferred municipal irrigation meter and installation specifics.

3.06 BACKFLOW PREVENTION DEVICE INSTALLATION

- A. Install according to local code, TCEQ and manufacturer's instructions and details.
- B. Secure upright pipes so unit does not wiggle.
- C. Isolation valve to be installed between meter and BFP and no more than 48" from BFP.
- D. Insulate backflow preventer

3.07 CONDUITS AND SLEEVES

- A. Furnish and install conduit where control wires pass under or through walls. Conduits to be of adequate size to accommodate retrieval for repair of wiring and shall extend 12 in. beyond edge of walls.
- B. Install sleeves for all pipes passing through of under walls and as shown on drawings. Install sleeves under walks, paving, etc. as required to facilitate a smooth construction sequence. Mark sleeve locations with a large X in wet concrete or set hex nut at sleeve location. Sleeving to be of adequate size to accommodate retrieval for repair of wiring or piping and shall extend 12" beyond edge of paving or other construction.
- C. Coordinate conduit and sleeve installation with other trades as required.

3.08 PIPE LINE ASSEMBLY

- A. Install pipe in accordance with manufacturer's instructions.
- B. Clean all pipes and fittings of dirt, scales and moisture before assembly. Bevel all pipe cuts.
- C. All pipe, fittings and valves, etc., shall be carefully placed in the trenches. Interior of pipes shall be kept free from dirt and debris and when pipe laying is not in progress, open ends of pipe shall be capped.
- D. 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 top of the line shall be allowed.
- E. Solvent weld PVC pipe and fittings using solvents and methods recommended by manufacturer. Clean pipe and fittings of dirt and moisture before assembly. Use a primer and solvent cement. PVC pipe may be assembled on ground surface beside bottom to allow for expansion and contraction. Make all connections between PVC pipe and metal valves or pipe with threaded fittings using PVC male adapters. Cure joint a minimum of one hour before applying any external stress on the piping and at least twenty-four hours before placing the joint under water pressure.
- F. Threaded pipe shall be factory formed threads. Use Teflon tape on threaded PVC fittings.
- G. Laying of pipe :
 - 1. Pipes shall be bedded in at least 6" inches of bank sand prior to backfilling trench with native earth; standard trench width, 2" sand bed at bottom of trench, irrigation pipe, 4" sand on top of pipe, then native backfill.
 - 2. Pipe shall be snaked from side to side of trench bottom to allow for expansion and contraction. One additional foot per 100 feet of pipe is the minimum allowance for snaking.
 - 3. Do not lay PVC pipe when there is water in the trench.
 - 4. Plastic pipe shall be installed in a manner so as to provide for expansion and contraction as recommended by the manufacturer.
 - 5. Plastic pipe shall be cut with PVC pipe cutter or hacksaw, or in a manner so as to ensure a square cut. Bevel ends so that smooth unobstructed flow will be obtained.
 - 6. All plastic to plastic joints shall be solvent-weld joints or slip seal joints. Only the solvent recommended by the pipe manufacturer shall be used. All plastic pipe fittings shall be installed as outlined and instructed by the pipe manufacturer and it shall be the Contractor's responsibility to make arrangements with the pipe manufacturer for any field assistance that may be necessary. The Contractor shall assume full responsibility for the correct installation.

3.09 ISOLATION VALVES

- A. Install in rectangular valve box. Box lid to be flush with finish grade. Valve shall be at lateral line depth.
- B. Follow manufacturer's recommendations for installation.

3.10 IRRIGATION CONTROL VALVES

- A. Flush mainline before installation of electric valve.
- B. Install control valves in valve boxes. Place no closer than 12 in. to walk edges, buildings and walls. Valve box lids shall be flush with finish grade.
- C. Wire connectors and waterproof sealant shall be used to connect control wires to remote control valve wire. Install connectors and sealant per manufacturer's recommendations.
- D. One valve per box. Allow at least 12 inches between valve boxes.
- E. Attach ID tag with controller station number to control wiring.

3.11 SPRINKLER HEADS

- A. Flush lateral lines before installing sprinkler heads.
- B. Shrubs, lawn and rotary heads shall be set plumb, with top of head no more than ½ inch above proposed finish grade.
- C. Install proper nozzle model from series to obtain the pattern and coverage required as recommended by the manufacturer and to irrigate areas indicated on the drawings.

- D. Locate sprinkler head 4" inches off adjacent pavement, fences, walls or building.
- E. Extra Parts:
 - 1. Provide 2 extra heads of each size and type used.
 - 2. Provide 2 wrenches for each type of head core and 2 for removing and installing each type of head.

3.12 QUICK COUPLING VALVES

- A. Quick coupling valves to be installed on a swing joint assembly.
- B. Installed with in-line PVC ball valve per TCEQ requirements and details.
- C. Purple valve box lid for this assembly.

3.13 AUTOMATIC CONTROLLER

- A. Location of controller is approximate. Consult with Owner's representative for the exact location of each controller and rain sensor.
- B. Attach wire markers to the ends of the control wires inside the controller unit housing. Label wires with the ID numbers of the remote control valve to which the control wire corresponds.
- C. Install per local code and manufacturer's instructions.
- D. Connect remote control valves to controller in clockwise sequence to correspond with station setting beginning with Stations 1, 2, 3, etc.
- E. Affix controller name (i.e., "Controller A") on inside of controller cabinet door with letters minimum of 1 in. high. Affix a nonfading copy of irrigation diagram to cabinet door or below controller door. Irrigation diagram to be laminated. (Irrigation diagram shall be a reduced copy of the as-built drawing and shall show clearly all valves operated by the controller, showing station number, valve size and type of planting irrigated.)

3.14 CONTROL WIRING

- A. Install control wires with sprinkler mains and laterals in common trenches wherever possible. Lay to the side of pipeline. Provide looped slack at valves and snake wires in trench to allow for contraction of wires. Tie wires in bundles at 20 ft. intervals.
- 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 500 ft. Line splices to be taped and sealed with sealer. Place in separate valve box.
- C. Provide a 24" inch excess length of wire in an 8" inch diameter loop at each to degree change of direction and at 100' foot intervals along continuous runs of wiring.

3.15 CLOSING OF PIPE AND FLUSHING OF LINES

- A. Cap or plug all openings as soon as lines have been installed to prevent entrance of materials that would obstruct the pipe. Leave in place until removal is necessary for completion of installation.
- B. Thoroughly flush out all water lines before installing heads, valves or other hydrants.
- C. Test as specified.
- D. Upon completion of testing, complete assembly and adjust sprinkler heads for proper distribution.
- E. All sprinkler heads and quick coupling valves shall be set perpendicular to finished grades 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. Sprinkler heads which are to be installed in lawn areas where the turf has not yet been established shall be set 1/2 inch above the proposed finish grade. 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 this Contractor with no additional cost to the Owner.

3.16 TESTING

- A. Make hydrostatic tests when welded PVC joints have cured as per manufacturer's instructions.
 - 1. Pressurized Mains:
 - a. Completely install water meter mains, isolation valves and control valves. Do not install laterals.

- b. Open all isolation valves
 - c. Fill lines with water and shut off meter
 - d. Pressurize the main with air to 70 psi. Monitor gauge for pressure loss for four hours. Maximum pressure loss shall be 3 psi in four hours.
 - e. Leave lines and fittings exposed throughout testing period.
 - f. Leaks resulting from tests shall be repaired and tests repeated until the system passes.
 - g. Test all isolation valves for leakage.
- 2. Non-pressure Laterals:
 - a. Test piping after laterals and risers are installed and system is fully operational by visual methods.
 - b. Leave trenches open to detect possible leaks.
- B. Submit written requests for inspections to the Landscape Architect at least 48 hours prior to anticipated inspection date.
 - C. Document testing with video or photos.

3.17 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 ninety-five percent density under pavements, eighty-five percent under planted areas.
- C. Compact trenches by thoroughly flooding the backfill in lifts.
- D. Dress off all areas to finish grades.

3.18 BALANCING AND ADJUSTING

- A. Adjust heads to proper grade when turf is sufficiently established to allow walking on it without appreciable harm. Such lowering or raising of heads shall be part of the original contract with no additional costs to the Owner.
- B. Adjust sprinkler heads for proper distribution and trim spray so it does not fall on building, walks or drives.
- C. Adjust watering time of zones to provide proper amounts of water to all plants.

3.19 CLEAN-UP

Clean up and remove all debris, temporary sleeve markers, flagging, etc. from entire work area prior to Inspections to the satisfaction of the Owner's Representative.

3.20 INSPECTION AND ACCEPTANCE

- A. Periodic and key system observations prior to cover-up by District, governing jurisdiction and/or Landscape Architect.
- B. Work under this Section will be accepted by the Owner's Representative upon satisfactory completion of all work and "punch list" items generated by Substantial Completion review, but exclusive of contractor obligations under warranty.
- C. Acceptance will include a 2 hour Owner orientation session with the contractor and owner/operator.
- D. Contractor to provide a seasonal maintenance written instructions to the Owner.
- E. Contractor to provide a reduced size, laminated zone map at controller.
- F. Contractor shall provide Record Drawings/As-builts showing accurate and altered field locations.
- G. Provide a copy of the backflow preventer test as performed by a licensed irrigation technician.

