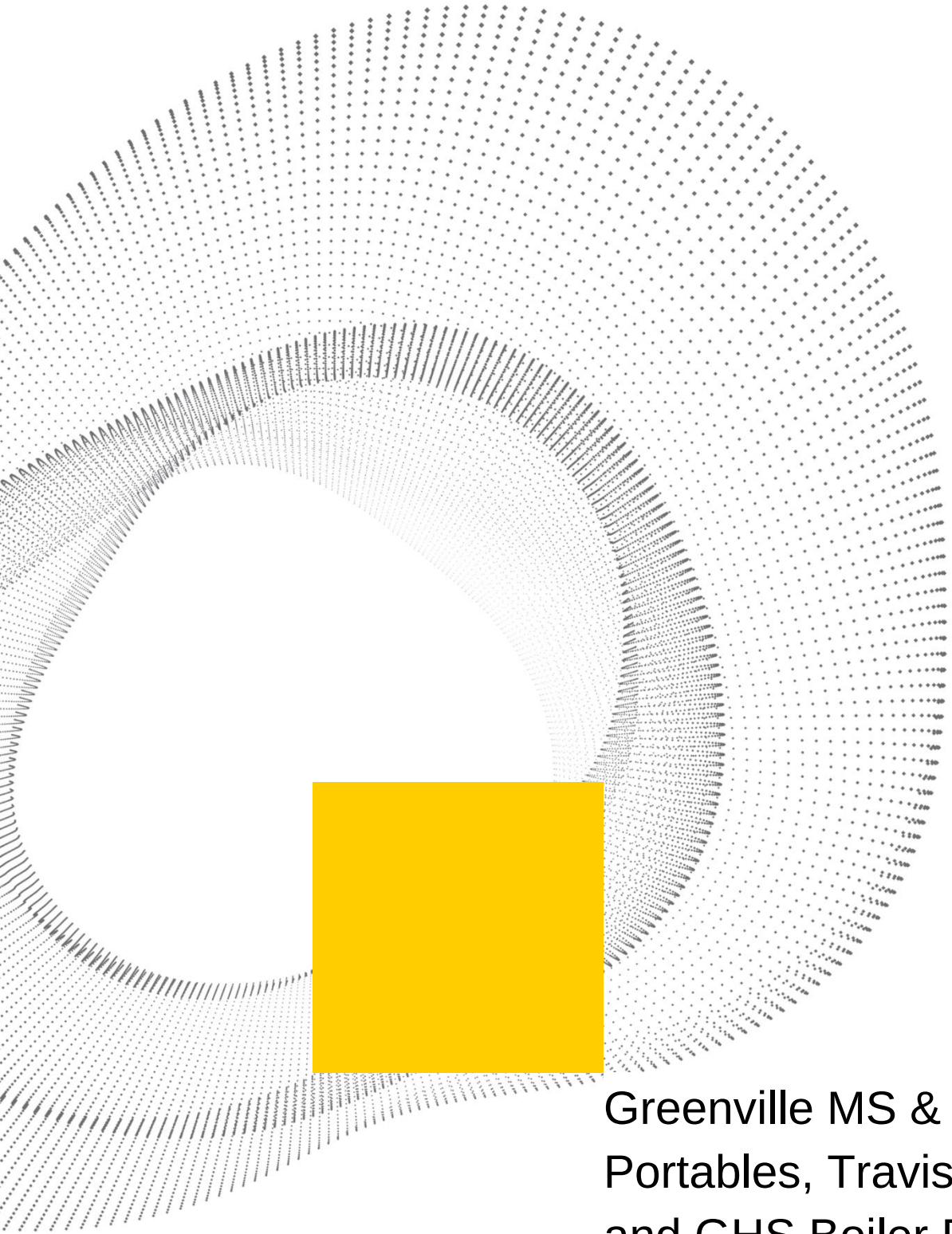
CORGAN

Issued for Construction
27 July 2023
23168.0000

Project Manual

Corgan Associates, Inc.
401 North Houston Street
Dallas, Texas 75202
214 748 2000



Greenville MS & LP Waters Portables, Travis Renovation, and GHS Boiler Replacement