3.21 INSTALLATION MAINTENANCE

- A. Contractor shall maintain the entire limit of landscape work during the course of landscape installation leading up to and including satisfactory completion of all punch list items.
- B. Installation maintenance shall begin immediately after irrigation and planting is installed and continue until all punch list items are complete. Installation maintenance includes all watering operations (permanent irrigation, temporary irrigation and hand watering).

- C. Installation maintenance shall include watering, monitoring, adjustments to watering schedule, head and/or nozzle adjustments and/or repairs and replacements.
- D. Once accepted at Substantial Completion, the Contractor shall continue to maintain all landscape items including turf, trees, shrubs, groundcover and all underground irrigation for a period of 90 days starting at the date of punch list completion. See Exterior Landscape Maintenance section.

3.22 OWNER RESPONSIBILITY

Owner shall take responsibility of the landscape areas by maintaining, monitoring and repairing as needed the irrigation system to ensure the irrigation system remains in working order. Owner shall also fertilize, mow and maintain the landscape in a healthy condition with best practices and industry standards for landscape maintenance.

3.23 WARRANTY AND REPLACEMENTS

- A. In addition to the manufacturer's guarantees or warranties, all work shall be warranted for two years from the date of Substantial Completion against defects in material, equipment and workmanship to the satisfaction of the Owner.
- B. Contractor's responsibility to ensure and guarantee satisfactory operation of the entire system and the workmanship and restoration of the area.
- C. During the two year period, Contractor shall fill and repair trench line depressions more than one inch. And repair landscape or structural features damaged by the settlement of irrigation trenches and excavation.
- D. Make the repairs within 7 days of notification.
- E. Any replacements shall be identical to the specified items in the Contract Documents. Repairs/replacements at no additional cost to Owner.
- F. Contractor shall not be held responsible for failure/damage due to vandalism, storms, etc. during the Warranty Period. Document and report such conditions to the Owner.

END OF SECTION 32 84 00

**SECTION 32 90 00
LANDSCAPE PLANTING**

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

Drawings and General Provisions of the Contract, including General and Supplementary Conditions and all applicable specification sections apply to this section.

1.02 SCOPE OF WORK

- A. Scope of work under this Section of the specifications shall include all approved materials, labor, equipment, transportation and services required and incidental thereto, in conformity with the plans and specifications, including but not limited to fine grading, prepared soil mix, supply and planting of trees, shrubs, groundcovers, grass and fertilizing, installation maintenance, clean-up, plant guarantee and replacement and other work related thereto.
- B. Protection of existing features. During construction, protect all existing trees and specified vegetation, site features and improvements, structures and utilities as specified on drawings and/or in specifications. Repair or replace any damaged existing planting noted to remain.
- C. Tree staking and any remaining leader stakes shall be removed at the 11 month review

1.03 REFERENCE STANDARDS

- A. American Joint Committee on Horticultural Nomenclature Standardized Plant Names
- B. Texas Association of Nurserymen, Grades and Standards for Nursery Stock.
- C. American Standard for Nursery Stock
- D. ANSI A300 and Z60.1

1.04 QUALITY ASSURANCE

- A. Installation of planting shall be performed by a single company specializing in landscape work. Contractor shall be licensed by the Texas Association of Nurserymen and shall possess an agricultural certificate and licensed pest applicator. Contractor shall have not less than 5 years of experience in this type and scale of work.
- B. Contractor to attend a pre-installation meeting with District Representatives, Landscape Architect and others and participate in ongoing meetings during installation with General Contractor and others.

1.05 SUBSTITUTIONS

Substitutions must be submitted 10 days before proposals are due, if accepted, an Addendum will be issued, otherwise no substitutions are allowed. See Architect for any other requirements.

1.06 SUBMITTALS

Provide the following:

- A. Product data and source for all items listed in Materials.
- B. Material samples for planting mix, mulch and fertilizer. Samples shall be packaged in plastic bags and shall be typical of the material to be delivered to the site.
- C. Color photos of plant material with gallon size indicated, height pole/scale rod (as needed) and plant name with grower and/or nursery source name provided.
- D. List the Landscape Contractor responsible for the work on this project.
- E. Landscape Architect reserves the right to request purchase and delivery tickets when needed to verify correct variety or material for the project and to reject plant material on site.

1.07 UTILITY VERIFICATION

- A. The contractor is responsible for contacting local utility companies for underground line

- location and verification. If underground lines interfere with planting then Landscape Architect shall be notified to make revisions prior to planting at no additional cost to the owner.
- B. The contractor shall be responsible for all damages resulting from failure to comply with this requirement.

PART 2 - MATERIALS

2.01 MATERIAL delivery may begin upon approval of samples or as directed.

- A. Topsoil: Contractor responsible for adding topsoil from off-site source if needed. Limited existing topsoil will be available. Existing and off-site borrow soil shall be natural, friable, fertile soil possessing characteristics of the local area. Topsoil is defined as the total amount of soil stripped in the top 4" inches less the vegetative layer. Soil to be free of subsoil, stones, clay, clod, sticks and roots. Topsoil containing nut grass or dallis grass will be rejected. See TOPSOIL specifications for requirements.
- B. Mixed soil: If pre-mixed soil is used, an acceptable product is 'Landscaper Mix' by Nature's Way Resources or approved equal.
- C. Compost: Compost as manufactured by Nature's Way Resources, Inc. or approved equal. Major nutrients: Nitrogen, Phosphorus, Potassium. Secondary: Calcium, Magnesium, Sulfur. Micronutrients: Iron, Manganese, Zinc, Copper. Materials to be commercially prepared fully composted under sustained temperatures to 165 degrees with a PH averaging 6.5 to 7.0.
- D. Commercial Fertilizer: MicroLife 6-2-4 All organic, biological fertilizer as available at San Jacinto Environmental Supplies. No substitutions.
- E. Mulch: Landscape finish mulch shall be imported, dark brown in color, shredded hardwood bark used for top dressing and shall have a particle size that passes 100% through a one inch think square mesh and is retained on a 1/8" square mesh.
- F. Sand: shall be sharp white sand (not bank sand).
- G. Staking material:
1. Landscape fiber strap. ArborTie webbing green in color or equivalent.
 2. Stakes shall be sound No. 2 Douglas fir, lodge poles uniform size 2-1/2" in diameter, and not less than 7 ft. long, pointed at one end with the slope of the point back about 6" from the end. Stakes shall be cut off square at top after installation to a level of 2" above the straps.
 3. Three stakes per tree (45 gallon and larger).
 4. Two stakes per tree (30 gallon and smaller).
- H. Post-emergent herbicide: Mirimichi Weed & Grass Killer available at San Jacinto Environmental Supplies in Houston, Texas
- I. Pre-emergent herbicide: Barricade granular pre-emergent herbicide or approved equal applied to planting beds.

2.02 PLANTS

- A. Quality: plants shall be No. 1 grade and true to species, commercial nursery grown in accordance with good horticultural practices under similar climatic conditions similar to those of the project site (approximately 200 miles or less from project site). They shall be fresh, vigorous, of normal growth, free of disease, insects, insect eggs and larva, and have strong root systems. Plant material shall be symmetrical or typical for variety and species and conform to measurements specified in Plant List. **No root bound plant material shall be**

accepted.

- B. Size: all plants shall equal or exceed the measurements stated in the plant list. Plants shall be measured when branches are in their normal positions. If larger plants are used, then the root ball shall be increased in proportion to the size of the plant.
 - 1. Caliper measurements shall be taken 6 inches above the natural ground line for trees up to and including 4 inches in caliper and measured 12 inches above the natural ground for trees over 4 inches in caliper.
- C. Selection: plants shall be subject to inspection and approval by the Owner at their place of growth and upon delivery for conformation to specification requirements. Such approval shall not impair the right of inspection and rejection during progress of the work.
 - 1. Trees with multiple leaders, unless specified, will be rejected. Trees with damaged bark, abrasions, crooked leaders, sunscald, disfiguring knots, pruned limbs over $\frac{3}{4}$ " in diameter that are not completely healed will be rejected.
- D. Contractor Responsibility: all questions regarding plant material selection, size and specifications will be directed to the Owner's Representative prior to submission of bids. Submission of bids will be understood that the Contractor fully understands the plans and specifications; that all plants and materials will be available in size, character and number at the time of installation. No substitutions will be allowed after bids are received.
 - 1. The plant list on the drawing is for the contractor's information only and is not guaranteed that quantities therein are correct. The contractor shall be responsible for providing the correct quantities and installation at the correct spacing.

2.03 PLANTING PREPARATION

- A. Rock, underground construction work, tree roots, utility conflicts or obstructions encountered in the excavation of tree or shrub pits shall be brought to the attention of the Landscape Architect. Proceed with work after alternate locations have been designated by the Landscape Architect.
- B. Layout plants and trees in locations shown on drawings. Use color coded wire and wood stakes. Stake location of each tree and major shrub and outline of shrub and groundcover beds for approval by Landscape Architect.
- C. Apply Mirimichi for existing weed elimination only in lawn and planting areas prior to bed prep or planting. All weeds to be killed and removed prior to landscaping work.
- D. All planting beds to be constructed with final grade and mulch below building weep holes. Under no circumstances shall the building weeps be covered. Contractor to bring all related concerns to the Project Manager prior to installation.

PART 3 - EXECUTION

3.01 WORK PROCEDURE

- A. Planting Mix for all root zones: all tree and shrub areas shall be backfilled with a prepared planting mix as follows: 25% parent soil, 25% topsoil, 25% compost, 25% sand (not bank sand).
- B. Excavation for container trees shall be twice the width of the container (with angled sides), with natural ground shelf and the depth shall keep the root flare and ball 1"-2" above grade (see detail).
 - 1. After tree pit excavation, fill hole 2/3 full with water. Water must be absorbed before tree planting. If water is not absorbed within 24 hrs of flooding, let Landscape

Architect know. A tree de-watering sump detail will be provided for tree pits holding water.

2. Ground shelf lift must be in place before tree planting.
- C. Excavation for shrub pits shall be the width of the container + 18" and the depth shall keep the root ball 1"-2" above grade (see detail).
- D. Excavation for groundcover beds shall include replacement of existing soil (for the entire groundcover bed) with prepared planting mix to a depth of the container (see detail). Spread granular pre-emergent across total planting bed at rates recommended by manufacturer. Apply January 1 – March 20 to target summer weeds and August 15 – September 15 to target winter weeds.
- E. When plant pits have been backfilled approximately 2/3 full, water thoroughly before installing remaining soil to top of pit, eliminating all air pockets.
- F. Form an earth saucer around the perimeter of plant pits.
- G. Water all plants immediately after planting.
- H. Mulch all planting areas 2"-3" deep immediately after planting.
- I. Do not mound mulch against tree trunk.
- J. Staking of all trees by Contractor in accordance with plan details. Plants shall stand plumb after staking and all trees shall be staked within 24 hours of planting. Stakes shall be driven into the ground (not root ball) until rigid.

3.02 FINE GRADING

Landscape Contractor will receive the project in a rough grade condition. It is the Landscape Contractor's responsibility to fine grade the 'green' areas; that includes adding topsoil as required to smooth out the rough grade and remove the clumps, clods, dips, ruts, bumps, lumps and removal of construction debris within the 'green' areas. Contractor to fine grade and provide positive drainage and even transition to drain inlets.

3.03 CLEAN UP

As planting operations proceed, all rope, wire, empty containers, rocks, clods and all other debris shall not be allowed to accumulate, but shall be removed daily and the site kept as tidy as possible at all times. After planting operations are finished, all paved areas shall be cleaned by sweeping and washing if necessary.

3.04 INSTALLATION MAINTENANCE

- A. Contractor shall maintain the entire limit of landscape work during the course of landscape installation leading up to and including satisfactory completion of all punch list items.
- B. Installation maintenance shall begin immediately after each plant is planted and continue until all punch list items are completed. This includes all watering operations (permanent irrigation, temporary irrigation and hand watering).
- C. Installation maintenance shall also include watering, weeding, mowing and edging once a week, weeding, mulching, removal of dead materials, resetting plants to proper grades or upright positions, repairs of soil settlements, dips and depressions, fertilizing and applying sprays or chemicals as necessary to keep the planting and new work free of ants, insects and disease.
- D. Once accepted after Substantial Completion punchlist review, the Contractor shall continue to maintain all landscape items including turf, trees, shrubs, groundcover and all underground irrigation for a period of 90 days starting at the date of punch list completion. See Exterior

Landscape Maintenance section.

3.05 PROTECTION

Planting areas and plants shall be protected during installation at all times against trespassing and damage of all kinds until acceptance of the project by the Owner. If any plants become damaged, injured or stolen, they shall be treated or replaced as directed by the Owners Representative at no additional cost to the Owner. The Owner does not assume any responsibility for security until project acceptance.

3.06 INSPECTION AND ACCEPTANCE

- A. Substantial Completion notice will be issued only after Owner and Landscape Architect inspect and approve all required planted work including grass areas.
- B. Acceptance will be determined after all punchlist items generated during walks are completed. This also requires all plant material to be alive and healthy and grass areas established.
- C. Acceptance notice will be issued only after Owner and Landscape Architect inspect and approve all planting work as in accordance with Contract Documents but exclusive of replacement of plant materials under the Warranty Period.

3.07 OWNER RESPONSIBILITY

Owner shall take responsibility of the landscape areas by maintaining, monitoring and repairing as needed the irrigation system to ensure the irrigation system remains in working order. Owner shall also fertilize, mow and maintain the landscape in a healthy condition with best practices and industry standards for landscape maintenance.

3.08 WARRANTY PERIOD AND REPLACEMENTS

- A. Apart from Natural Act of God occurrences, Contractor shall warrant unconditionally that all trees, shrubs, groundcovers planted under this contract will be healthy and in flourishing condition of active growth for one year from date of Substantial Completion.
- B. Any delay in completion of planting operations which extends the planting into more than one planting season will extend the Warranty Period correspondingly.
- C. Replace without cost to the Owner, and as soon as weather conditions permit, all dead plants and all plants not in vigorous, thriving conditions as determined by the Owner's Representative during and at the end of the Warranty Period. Plants shall be free of dead or dying branches and branch tips and shall bear foliage of a normal density, size and color. Replacements shall closely match adjacent specimens of the same species and shall be subject to all requirements of this specification.
- D. Replacements shall be warranted through one (1) full growing season.

END OF SECTION

SECTION 32 90 30
EXTERIOR LANDSCAPE MAINTENANCE

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Subject to the General and Special Conditions, this Section includes furnishing all labor, materials and equipment necessary to provide a landscape maintenance program including (landscape and irrigation maintenance):
 - 1. Running, monitoring, adjustments (both seasonal and plant needs based) and repair to the irrigation system.
 - 2. Watering trees, shrubs and grass areas.
 - 3. Replacement of plants that die.
 - 4. Mowing and edging of school landscaping.
 - 5. Monitoring, weeding, and cultivating of plant material.
 - 6. Application of organic fertilizers, insecticides, and herbicides.
 - 7. General site clean up; removal of trash and products of maintenance.
- B. Application of herbicides and pesticides on school facilities is heavily regulated by Texas Department of Agriculture Commercial Applicator. The landscape maintenance contractor shall meet with the school district's IPM (Integrated Pest Management) coordinator prior to the first day of school to discuss responsibilities and methods for complying with TDA documentation and regulation requirements.

1.02 EXTRA SERVICES

- A. All services not covered under this contract shall be considered "extra services" and will be charged for separately according to the nature of the item of work. The consent and authorization of the Owner or their authorized representative must be obtained prior to the performance or installation of such "extra services" items and prior to purchase of any chargeable materials.
- B. Such work may include by-products of vandalism or other site related work.

1.03 MAINTENANCE REQUIREMENTS

- A. Maintenance period shall begin upon satisfactory completion of punch list items generated from the Substantial Completion Review for the installation of the project. The Contractor shall continue to maintain all landscape items including turf, trees, shrubs, groundcover and all underground irrigation for a period of 90 days.
- B. Watering: Contractor is responsible for all watering (irrigation system operations and maintenance, adjustments, hand watering or temporary irrigation system). Watering shall consist of determining the plant watering requirements, adjustment of schedule and duration for coverage and elevation, and all other work required to maintain living plant material.
- C. Trees, Shrubs, Groundcovers and Grass: Maintenance of new planting shall consist of watering, mowing, edging, cultivating, weeding, removal of undesirable volunteer plants, reseeding, mulching, re-staking, re-placing plants, tightening and repairing of guys, resetting

plants to proper grades or upright position, restoration of the planting saucer and furnishing and applying such organic fertilizers, sprays and invigorants as are necessary to keep the plantings free of insects and disease and in thriving condition.

1.04 PROTECTION:

- A. Protect planting areas against damage of all kinds for duration of maintenance period. Maintenance may include temporary protection fences, 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 Owner at no additional cost to Owner.

1.05 NEGLECT AND VANDALISM:

- A. All plant material that is damaged or killed due to contractors operations, negligence or chemicals shall be replaced at no expense to the Owner. If plant damage or death is caused by conditions beyond the contractor's control, replacement shall be at the Owner's expense, but will need written authorization prior to replacement.
- B. All water damage, either natural or man-made, resulting from contractor's neglect shall be corrected at the contractor's expense.
- C. All damage to or thefts of landscaping not caused or allowed by the contractor shall be corrected by the contractor at the Owner's expense upon receipt of written authorization to proceed.

1.06 EMERGENCIES

- A. Answer emergency or complaint calls regarding conditions in landscaped areas regarding fallen trees, broken water lines or other urgent site conditions and correct the problem or place warning signs and advise the Owner of the need for major work to be performed within 24 hours of the initial contact.

1.07 FINAL ACCEPTANCE

- A. Work under this Section will be accepted by Owner's representative upon satisfactory completion of all work, including maintenance, but exclusive of any required replacement of plant materials. Upon the final acceptance, the Owner will assume responsibility for maintenance of the work.
- B. Plant material shall all be in healthy vigorous condition with no signs of stress or declining health.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Materials required for installed items shall match those already in use including MicroLife organic fertilizer.