For Greenville ISD

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DOCUMENT 00 01 07

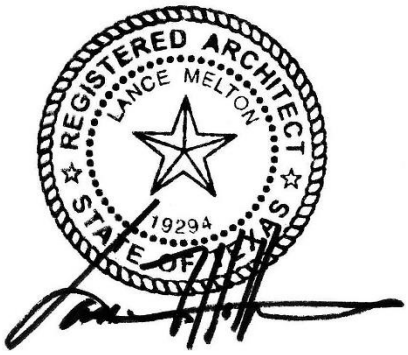
SEALS PAGE

Greenville MS & LP Waters Portables, Travis Renovation, and GHS Boiler Replacement For Greenville ISD

Project Manual

Issued for Construction
27 July 2023
23168.0000

ARCHITECT OF RECORD
Corgan Associates, Inc.
401 North Houston Street
Dallas, Texas 75202
214 748 2000
Responsible for Sections marked with (CAI) in Document 00 01 10 "Table of Contents."



07/27/23
Architect of Record Date

CIVIL ENGINEER OF RECORD
MTG Engineers & Surveyors, Inc.
5930 Summerhill Road
Texarkana, Texas 75503
903 838 8533
Firm License #: F-354
Responsible for Sections marked with (MTG) in Document 00 01 10 "Table of Contents."

Civil Engineer of Record — Date: 07/27/23

MECHANICAL ENGINEER OF RECORD
EMA Engineering & Consulting, Inc.
328 S. Broadway Ave.
Tyler, Texas 75702
903 581 2677
Firm License #: F-893
Responsible for Sections marked with (EMA-M) in Document 00 01 10 "Table of Contents."

Mechanical Engineer of Record — Date: 07/27/23

ELECTRICAL ENGINEER OF RECORD
EMA Engineering & Consulting, Inc.
328 S. Broadway Ave.
Tyler, Texas 75702
903 581 2677
Firm License #: F-893
Responsible for Sections marked with (EMA-E) in Document 00 01 10 "Table of Contents."

Electrical Engineer of Record — Date: 07/27/23

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DOCUMENT 00 01 10

TABLE OF CONTENTS

Seal Codes: For the seal column codes, refer to Document 00 01 07 "Seals Page."

END OF DOCUMENT

GREENVILLE ISD - PURCHASING DEPARTMENT
4004 MOULTON STREET
GREENVILLE, TEXAS 75401

July 28, 2023

REQUEST FOR COMPETITIVE SEALED PROPOSALS NUMBER 24-002

Greenville ISD – GMS & LP Waters Portables, Travis Renovation, and GHS Boiler Replacement

The Greenville Independent School District ("GISD" or "District") is issuing this Request for Competitive Sealed Proposals Number 24-002 for a general contractor for GMS & LP Waters Portables, Travis Renovation, and GHS Boiler Replacement ("CSP" or "CSP #24-002"). All qualified firms are invited to submit Competitive Sealed Proposals ("Proposals") to the Greenville Independent School District, Purchasing Office, 4004 Moulton Street, Greenville, Texas 75401 until the date and time indicated below. The package containing your Proposal (1 original and 6 copies), must be hand delivered to the address above, and shall be submitted in a sealed, opaque envelope that is plainly marked with:

Competitive Sealed Proposal for:

GMS & LP Waters Portables, Travis Renovation, and GHS Boiler Replacement
CSP NUMBER 24-002

The deadline for Proposals is 2:00 p.m., THURSDAY, AUGUST 24, 2023 ("Deadline"). Proposals received after the Deadline will be returned unopened.

The District reserves the right to reject any and / or all Proposals, to award contracts for individual products or services as may appear advantageous, and to negotiate separately in any manner necessary to serve the best interest of the District. **The District reserves the right to seek clarification and/or request additional information.** District's waiver of any deviations in any Proposal will not constitute a modification of this CSP #24-002 and will not preclude District from asserting all rights against contractor for failure to fully comply with all terms and conditions of this CSP #24-002. Should a Proposal contain conflicting terms, the District reserves the right to enforce the term or terms in such Proposals that it determines to be in the best interest of the District, and Contractor agrees to be bound by the terms it has proposed that are most favorable to the District. All Proposals in response to this CSP #24-002 become the property of the District and may be subject to release to any requestor under the provisions of the Texas Public Information Act, Chapter 552 of the Texas Government Code, and Attorney General Opinions issued under that statute. If Contractor believes any portion of the Proposal is excepted from release, it should clearly mark such portion as "CONFIDENTIAL," and provide written legal authority as to why Contractor believes such information should not be released.