2.02 REQUIRED EQUIPMENT

- A. Contractor shall furnish the following equipment:
 - 1. Riding lawnmowers

2. Push lawnmowers
3. Line trimmers
4. Miscellaneous hand tools, trimmers, pruners, rakes, brooms, etc.
5. Blowers
6. Others as needed

PART 3 - EXECUTION

3.01 WATERING

- A. It shall be the responsibility of the Contractor to assure that the correct watering of plant materials is being accomplished through the following irrigation services:
 1. Regular watering to all new trees.
 2. Regular watering to the shrubs, perennials, ornamental grasses and sodded lawns.
 3. All adjustments for water delivery and all repair of the irrigation system for any and all damage to the system during the course of the maintenance period.
 4. Seasonally adjusting the irrigation controller.
- B. The irrigation system will be thoroughly inspected once per month. Check clock setting, clock operation, head elevation and coverage, valve function, vacuum breaker, and verify that all heads are intact and secure. Contractor to repair any issues that he finds.

3.02 MAINTENANCE OF SODDED LAWN AND HYDROMULCH

- A. Reseed and water as needed to get permanent grass (Bermuda) hydromulch areas growing and established.
- B. The Contractor will be responsible for replacing soils that have eroded. Residual soils will be removed and if not mingled with objectionable materials, may be re-used in eroded areas.
- C. Immediately upon observing any undesirable volunteer plants or seedlings, contractor shall promptly remove. The Contractor shall initiate a program of mechanical removal and maintain this program throughout the maintenance period.
- D. Special effort shall be given to the control of fire ants infesting the site. After control is accomplished, the ant mounds shall be lowered and tamped to the existing grade.
- E. Removal of debris from the site unrelated to horticultural maintenance (paper, bottles, cans, "Pirate" signs, etc.) and construction debris shall be the responsibility of the maintenance Contractor. Frequency shall be as per Landscape Maintenance Program.
- F. Sod lawn areas shall be mowed and edged as a part of this section. Frequency shall be as per Landscape Maintenance Program. No mowing within 75'-100' of children outside on site and no mowing during SCHOOL ZONE hours at drop off and pick up.

3.03 MAINTENANCE OF TREES, SHRUBS and GROUNDCOVERS

- A. Contractor shall adjust and tighten as required all tree staking and guying. Removal at the time of the 11 month review.

- B. Contractor shall deep water all new trees until there are definite signs the trees have established themselves and are pushing out new growth.
- C. Contractor shall trim broken branches and trunk suckers from trees and shrubs. All pruning equipment shall be sharp and clean.

PART 4 - MAINTENANCE FREQUENCY SCHEDULE

4.01 MAINTENANCE OPERATIONS

<u>Month</u>	<u>Minimum Number of Visits per Month</u>
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January	2
February	2
March	4
April	4
May	4
June	4
July	4
August	4
September	4
October	3
November	3
December	2

4.02 MULCHING, WEED CONTROL AND GUYING ADJUSTMENT

- A. As required at each visit.

4.03 TRASH AND DEBRIS REMOVAL

- A. Collect all trash and debris at each visit and dispose of off site.

END OF SECTION

**SECTION 32 91 00
TOPSOIL, PLACEMENT AND GRADING**

PART 1-GENERAL

1.01 SCOPE OF WORK

Scope of work under this Section of the specifications shall include all approved materials, labor, equipment, transportation and services required and incidental thereto, in conformity with the plans and specifications, including but not limited to furnishing and placing topsoil for finish grading for seeding, sodding and planting.

1.02 QUALITY ASSURANCE

Contractor to attend a pre-installation meeting and participate in an installation meeting with Owner's Representative.

1.03 SUBSTITUTIONS

Substitutions must be submitted 10 days before proposals are due, if accepted an Addendum will be issued, otherwise no substitutions are allowed. See Architects for any other requirements.

1.04 SUBMITTALS

- A. Contractor shall provide required sample and soil analysis to Landscape Architect prior to delivery of any soil materials to site.
- B. Topsoil test report for imported topsoil.
- C.. MicroLife Humates Plus 0-0-4

PART 2- MATERIALS

- 2.01 TOPSOIL:** Contractor responsible for adding topsoil from off-site source if needed. Existing topsoil will be stockpiled by General Contractor for landscape use on site but must be uncontaminated and clean for landscape use.

ASTM D 5268, shall be fertile, friable, natural sandy loam surface soil with a minimum of 4 percent organic material content; free of stones 1 inch or larger in any dimension and other extraneous materials harmful to plant growth and obtained from excavation or borrow operations having the following characteristics:

- 1. Ph value between 5.5 and 7.0
 - 2. Liquid limit - topsoil not to exceed 50.
 - 3. Plasticity index - 10 or less
 - 4. Gradation - maximum of 40 % passing the No. 280 sieve.
- A. On-site Topsoil Source: Reuse surface soil on-site if approved by Owner's Representative. Verify suitability of existing surface soil to produce topsoil. Supplement with imported or augmented topsoil from off-site sources when quantities are insufficient. Contractor responsible for testing topsoil (existing or imported) for compliance. Topsoil shall be free of subsoil, clay, lumps, weeds, weed seed, non-soil materials and other litter or contamination. Topsoil shall not contain roots, stumps, or stones larger than 1" inch.

Obtain topsoil from naturally well drained areas where topsoil occurs at a minimum depth of 4 inches and has similar characteristics to that found at the placement site. Do not obtain topsoil from areas infected with a growth of, or reproductive parts of, nut grass or other

noxious weeds or high clay content.

- B. Off-site Topsoil Source: Import enriched topsoil or manufactured topsoil from off-site sources. Obtain topsoil from naturally well drained areas where topsoil occurs at a minimum depth of 4 inches and has similar characteristics to that found at the placement site. Do not obtain topsoil from areas infected with a growth of, or reproductive parts of, nut grass or other noxious weeds.

2.02 SCHOOL SITE

- A. Bermuda solid sod areas (see plan) shall receive 2" inch of topsoil before sodding.

2.03 AMENDMENTS

- A. MicroLife Humates Plus 0-0-4
- B. Compost – if topsoil needs additional organic material.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Coordinate location of stockpile topsoil area with District and Project Manager.
- B. Verify that excavation and subgrade operations have been completed to correct lines and grades and have been coordinated and reviewed by District, Project Manager, Civil Engineer and Landscape Architect.

3.02 PLACEMENT

- A. Scarify and breakup subgrade. See Lawn Sodding and Seeding Section.
- B. Remove construction debris (may require ongoing effort)
- C. Apply Humates at a rate of 10lbs per 1,000 sq ft. Process must be documented (video/photos) by contractor while applying product.
- D. Spread topsoil in lifts according to plan grades.
- E. Lightly roll or water topsoil and let topsoil settle.
- F. Grade the surface of all areas to meet the grades shown on the civil drawings. Add enough topsoil to allow for settlement so soil will be at correct grades and achieve positive drainage after settlement.
 - 1. Provide for positive drainage from all areas toward the inlets and drainage structures.
 - 2. Provide even transitions.
 - 3. Cut grade where sod meets hydromulch for even level transition from one to the other.
 - 4. All grading must be reviewed by Project Manager, District, Civil Engineer and Landscape Architect.
 - 5. Fill all settlement depressions at no additional cost to Owner.
- G. Coordinate this operation with irrigation placement and all other trades.

3.03 CLEAN UP

Remove spilled topsoil from paved areas, curbs, gutters, etc. As operations proceed all excess soil and debris shall not be allowed to accumulate, but shall be removed daily and the site kept as tidy as possible at all times.

3.04 PROTECTION

Protect topsoil from wind and water erosion until planting is completed.

END OF SECTION

**SECTION 32 92 00
LAWN SODDING & HYDROMULCH**

PART 1-GENERAL

1.01 SCOPE OF WORK

Scope of work under this Section of the specifications shall include all approved materials, labor, equipment, transportation and services required and incidental thereto, in conformity with the plans and specifications, including but not limited to fine grading, seeding, hydromulching and sodding areas, fertilizing, maintenance, clean-up, guarantee and replacement and other work related thereto. Including:

- A. Planting of sod within areas designated on Drawings for purpose of surface stabilization, channel stabilization, vegetation buffer strips or patching and lawn areas.
- B. Sod is defined as blocks, squares, strips of turf grass with adhering soil used for vegetative planting. To be placed edge to edge for complete coverage.
- C. A double row of sod shall be placed around all inlets within seeded/hydromulch areas.
- D. A single row of sod shall be placed around all pavement including pedestrian, vehicular and back of curb surfaces within the seeded/hydromulch areas.
- E. Lawn is defined as ground covered with fine textured grass kept neatly mowed.

1.02 QUALITY ASSURANCE

- A. Contractor to attend a pre-installation meeting and participate in an installation meeting with Owner's Representative.
- B. Sod certification shall be submitted from the sod nursery as to grass species and stripping date.
- C. Seed certification shall be submitted from the supplier for each type of seed specified.

1.03 SUBSTITUTIONS

Substitutions must be submitted 10 days before proposals are due, if accepted, an Addendum will be issued, otherwise no substitutions are allowed. See Architects for any other requirements.

PART 2- MATERIALS

2.01 Project site includes seeding/hydromulch and Common Bermuda solid sod (see plan for each indicated area).

A. Seeding:

Hydromulch shall be accomplished according to the following schedule:

Summer application (April 1 - September 30) per 1000 square feet
50# wood cellulose fiber mulch
2# hulled Bermuda seed
15# 13-13-13 water soluble fertilizer

Winter application (October 1 - February 14) per 1000 square feet
50# wood cellulose fiber mulch
2#-3# unhulled Bermuda seed
2#-3# hulled Bermuda seed
2# gulf rye seed
15# 13-13-13 water soluble fertilizer

Late Winter/Early Spring application (February 15 - March 31) per 1000 square feet
50# wood cellulose fiber mulch
2#-3# unhulled Bermuda seed
2#-3# hulled Bermuda seed
15# 13-13-13 water soluble fertilizer

Seed shall be certified 90 % pure and conform to the Federal Seed Act and Texas Seed Law.

Seeding or Hydromulch to be applied at an accelerated schedule in order for the grass to grow prior to the start of school. The permanent grass (Bermuda) must achieve full growth no later than the 60 day grow-in period and prior to the start of the maintenance period.

- B. Solid sod as called for on plans. Sod shall be certified nursery/farm grown grass true to the name and variety. Sod shall be substantially free of noxious weeds, disease, insects, thatch and undesirable grasses.

Sod shall be nursery grown and have a healthy root system of dense thickly matted roots throughout the soil of the sod for a minimum thickness of 1 inch. Sod shall be rectangular in size approx 16" x 24".

Schedule deliveries to coincide with topsoil operations and laying. During wet weather allow sod to dry sufficiently to prevent tearing. During dry weather, protect sod from drying out. Water as necessary to insure vitality and to prevent excess loss of soil while handling. Sod which dries out will be rejected. Sod shall be cut delivered and installed within 24 hours of cutting.

- C. Fertilizer – Organic Microlife 6-2-4
- D. Bank Sand – Free of clay lumps, roots, grass, salt or other foreign material.
- E. Topsoil – See TOPSOIL spec section
- F. Humates – MicroLife Humates Plus 0-0-4 applied in ALL sod and seeded/hydromulch areas.

PART 3 - EXECUTION

3.01 PREPARATION - Grades to be reviewed by District, Project Manager, Civil Engineer and Landscape Architect prior to sodding or seeded/hydromulch operations.

- A. Protection
1. Take care and preparation in work to avoid conditions which will create hazards. Post signs or barriers as required.
 2. Provide adequate means for protection from damage through excessive erosion, flooding, heavy rains, etc. Repair or replace damaged areas.
- B. Surface Preparation for seeding/hydromulch
1. Remove all existing weeds by hand or herbicide use. **Remove top growth and roots.**
 2. Scarify small areas (less than 500sq ft) by hand raking to 3" deep to remove rocks and construction debris and break up compacted soil.
 3. Larger areas to be prepared by removing large debris by hand, then using a Rock rake to loosen soil and remove rocks, then using a Harley rake to push smaller rocks into a pile and remove. Several passes with each type of equipment may be required to reach an acceptable soil condition that is ready for seeding.
 4. At each step continue to remove soil clods, rocks ($\frac{3}{4}$ "), weeds, roots and construction

- debris above and below grade.
- 5. Refine grades for positive drainage to area inlets.
- 6. Grades to be reviewed by District, Project Manager, Civil Engineer and Landscape Architect prior next phase.

C. Surface Preparation for solid sod

- 1. Remove all existing weeds by hand or herbicide use. **Remove top growth and roots.**
- 2. Scarify small areas (less than 500sq ft) by hand raking to 3" deep to remove rocks and construction debris and break up compacted soil.
- 3. Larger areas to be prepared by removing large debris by hand, then using a Rock rake to loosen soil and remove rocks, then using a Harley rake to push smaller rocks into a pile and remove. Several passes with each type of equipment may be required to reach an acceptable soil condition that is ready for seeding.
- 4. At each step continue to remove soil clods, rocks (3/4"), weeds, roots and construction debris above and below grade.
- 5. See TOPSOIL section for amended topsoil requirements. Add a minimum of two (2") inches of topsoil as a setting bed for landscape sod.
- 6. Refine grades for positive drainage to area drains. Sod areas to be graded to achieve proper final elevations, eliminating all bumps, ridges or depressions to provide for smooth drainage.
- 7. Grades to be reviewed by District, Project Manager, Civil Engineer and Landscape Architect prior to sodding.

3.02 INSTALLATION

A. Site Tolerances

Final grade after complete shall be one half inch below top of adjacent pavement of any kind. Coordinate with Civil drainage plans for possible conflicts, such as sheet drainage across sidewalks, etc. Bring all conflicts to the Project Managers attention for resolution.

B. Hydromulch

- 1. Apply Humates at a rate of 10lbs per 1,000 sq ft and lightly rake to incorporate into soil. Process must be documented (video/photos) by contractor while applying product.
- 2. Apply seed with approved spray equipment and water (to keep moist) seeded areas.
- 3. Hydromulch to be applied at an accelerated schedule in order for the permanent grass (Bermuda) to grow prior to the start of school.
- 4. Reseed areas that do not show prompt germination. Bare areas must be less than 12" in any direction.
- 5. Grass must achieve full growth no later than the 60 day grown-in period but prior to the start of the 12 month maintenance period.
- 6. Additionally, if winter rye is the initial grass grown during winter, the contractor is also responsible for permanent (Bermuda) grass growth once the winter grass dies off.

C. Solid sod

- 1. Lay sod in rows with staggered joints. Butt sections closely without overlapping or leaving gaps between sections. Topdress/Sand fill sod joints.
- 2. Lay a single row of sod along pavement including pedestrian and vehicular surfaces and back of curb within seeded/hydromulch areas.
- 3. Lay a double row of sod around inlet drains within the hydromulch areas.
- 4. Cut grade where sod meets hydromulch for even transition from one to the other.
- 5. Sod blocks shall not prevent drainage away from walk or create ponding issues.

3.08 WARRANTY PERIOD AND REPLACEMENTS

Contractor shall warrant that grass planted under this contract will be healthy and in flourishing condition of active growth for one year from date of Final Acceptance.

Any delay in completion of planting operations which extends the planting into more than one season will extend the Warranty Period correspondingly.

Replace without cost to the Owner, and as soon as weather conditions permit, all dead grass as determined by the Owner's Representative during and at the end of the Warranty Period. Replacements shall be warranted through one full growing season.

END OF SECTION

SECTION 32 16 13

CONCRETE CURBS AND CURB AND GUTTER

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

1. 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
 - 1. Either wood or metal, of the size and shape necessary for forming the item, straight and free of warp.
- B. Reinforcing Steel Bars
 - 1. As specified in Section 032100 - Concrete Reinforcement of these Specifications.
- C. Dowel Bars
 - 1. 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
 - 1. 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
 - 1. As specified in Section 321373.19 – Cast-in-Place Concrete of these Specifications.
- F. Membrane Forming Curing Compound

1. 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 321319 of these Specifications.
- H. Form Coating
 1. 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 32 13 73.19 - 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 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.
- B. Interior trench drains and gratings for interior uses are specified in Submittals.
- C. Duct banks are specified per submittals 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 Section 01, Article 1.03.
- 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 Section 01, 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 32 13 13 - 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 32 13 13 - Portland Cement Concrete, and incorporate the following requirements:
 1. Concrete Strength: Class 4000 minimum in accordance with Table 03305-A of Section 32 13 13 - 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 ASTM C478, ASTM C789, ASTM C850, and ASTM C858, as applicable, and applicable manufacturers' standards.
- C. Materials: Comply with requirements of Section 03 21 00 - Concrete Reinforcing, Section 32 13 13 - Portland Cement 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 32 13 13 - 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, 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: NOT USED.
- 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 HS-20 loadings when proof-tested in accordance with Caltrans Bridge Design Specifications Manual, Section 3.

2. Bar-Type Steel Grates: 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 HS-20 loading.
- 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: 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, Section 33 05 28 - Trenching and Backfilling for Utilities, Section 32 11 17 - Aggregate Subbase Courses, and Section 32 11 23 - Aggregate Base Course, as indicated.
- C. Cast-in-Place Concrete Structures: Provide formwork, steel reinforcement, and concrete in accordance with applicable requirements of Section 03 21 00 - Concrete Reinforcing, and Section 32 13 73.19 - 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.
- B. Acceptance of cast-in-place structures will be in accordance with Section 32 13 13, Portland Cement 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 the Engineer 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 Engineer 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 01.
- 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 01 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, reducers, 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 01.
- 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 33 05 28 Trenching Backfill for Utilities.
- 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 caving, 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.
- X. 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/ft³ (600 kN-m/m³)).
- 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 City Engineer, perform construction activities between 7 AM and 7 PM, Monday through Friday. No work permitted around a LDWL on weekends or City Holiday.
 - 5. A City 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 01.
- 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 31 23 00 – Grading Excavation and Fill.
- D. Submit trench excavation safety program in accordance with requirements of Section 02. 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 City in accordance with requirements of Section 01 and as specified in this Section.
- B. Perform backfill material source qualification testing in accordance with requirements of Section 312300 – Grading Excavation and Fill.

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**2.1 EQUIPMENT**

- A. Perform excavation with hydraulic excavator or other equipment suitable for achieving requirements of this Section.
- B. Use only hand-operated tamping equipment until minimum cover of 12-inches is obtained over pipes, conduits, and ducts. Do not use heavy compacting equipment until adequate cover is attained to prevent damage to pipes, conduits, or ducts.
- C. Use trench shields or other protective systems or shoring systems which are designed and operated to achieve placement and compaction of backfill directly against undisturbed native soil.
- D. Use special shoring systems where required which may consist of braced sheeting, braced soldier piles and lagging, slide rail systems, or other systems meeting requirements as specified in Paragraph 1.08, Special Shoring Design Requirements.