No Proposals may be withdrawn for a period of forty-five (45) days after the Deadline without the prior written consent of the Board of Trustees, Greenville Independent School District.

The District may re-issue another CSP for the services as described in this CSP or similar services at any time.

Pursuant to Texas Government Code §2269.053, the GISD Board of Trustees has delegated and authorized a Construction Contractor Selection Committee to receive and review Proposals, and recommend to the Board those contractors it believes will provide the best value to the District based on the criteria and weights provided herein.

GREENVILLE ISD - PURCHASING DEPARTMENT
4004 MOULTON STREET
GREENVILLE, TEXAS 75401

A Pre-Proposal Conference will be held at 3:30 PM, Tuesday, August 15, 2023 at the District Administration (4004 Moulton Street, Greenville, TX 75401). The conference is not mandatory but the District highly recommends Contractor representation. The District does not anticipate having additional walkthroughs or site visits; therefore, any personnel or subcontractors who have a need to visit this site should plan to attend this conference.

- A contractor that fails to have representation at the conference shall not be excused from having complete knowledge of the specifications and facility requirements. Price adjustments, change orders, etc., that would be considered a part of the working knowledge of the Contractor, based on the project specifications, pre-Proposal conference, and the walkthrough (as applicable), will not be accepted by the District.

Thank you for your interest.

Dr. Greg Anderson
Assistant Superintendent of Operations, GISD
903.408.4422
Email: andersonw@greenvilleisd.com

WAIVER OF CLAIMS: BY TENDERING A PROPOSAL IN RESPONSE TO THIS CSP #24-002, THE CONTRACTOR ACKNOWLEDGES THAT IT HAS READ AND FULLY UNDERSTANDS THE REQUIREMENTS FOR SUBMITTING A PROPOSAL, AND THE PROCESS USED BY THE DISTRICT FOR SELECTING A CONTRACTOR. FURTHER, BY RESPONDING AND FOR BEING CONSIDERED FOR THIS PROJECT, THE CONTRACTOR FULLY, VOLUNTARILY AND UNDERSTANDINGLY WAIVES AND RELEASES ANY AND ALL CLAIMS AGAINST DISTRICT, OR ANY OF ITS TRUSTEES, OFFICERS, AGENTS AND/OR EMPLOYEES THAT COULD ARISE OUT OF THE EVALUATION, REJECTION OR RECOMMENDATION OF ANY PROPOSAL SUBMITTED IN RESPONSE TO THIS CSP #24-002.

Request for Competitive Sealed Proposal Index

GREENVILLE INDEPENDENT SCHOOL DISTRICT
GMS & LP WATERS PORTABLES, TRAVIS RENOVATION, AND GHS BOILER REPLACEMENT
Request for Competitive Sealed Proposal Number 24-002

SECTION I - INSTRUCTIONS TO PROPOSERS

Pursuant to the provisions of Texas Government Code, in particular Chapter 2269, Subchapter D, the Greenville Independent School District ("GISD," "Greenville ISD" or the "District") is seeking Proposals from firms ("Contractor" or "Proposer") qualified and experienced in providing construction services related to the construction project described in Section III herein. The District reserves the right to adjust the scope of work based on its needs and estimated construction costs at the time any contract entered into as a result of this CSP is executed.

This Request for Competitive Sealed Proposals Number 24-002 ("CSP" or "CSP #24-002") contains information and instructions to enable interested Proposers to prepare and submit a Proposal and describes the terms and conditions that the successful Contractor will be expected to accept as part of the performance of the Contract.

1. **PRE-PROPOSAL CONFERENCE.** A Pre-Proposal Conference will be held 3:30 PM, Tuesday, August 15, 2023 at the District Support Center (4004 Moulton Street, Greenville, TX 75401). Site visits are allowed by appointment only.
   - 1.1. The conference is not mandatory, but the District highly recommends Contractor representation.
   - 1.2. If necessary, the District will issue answers to questions, clarifications and scope changes to all known CSP document holders via addendum.
   - 1.3. The District does not anticipate having additional walkthroughs or site visits; therefore, any personnel or subcontractors who have a need to visit this site should plan to attend this conference.
   - 1.4. A contractor that fails to have representation at the conference shall not be excused from having complete knowledge of the specifications and facility requirements. Price adjustments, change orders, etc., that would be considered a part of the working knowledge of the Contractor, based on the project specifications, pre-Proposal conference, and the walkthrough (as applicable), will not be accepted by the District.