2.2 MATERIAL CLASSIFICATIONS

- A. Embedment and Trench Zone Backfill Materials: Conform to classifications and product descriptions of Section 31 23 00 – Grading Excavation and Fill and Section 02321 – Cement Stabilized Sand.
- B. Concrete Backfill: Conform to requirements for Class B concrete as specified in Section 33 05 16 - Utility Structures.
- 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 1675 as 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 01. 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 02.
- 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 02, as applicable.
- E. Install and operate necessary dewatering and surface-water control measures to conform to Section 01. 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 01.

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 related work.
- 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 City 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 01.
- 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 City.

- 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 City 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 unbraced 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 02.
- 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 02. 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 02.
- 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 01. 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 01.
- 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. 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.
- I. For water lines construction embedment, use bank run sand, concrete sand, gem sand, pea gravel, or crushed limestone as specified in Section 02. 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.
- J. 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.
- K. For Storm Sewers constructed of any flexible pipe product and installed under pavement provide flowable fill pipe embedment as specified in Section 02.
- L. 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 31 23 00- Grading Excavation and Fill. 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 02. 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. 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 City, 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 City.
- 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 01.

END OF SECTION 33 05 28

SECTION 33 16 53 TRAFFIC PAINT STRIPING

PART 1 - REFLECTORIZED MULTIPOLYMER PAVEMENT MARKINGS

1. DESCRIPTION.

This Item shall govern to furnish, and place reflectORIZED multi-polymer pavement markings as shown on the plans.

2. MATERIALS.

- A. **Multi-Polymer Pavement Marking Materials.** Provide a prequalified multi-polymer resin material which is:
- toxic heavy metal free (lead, chromium, cadmium, and other toxic heavy metals as defined by the United States Environmental Protection Agency,)
 - two-component (a predominantly multi-polymer pigmented resin component with a curing agent component),
 - 100% solids, producing no toxic fumes when heated to application temperature,
 - track-free in less than 40 minutes, and
 - formulated and tested to perform as a pavement marking material with glass spheres applied to the surface.

Furnish in accordance with the requirements below.

**Table 1
Color Requirements**

Federal 595 Color		Chromaticity Coordinates								Brightnes s (Y)
		1		2		3		4		
		x	y	x	y	x	y	x	y	
White	17855	.290	.315	.310	.295	.350	.340	.330	.360	60 min
Yellow	33538	.470	.455	.510	.489	.490	.432	.537	.462	30 min

**Table 2
Physical Properties**

Property	Test Procedure	Min	Max
Abrasion Resistance, loss, 750±38µm film, 72 hr cure, CS17 wheel, 1000 g, 1000 cycles	ASTM C501		0.080 g
Hardness, Shore D	ASTM D 2240	75	
Adhesion, 375±38 µm film, 72 hr cure, 25C	ACI 503, Appendix A.1	Fail in Concrete	
Yellowness Index (White only), QUV, 375±38 µm film, 72 hr cure	ASTM 1925		30

Prequalify materials with the Construction Division, Materials and Pavements Section. To prequalify, supply:

- a test report showing proposed multi-polymer pavement marking materials meet the requirements above,
- a 1-quart sample of each component for specification verification, and
- documentation of acceptable performance from TxDOT pavement marking field applications that have been in place for at least 1 year or published documentation from the National Transportation Product Evaluation Program showing a minimum retro reflectivity readings along the skip lines of 250 mcd for white and 200mcd for yellow after one year.

Formulation changes require a new prequalification.

The material supplied to the project will be tested against the prequalification sample to assure that no formulation changes are made without notifying the Construction Division. The testing to characterize the project samples will include but not be limited by those requirements listed in Table 3. Tests to be run and allowable variations are:

Table 3 Material Requirements

Tests	Requirements
Density (Gallon Weight)	±0.10 lb./gal
Viscosity (Krebs-Stormer)	±7 KU
Viscosity (Cone & Plate)	±0.5 Poises
Grind	Not Less than the Standard
% Non-Volatile Matter	±1.0%
% Pigment (white)	±3.0 %
% Volume Non-Volatile Matter	±3.0%
Infrared Spectrum	Match Standard

Provide certified test results for project materials prior to the start of the project.

- B. **Glass Traffic Beads.** Furnish Type II or Type III drop-on glass beads conforming to DMS-8290, "Glass Traffic Beads." Use Type II beads only as a part of a double drop system with Type III beads. For double drop systems, dispense each type bead with a separate dispenser system, with the ratio of Type II beads not greater than 50% by weight of the beads used.
- C. **Labeling.** Use clearly marked containers that indicate color, mass, material type, manufacturer, and batch number.

3. EQUIPMENT.

- A. **General Requirements.** Use equipment which:
- is maintained in satisfactory condition,
 - meets or exceeds the requirements of the National Board of Fire Underwriters and Texas Railroad Commission for this application,
 - uses an automatic bead dispenser attached to the pavement marking equipment, and
 - can provide continuous mixing and agitation of the pavement marking material.
- B. **Material Placement Requirements.** Use equipment which can place:
- at least 40,000 ft. of 4-in. solid or broken markings per day at the specified thickness.
 - linear markings up to 8 in. wide in a single pass.

- markings other than solid or broken lines.
- a center-line and no-passing barrier-line configuration consisting of 1 broken line with 2 solid lines, at the same time, to the alignment, spacing, and thickness shown on the plans, for 3-line application;
- white line from both sides;
- lines with clean edges, uniform cross-section and thickness and reasonably square ends;
- skip lines between 10 and 10-1/2 ft., an approximate stripe-to-gap ratio of 1 to 3, and a stripe– gap cycle between 39-1/2 ft. and 40-1/2 ft., automatically;
- beads uniformly and almost instantly upon the marking as the marking is being applied;
- beads uniformly during the application of 2 adjacent lines. Each line must have an equivalent bead yield rate and embedment;
- each component within the component mix tolerances recommended by the manufacturer.

4. CONSTRUCTION. Place markings prior to opening to traffic unless short term or work zone markings are allowed.

- (1) **General.** Obtain approval for the sequence of work and estimated daily production. On roadways already open to traffic, place markings with minimum interference to the operations of that roadway. Use traffic control as shown on the plans or as approved. Protect all markings placed under open-traffic conditions from traffic damage and disfigurement.

Establish guides to mark the lateral location of pavement markings as shown on the plans or as directed and have guide locations verified. Use material for guides that will not leave a permanent mark on the roadway.

Apply markings on pavement that is completely dry and meets all temperature and humidity requirements of the manufacturer: Apply markings:

- using widths, colors, and at locations shown on the plans;
- in proper alignment with the guides without deviating from the alignment more than 1 in. per 200 ft. of roadway or more than 2 in. maximum;
- free of blisters and with no more than 5%, by area, holes or voids;
- with uniform cross section and thickness;
- with clean and reasonably square ends;
- which harden properly with no tackiness;
- using personnel skilled and experienced with installation of pavement markings;
- which are reflectorized; and
- that meet requirements in Test Method Tex-828-B.

Remove all applied markings that are not in alignment or sequence as stated in the plans or as stated in the specifications at the Contractor's expense in accordance with Item 677, "Eliminating Existing Pavement Markings and Markers," except for measurement and payment.

(2) Surface Preparation.

- (a) Surface preparation methods should be determined by the manufacturer and be in accordance to Item 678.
- (b) Cleaning for Asphalt Surfaces Younger Than 3 Years, Old Hydraulic Concrete Surfaces and All Retracing. Air-blast or broom old hydraulic cement concrete surfaces and all asphalt surfaces to remove loose material, unless otherwise shown on the plans.
- (c) Cleaning for Asphalt Surfaces Older than 3 Years and New Hydraulic Concrete (No Existing Markings). Clean in accordance with Item 678, "Pavement Surface Preparation for Markings," to remove curing membrane, dirt, grease, loose and flaking existing

construction markings, and other forms of contamination.

- (3) **Application.** Apply markings during good weather unless otherwise directed. If markings are placed at Contractor option when inclement weather is impending and the markings are damaged by subsequent precipitation, the Contractor is responsible for all costs associated with replacing the markings if required.

Adding thinner to the coating is not allowed.

Apply on surfaces with a minimum surface temperature of 50°F.

- (4) **Performance Requirements.** All markings and replacement markings must meet the requirements of this Item for at least 15 calendar days after installation. Remove pavement markings that fail to meet requirements and replace at the Contractor's expense unless otherwise directed. Replace all failing markings within 30 days of notification.

If the material does not cure properly, remains soft and tacky, or discolors and the Engineer requires removal, at least 90% of the material must be removed by approved methods before restriping will be allowed.

Conduct visual inspections and instrument evaluations of placed pavement markings.

- (a) **Visual Inspections.** Conduct a visual inspection of the stripe placement according to Tex-828-B, "Determining Functional Characteristics of Pavement Markings." Conduct reviews during dry off-peak traffic periods without closing any lanes. Conduct the inspection within 7 days after the stripe has been placed. A department's designated representative will be present for the inspection.
- (b) **Instrument Evaluations.** Conduct instrument evaluations in areas as directed by the Engineer. For edge line markings; center-line/no passing barrier-line; and lane lines; meet the following initial minimum retro reflectivity values when measured between 5 and 15 days after application:

White markings: 250 millicandelas per square meter per lux

(mcd/m²lux) Yellow markings: 200 mcd/m²lux

Make all measurements in the direction of traffic flow, except for broken centerline on two-way roadways, where measurements will be made in both directions.

Provide a portable retro reflectometer, which uses 30-meter geometry meeting the requirements described in ASTM E 1710.

Provide a report to the Engineer of all readings taken and their approximate locations.

The Contractor is responsible for traffic control when making initial retroreflectivity measurements.

At locations approved by the Engineer, take a minimum of 1 measurement every mile on each series of markings (i.e. edge-line, center skip line, each line of a double line...etc.). If more than one measurement is taken, the measurements will be averaged. For all markings measured in both directions, take a minimum of 1 measurement in each direction.

If the measurement taken on a specific series of markings within each mile segment falls below the initial minimum retroreflectivity values, take a minimum of 5 more measurements within that mile segment for that series of marking. If the average of these 5 measurements falls below the initial minimum retroreflectivity requirements, that mile segment of the applied markings is considered unacceptable. Restripe any unacceptable segments

until initial minimum retroreflectivity requirements are met.

- (5) **Warranty.** Before application of pavement markings, provide TxDOT a warranty by the Manufacturer that the Manufacturer will replace, at no cost to the department, except as noted below, any materials which fail to meet the warranty performance requirements as listed in this specification for 3 years from the date the portion of the facility containing those markings becomes operational.

If the markings fail to meet the requirements of Special Specification 1653, the manufacturer will provide the replacement materials and labor that will restore the pavement marking retroreflectivity values to warranty levels or greater.

- (a) **Warranty Performance Requirements.** Pavement markings will meet the following performance requirements for the warranted life of the materials.

Reflectivity. When measured at 30-meter geometry, maintain a minimum retroreflectivity value of:

- White markings: 150 mcd/m²lux.
- Yellow markings: 125 mcd/m²lux.

Durability. Pavement markings will maintain the color (daytime and nighttime reflected), length, width, shape, and configuration shown on the plans. Nighttime and daytime color will be essentially the same color as the standard maintained by the department's Construction Division, Materials Section.

Deviations in length, width, shape, or configuration caused by, in the Engineer's opinion, pavement failure will not be considered as a failure of the pavement markings.

- (b) **Reflectivity Determination.** The following procedures will be used to determine the performance of pavement markings for warranty purposes. Periodic visual night inspection will be made by TxDOT as described by TxDOT Test Method TEX-828-B, when deemed necessary by the Engineer. The Manufacturer's representative may accompany the Engineer on a subsequent inspection when pavement markings do not appear to meet minimum retroreflectivity or nighttime color requirements. All retroreflectivity measurements shall be made on a clean, dry surface at a minimum temperature of 40°F. The average retroreflectivity value for the Measurement Zone shall be used to determine if the minimum performance values have been met.

Longitudinal Markings. A Measurement Zone shall consist of either edge lines, center lines, or lane lines, but not in combination. Random sampling techniques shall be used to determine the average reflectivity throughout the zone.

- (c) **Replacement.** Pavement markings that do not meet the warranty performance requirements will be replaced by the Manufacturer normally within 15 days unless weather conditions or other conditions as approved by the Engineer dictate otherwise, but not more than 90 days. Notification will be by mail, return receipt requested, to an address as specified by the Manufacturer as indicated on the warranty.

The Manufacturer will be responsible for application, at no cost to the department, of all replacement materials covered by the warranty.

- (d) **Exclusions.** Up to 5% of the markings on any project may at the discretion of the Engineer, be excluded from the replacement provisions provided that the failure is a result of outside causes rather than defective material as determined by the Engineer. Outside causes include, without limitation: Extreme wear at intersections or crossover areas, unusually large amounts of heavy vehicles. Outside causes exclude, without limitation: Linear, free rolling traffic regardless of

ADT.

Pavement markings damaged by snow or ice removal operations or other natural occurrences such as flooding, earthquakes, or landslides are exempt from warranty.

5. **Measurement.** This Item will be measured by the foot; by each word, symbol, or shape; or by any other unit shown on the plans. Each stripe will be measured separately.

This is a plans quantity measurement Item. The quantity to be paid is the quantity shown in the proposal unless modified by Article 9.8, "Plans Quantity Measurement." Additional measurements or calculations will be made if adjustments of quantities are required.

6. **Payment.** The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Reflectorized Multipolymer Pavement Markings" of the types and colors, shape, width, size, and thickness as applicable. This price will be full compensation for materials, application of pavement markings, equipment, labor, tools, and incidentals.

Surface preparation, when shown on the plans, will be paid for under Item 678, "Pavement Surface Preparation for Markings."

When replacement markings are required due to damage to the original markings from precipitation, and the original markings were placed at the direction of the Department, the plans quantity requirements under "Measurement" do not apply to the original and replacement markings. The Contractor will be paid for the actual quantity of original and replacement markings at the unit price bid for that bid item.

END OF SECTION 33 16 53

SECTION 33 11 00
WATER DISTRUBUTION SYSTEM

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.
- B. Coordinate the work of this Section with the work of Section 33 11 13 - Water Lines

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 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, 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, 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 32 13 13 - 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 City requirements.

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:

1. Provide water service connections, where necessary, in accordance with the Texas 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:

1. 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 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. 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

- A. 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

- A. ANSI A 21.11/AWWA C111 - Standard for Rubber-Gasket Joints for Ductile - Iron Pressure Pipe and Fittings.
- B. ANSI/NSF Standard 61 - Drinking Water System -Health Components.
- C. ASTM A 36 - Standard Specification for Carbon Structural Steel
- D. ASTM A 536 - Standard Specification for Ductile Iron Castings
- E. ASTM A 126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
- F. ASTM B 21 - Standard Specification for Naval Brass Rod, Bar, and Shapes.
- G. ASTM B 98 - Standard Specification for Copper-Silicon Alloy Rod, Bar, and Shapes.
- H. ASTM B 301 - Standard Specification for Free-Cutting Copper Rod and Bar.
- I. ASTM B 584 - Standard Specification for Copper Alloy Sand Casting for General Application.

- J. ASTM E 165 - Standard Test Method for Liquid Penetrant Examination.
- K. ASTM E 709 - Standard Guide for Magnetic Particle Examination
- L. ASTM F 1674 - Standard Test Method for Joint Restraint Products for Use with PVC Pipe.
- M. AWWA C 206 - Standard for Field Welding of Steel Water Pipe.
- N. AWWA C 207 - Standard for Steel Pipe Flanges for Waterworks Service - Sizes 4 Inches through 144 Inches.

1.4 SUBMITTALS

- A. Conform to requirements of Section 01.
- B. Conform to submittal requirements of applicable Section for type of pipe used.
- C. 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 2 – PRODUCTS (NOT USED)

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 use 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 City 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 City.
- I. City of Conroe 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

A. Handling:

1. Place pipe along project site where storm water or other water will not enter or pass through pipe.
2. Load, transport, unload, and otherwise handle pipe and fittings to prevent damage of any kind. Handle and transport pipe with equipment designed, constructed and arranged to prevent damage to pipe, lining and coating. Do not permit bare chains, hooks, metal bars, or narrow skids or cradles to come in

contact with coatings. Where required, provide pipe fittings with sufficient interior strutting or cross bracing to prevent deflection under their own weight.

3. Hoist pipe from trench side into trench by means of sling of smooth steel cable, canvas, leather, nylon or similar material.
 4. For large diameter water lines, handle pipe only by means of sling of canvas, leather, nylon, or similar material. Sling shall be minimum 36 inches in width. Do not tear or wrinkle tape layers.
 5. Use precautions to prevent injury to pipe, protective linings and coatings.
 - a. Package stacked pipe on timbers. Place protective pads under banding straps at time of packaging.
 - b. Pad fork trucks with carpet or other suitable material. Use nylon straps around pipe for lift when relocating pipe with crane or backhoe.
 - c. Do not lift pipe using hooks at each end of pipe.
 - d. Do not place debris, tools, clothing, or other materials on pipe.
 6. Repair damage to pipe or protective lining and coating before final acceptance.
 7. Reject pipe with visible cracks (not meeting exceptions) and remove from project site.
- B. Cleaning: Thoroughly clean and dry interior of pipe and fittings of foreign matter before installation, and keep interior clean until Work has been accepted. Keep joint contact surfaces clean until jointing is completed. Do not place debris, tools, clothing or other materials in pipe. After pipe laying and joining operations are completed, clean inside of pipe and remove debris.
- C. Inspection: Before installation, inspect each pipe and fitting for defects. Reject defective, damaged or unsound pipe and fittings and remove them from site.

3.3 EARTHWORK

- A. Conform to applicable provisions of Section 33 05 28 Trenching and Backfilling for Utilities.
- B. Bedding: Use bedding materials in conformance with Section 33 05 28 Trenching and Backfill for Utilities
- C. Backfill: Use bank run sand or earth or native soil as specified in Section 33 05 28 Trenching and Backfill for Utilities. Backfill excavated areas in same day excavated. When not possible, cover excavated areas using steel plates on paved areas and other protective measures elsewhere.
- D. Place material in uniform layers of prescribed maximum 8-inch loose lifts and wet or dry material to approximately optimum moisture content. Compact to prescribed density. Water tamping is not allowed.
- E. Pipe Embedment: Including 6-inch pipe bedding and backfill to 12 inches above top of pipe.