2. **PRE-RESPONSE QUESTIONS**. All questions regarding clarification or interpretation of this CSP #24-002 will be submitted in writing by the Proposer, and must be received by **5:00 p.m., Thursday, August 17, 2023**. No questions will be addressed unless provided in writing. All correspondence pertaining to this CSP will be addressed to:

Dr. Greg Anderson
Greenville Independent School District
Assistant Superintendent of Operations
4004 Moulton Street
Greenville, Texas 75401
Email: andersonw@greenvilleisd.com

- 2.1. Inquiries about the Project and CSP document should be addressed to the Assistant Superintendent of Operations – Greenville ISD Purchasing Department in writing by e-mail.
- 2.2. PROPOSERS ARE REMINDED THAT VERBAL RESPONSES OR CONVERSATIONS ARE NOT BINDING - ONLY QUESTIONS ANSWERED BY FORMAL WRITTEN ADDENDA WILL BE BINDING AND WILL BE MADE PART OF THE PROPOSAL DOCUMENTS.
- 2.3. All interpretations or clarifications considered necessary by and approved by GISD, in response to Proposer's request, will be issued by written Addenda.
- 2.4. Oral and other interpretations or clarifications will be without legal effect. Only questions answered by formal written Addenda will be binding.
- 2.5. GISD is not responsible for any other explanation or interpretations, which anyone presumes to make.

2.6. Any interpretations, corrections, approvals, supplemental instructions or changes to the Proposal Documents will be made by written Addenda. Sole issuing authority of addenda shall be vested in the Greenville Independent School District.

3. **PREPARATION OF PROPOSALS**.

3.1. ***Proposal*.** Each Proposer shall furnish the information required by this CSP. The person signing the Proposal must be an authorized representative of the proposing firm. All erasures or other changes must be initialed by the submitting party.

3.2. ***Exceptions***. If any exceptions are taken to any portion of the CSP, including the AIA A101-2017, AIA A101-2017 Exhibit A, or AIA A201-2017 contracts as amended by the District, the Proposer must clearly indicate the exceptions taken and include a full explanation as a separate attachment to the Proposal. Failure to identify exceptions or proposed changes with a full explanation will constitute acceptance by the Proposer of the CSP as proposed by the District. The District reserves the right to reject a Proposal containing exceptions, additions, qualifications or conditions not called for in the Solicitation.

3.3. ***Tax Exemption***. The District is usually exempt from City, State and Federal Taxes. Proposals may not include exempted taxes. If it is determined that tax was included in the Proposal, it will not be included in the tabulation or any awards. Tax exemption certificates will be furnished upon request. Under no circumstances shall the District be liable to pay exempt taxes under any Contract.

4. **SUBMISSION OF PROPOSALS**.

4.1. ***Submission***.

4.1.1. The Proposal shall be returned in an opaque, sealed envelope or package marked on the outside with the Proposer's name, address, project and CSP number, as follows:

Competitive Sealed Proposal for:

GMS & LP WATERS PORTABLES, TRAVIS RENOVATION, AND GHS BOILER REPLACEMENT
CSP NUMBER 24-002

4.1.2. Proposals must be hand delivery in sufficient time so as to be received and time stamped in the Greenville Independent School District Purchasing Department **before** the Deadline shown on this CSP in section 4.2.1 below. It is the sole responsibility of the Proposer to ensure timely delivery of the Proposal. The District will not be responsible for failure of service on the part of the U.S. Postal Office, courier companies, or any other form of delivery service chosen by the Proposer, and time/date stamp clock in District's office shall be the official time of receipt. NO ORAL, ELECTRONIC OR FAX PROPOSALS WILL BE CONSIDERED.

4.1.3. Receipt of an Addendum must be acknowledged by signing and returning the Addendum with the Proposal or under separate cover prior to the due date. If the Addendum is submitted under separate cover, the document must be returned in an opaque, sealed envelope marked on the outside with the Proposer's name, address and Proposal number, indicating the CSP and addendum number.

4.2. ***Closing Time***.

4.2.1. All Proposals must be received in the GISD Purchasing Department **before 2:00 p.m. on Thursday, AUGUST 24, 2023** (the Proposal "Deadline"). Reference the CSP #24-002 and closing time and date on correspondence. Address response to:

Greenville Independent School District
Dr. Greg Anderson
4004 Moulton Street
Greenville, Texas 75401

4.2.2. On the Deadline at the above location, Proposals will be publicly opened and the respondent's names and price for construction services read aloud.