3.4 PIPE CUTTING

- A. Cut pipe 12 inches and smaller with standard wheel pipe cutters. Cut pipe larger than 12 inches in manner approved by the City. Make cuts smooth and at right angles to axis of pipe. Bevel plain end with heavy file or grinder to remove sharp edges.

3.5 PIPING INSTALLATION

- A. General Requirements: *(Notify City 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 city block length of not more than 300 feet of pipe in trench ahead of backfilling operations. Cover or backfill laid pipe if pipe laying operations are interrupted and during non-working hours. Place backfill carefully and simultaneously on each side of pipe to avoid lateral displacement of pipe and damage to joints. If adjustment of pipe is required after it has been laid, remove and re-lay as new pipe.
- B. Install pipe continuously and uninterrupted along each street on which work is to be performed. Obtain approval of the City prior to skipping any portion of Work.
- C. Protection of Pipeline: Securely place stoppers or bulkheads in openings and in end of line when construction is stopped temporarily and at end of each day's work.
- D. Perform Critical Location as shown on Drawings. Refer to Section 33 05 28 Trenching and Backfill for Utilities.
- E. Laying Large Diameter, 24-inch or greater Water Line
 - 1. Lay not more than 200 feet of pipe (unless approved by the City) 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 City. 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.
- F. Perform following additional procedures when working on plant sites.
1. Seventy-two hours prior to each plant shut down or connection, schedule coordination meeting with City 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 City 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 City and the City's Utility Maintenance Division operator is present to observe.
 4. Coordinate with City'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 City.
 6. Perform critical stages of Work identified on Drawings at night or during low water demand months as specified in Section 01.
 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 City 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.

- G. For tie-ins to existing water lines, provide necessary material on hand to facilitate connection prior to shutting down existing water lines. Provide the City a minimum of one week notice prior to shutting down existing water lines. All valves shall be operated by City staff only.

3.6 JOINTS AND JOINTING

- A. 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.

- B. Flanged Joints where required on Concrete Cylinder Pipe, Bar Wrapped Pipe, Ductile Iron Pipe, or Steel Pipe:

1. AWWA C 207. Prior to installation of bolts, accurately center and align flanged joints to prevent mechanical 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."
- C. 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 City. Make adjustments in thrust restraint lengths at no additional cost to the City.
 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.
- D. Make curves and bends by deflecting joints or other method as recommended by manufacturer and approved by the City.
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 City 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

- A. Support piping as shown on Drawings and as specified in this Section, to maintain line and grade and prevent transfer of stress to adjacent structures.
- B. Where shown on Drawings, anchor pipe fittings and bends installed on water line by welding consecutive joints of pipe together to distance each side of fitting. Restrained length, as shown on Drawings, assumes that installation of pipe and subsequent hydrostatic testing begins upstream and proceed downstream, with respect to normal flow of water in pipe. If installation and testing differs from this assumption, submit for approval revised method of restraining pipe joints upstream and downstream of device used to test against (block valve, blind flange or dished head plug).
- C. Use adequate temporary blocking of fittings when making connections to distribution system and during hydrostatic tests. Use sufficient anchorage and blocking to resist stresses and forces encountered while tapping existing water line.

3.8 POLYETHYLENE WRAP

- A. Double wrap ductile iron pipe and appurtenances (except fire hydrants and fusion bond or polyurethane coated fittings) with 8-mil polyethylene film.
- B. Do not use polyethylene wrap if pipe is cathodically protected.

3.9 CLEANUP AND RESTORATION

- A. Cleanup and restore site as directed by the City of Conroe.

3.10 CLEANING PIPING SYSTEMS

- A. Remove construction debris or foreign material and thoroughly broom clean and flush piping systems. Provide temporary connections, equipment and labor for cleaning. Owner must inspect water line for cleanliness prior to filling.

3.11 DISINFECTION OF WATER LINES

- A. Conform to TCEQ requirements for Disinfection of Water Utility Distribution.

3.12 FIELD HYDROSTATIC TESTS

- A. Conform to TCEQ requirements for Field Hydrostatic Testing.

WATER LINES

SECTION 33 11 13

END OF SECTION 33 11 13

SECTION 33 31 00
SANITARY UTILITY SEWERAGE PIPING

PART 1 – GENERAL**1.1 SECTION INCLUDES**

- A. Buried Pipe and Fittings
- B. Cleanouts
- C. Sewage Ejector
- D. Field Quality Control

1.2 RELATED SECTIONS

- A. Section 01
- B. Section 33 11 00 – Water Distribution System
- C. Section 31 00 00 – Earthwork
- D. Section 33 05 16 – Utility Structures
- E. Section 33 05 28 – Trenching and Backfilling for Utilities

1.3 MEASUREMENT AND PAYMENT

- A. General
 - 1. 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
 - 1. 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, under Article entitled “Lump-Sum Measurement”.
- C. Unit Price
 - 1. 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:
 - 2. 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.
3. Payment:
- a. 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.

1.4 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):
 - 2. ASTM A74 Specification for Cast Iron Soil Pipe and Fittings
 - 3. ASTM C12 Practice for Installing Vitrified Clay Pipe Lines
 - 4. ASTM C14 Specification for Concrete Sewer, Storm Drain, and Culvert Pipe
 - 5. ASTM C76 Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
 - 6. ASTM C425 Specification for Compression Joints for Vitrified Clay Pipe and Fittings
 - 7. ASTM C443 Specification for Joints for Circular Concrete Sewer and Culvert Pipe, using Rubber Gaskets
 - 8. ASTM C564 Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings
 - 9. ASTM C700 Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength and Perforated
 - 10. ASTM D1785 Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
 - 11. ASTM C2321 Practice for Underground Installation of Flexible Thermoplastic

Sewer Pipe

12. ASTM D2466 Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings, Schedule 40
 13. ASTM D2564 Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) plastic Pipe and Fittings
 14. ASTM D2565 Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, Vent Pipe, and Fittings
 15. ASTM D2729 Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
 16. ASTM D2855 Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings
 17. ASTM D3139 Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
 18. 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.
- E. The Contractor shall be responsible for obtaining all such standards and for compliance with such standards as applicable.

1.5 SUBMITTALS

- A. Refer to Section 01, 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 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.

1.6 SUBMITTALS FOR CLOSEOUT

- A. Refer to Section 01, for submittal requirements and procedures.

- B. Record actual location of piping mains, valves, connections, thrust restraints, and invert elevations.

1.7 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.
- E. Clay Pipe:
 - 1. Pipe: ASTM C700, unperforated.
 - 2. Joint Device: ASTM C425, compression joint.

F. Concrete Pipe:

1. ASTM C14, Class 3, unreinforced.
2. Joint Device: ASTM C443, rubber compression gasket joint.

G. Reinforced Concrete Pipe:

1. Pipe: ASTM C76, Class III, with steel reinforcement.
2. Joint Device: ASTM C443, rubber compression gasket joint

H. 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.

I. 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 City requirements.

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 longswep 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, 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	138	198	309	444	595	680
150	100	165	238	375	510	595	680
175	123	193	277	425	510	595	680
200	141	220	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 SEWERAGE SYSTEM

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: Specifications for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe.
- e. C 150: Specification for Portland Concrete
- 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 Controller Inside Diameter
- m. D 2412: Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading
- n. D 2447: Specifications for Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter.
- o. D 2466: Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
- p. D 2467: Socket Type Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
- q. D 2564: Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings.
- r. D 2665: Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste and Vent Pipe and Fittings.
- s. D 2729: Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- t. D 2855: Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
- u. D 3035: Specifications for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Controlled Outside Diameter.
- v. D 3212: Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
- w. D 3261: Specification for Butt Heat Fusion of Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.
- x. D 3350: Specification for Polyethylene Plastics Pipe and Fittings Material.
- y. F 402: Safe Handling of Solvent Cements and Primers Used for Joining Thermoplastic Pipe and Fittings.
- z. F405: Specification for Corrugated Polyethylene (PE) Tubing and Fittings.
- aa. F 412: Standard Terminology Relating to Plastic Piping Systems.
- bb. F 477: Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
- cc. F 656: Specification for Primers for Use in Solvent Cement Joints of Poly (Vinyl Chloride) (PVC) Pipes and Fittings.

- dd. F 714: Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.
 - ee. F 913: Standard Specification for Thermoplastic Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
 - ff. 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 01 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 Huntsville 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

1. Type as indicated on the Drawings and conforming to applicable Standards for Conroe or Montgomery County Right-of-Way, or SHSU Property. Frame and Cover ASTM A 48 Class 35 B.

B. Inlet

1. Type as indicated on the Drawings and conforming to applicable Standards in Conroe or Montgomery County Right-of-Way, or SHSU Property. Frame and Grate ASTM A 48 Class 35 B.

C. Reinforcing Steel

1. As specified in Section 032100 - Concrete Reinforcement of these Specifications.

- D. Cast-in-Place Concrete (Class 3000)
 - 1. 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

1. 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

2. 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

3. Color test per ASTM C 40, color not darker than standard color.

B. Cement

1. ASTM C 150, Type I or II.

C. Water

1. Potable, from municipal supplies approved by the State or City Health Department.

D. Mixture

1. 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 SHSU.

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 Huntsville right-of-way shall meet the applicable requirements.

3.2 EXCAVATION

- A. All excavation shall be in accordance with Section 330528 – Trenching & Backfill for

Utilities 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