4.2.3. Proposals received after the published Deadline shall not be considered.

5. **PROPOSAL**. GISD has established guidelines to facilitate evaluation and comparison of each Proposal. GISD expects the Proposer to follow these guidelines. The Proposer will organize their response in accordance with the following:

NOTE: ALL PROPOSALS MUST BE HAND-DELIVERED.
PROPOSAL FORM PART "A"
SUBMITTED ON THURSDAY, AUGUST 24, 2023: NO LATER THAN 2:00 P.M.

A. Proposal Form – Part "A" – Base Bid and Alternates Proposal

B. ( ) Bid Bond or Bid Security (Include base bid and all alternates)

C. ( ) Vendor Compliance to State Law

PROPOSAL FORM PART "B" – QUALIFICATIONS

SUBMITTED ON THURSDAY, AUGUST 24, 2023: NO LATER THAN 4:00 P.M.

A. ( ) Proposal Part "B" – Qualifications – five (5) copies of the information as outlined in the Proposal, Tabbed, and Bound.

B. ( ) Contractor's Qualification Statement AIA Document A305 along with proposed sub-contractor list

C. ( ) Felony Conviction Notification Form

5.1. ***Required Submittal Documents***. Proposers are required to submit the following:

5.1.1. Number of Submittals. One (1) executed original and six (6) copies, including the original Proposal (Bid) Bond, Proof of Financial Status information, a completed Price Proposal Form, and all other submittals required by this CSP. The original must be marked clearly on the outside cover with "Original".

5.1.2. Proposal (Bid) Bond.

5.1.2.1. The Proposal must be accompanied by a Proposal Bond or cashier's check issued by a bank satisfactory to the District, in the minimum amount of 5% of the proposed cost of construction.

5.1.2.2. The bond must be on the Proposal Bond form prescribed by GISD (a copy is included in Section V) or an acceptable version of the GISD form.

5.1.2.3. GISD may execute the Proposer's Proposal Bond or cashier's check as liquidated damages in the event that the Proposer withdraws its Proposal prior to the award by the Board of Trustees and/or in the case of the awarded Proposer, the awarded Proposer fails within ten (10) days following the award to execute and return the Agreement, together with the Performance and Payment Bonds with acceptable surety.

5.1.3. Proof of Financial Status. The Proposer shall provide the following with the Proposer's executed original Proposal.

5.1.3.1. Financial statement, preferably audited, including your organization's latest balance sheet and income statement showing the following items:

5.1.3.1.1. Current assets (e.g., cash, joint venture accounts, accounts receivable, notes receivable, accrued income, deposits, materials inventory, and prepaid expenses).

5.1.3.1.2. Non-current assets (e.g., net fixed assets, other assets).

5.1.3.1.3. Current liabilities (e.g., accounts payable, notes payable, accrued expenses, provision for income taxes, advances, accrued salaries and accrued payroll taxes).

5.1.3.1.4. Non-current liabilities (e.g., notes payable).

5.1.3.1.5. Capital accounts and retained earnings (e.g., capital, capital stock, authorized and outstanding shares par value, earned surplus, and retained earnings).
5.1.3.1.6. Revenues (e.g. sales, other income).
5.1.3.1.7. Expenses (e.g. cost of sales, administrative, general, interest expense, other).
5.1.3.1.8. Income (Loss) from Continuing Operations before Income Tax.
5.1.3.1.9. Income (Loss) from Continuing Operations before Cumulative Effect of Accounting Change.
5.1.3.1.10. Net Income (Loss).

5.1.3.2. Name and address of firm preparing attached financial statement and date thereof. Attach a copy of the auditor's report, compilation report, or review report from an independent CPA firm.

5.1.3.3. If the financial statement is not the identical name of the Proposer, provide an explanation as to the relationship and financial responsibility of the organization whose financial statement is provided (e.g., parent-subsidiary).

5.1.3.4. If the organization identified in the financial statement will not act as Guarantor complete contact information.

5.1.3.5. Provide the following Financial Institution information.
5.1.3.5.1. Name of company;
5.1.3.5.2. Name of agent;
5.1.3.5.3. Address of agent; and
5.1.3.5.4. Phone number of agent.

5.1.3.6. Provide the following Surety Company information.
5.1.3.6.1. Name of bonding company;
5.1.3.6.2. Name of agent;
5.1.3.6.3. Address of agent; and
5.1.3.6.4. Phone number of agent.

5.1.3.7. Financial status will be either pass or fail. Proposers whose financial status fails shall be deemed not qualified and will not be considered for award.

5.1.4. Price Proposal Form.

5.1.4.1. Price Proposal. The Proposer shall complete and return the Price Proposal Form, Section IV, providing all requested information.
5.1.4.1.1. Base Proposal price to include all items listed in the Project Scope, detailed in the specifications on the plans.
5.1.4.1.2. Proposer to provide Alternate and/or Unit prices as required. Proposer to indicate if the price is an addition or deduction. If no indication is noted, the price will be considered as an addition.

5.1.4.2. Business History and Experience. The Proposer shall provide the information requested for:
5.1.4.2.1. Number of years providing commercial construction services based on the scope and size of the project indicated within this CSP.
5.1.4.2.2. Resumes of the proposed Job Superintendent and Project Manager for this project. Resume information should include project responsibility, relevant project experience, years with organization, education, training and certifications, and references. A list of the last five projects completed by your Organization of similar size, type and complexity to this particular project; For each project, provide the name, nature of the project/function of the building, size (SF), location, cost, contractual completion date, actual completion date, owner and

architect (and their phone numbers). Experience references should be for the type of work referenced in this Proposal.

5.1.4.2.3. A listing of those clients who have provided repeat business to your company in the last five years under the Competitive Sealed Proposal process.

5.1.4.3. Additional Documentation. This information will be evaluated on a pass/fail basis only. No points will be assigned.

5.1.4.3.1. The Proposer shall read and acknowledge the construction start and end date indicated in Section III, Item 3. Failure to acknowledge or adjust the dates may disqualify the Proposal.

5.1.4.3.2. A statement of firm's safety record and/or history.

5.1.4.3.3. Claims and suits.

5.1.4.3.3.1. Are there any judgments, claims, arbitration proceedings or suits, pending or outstanding against your organization or its officers? If yes, please include details.

5.1.4.3.3.2. Has your organization filed or been involved in any lawsuits or requested arbitration with regard to construction contracts within the last five years?

5.1.4.3.3.3. Within the last five years, has any officer or principal of your organization ever been an officer or principal of another organization when it failed to complete a construction contract? If the answer is yes, please include details as to why the contract was not completed.

5.1.4.3.3.4. Within the last five years, has any worker's compensation claims been filed by any workers on any job sites managed by your organization? If yes, please provide details of the incident and the outcome of the claim.

5.1.5. Insurance. The Proposer shall submit proof of insurance coverage for the types of insurance listed in the amounts stated in the Standard Terms and Conditions of this CSP.

5.1.6. Completion of Certifications. The Proposal shall include the executed copies of the certifications included at the end of this CSP in Section IV.

5.1.6.1. Failure to sign and submit the Request for Competitive Sealed Proposal Certification form will result in disqualification.

5.2. ***Proposer Affirmation of Understanding***. By submission of a Proposal in response to this CSP, the Proposer confirms and affirms the Proposer's understanding of the entire document and all of its contents. It also ensures the Proposal is submitted in accordance with the stated requirements of the CSP. Should the Proposal not fully comply with the requirements set forth in the CSP, the Proposer will clearly identify each deviation or proposed alternative. By affirmation of a signed Proposal, the Proposal will represent a true and correct statement and shall contain no cause for claim of omission or error.

5.3. ***Incomplete Proposals***. All Proposals will include all information solicited by this CSP and any additional material that the Proposer deems pertinent to the understanding and evaluation of their Proposal. Incomplete Proposals may be disqualified from further consideration at the sole discretion of GISD.

6. **COMPETITIVE SELECTION**.

6.1. ***Selection Process***.

6.1.1. THIS IS A NEGOTIATED PROCUREMENT, and as such, award will not necessarily be made to the Proposer submitting the lowest fee / cost Proposal. **Award(s) may be made to a Proposer other than the Proposer that submits the lowest priced Proposal.**

6.1.2. The District shall accept the Proposal it deems to be in the best interest of the District.
6.1.3. In determining the Proposal that is in the best interest of the District, the District shall consider those criteria and their weighted values as set out below.

6.2. ***Evaluation***.
6.2.1. The awarded firm will be selected via an evaluation process, pursuant to the Texas Government Code §2269.
6.2.2. Upon receipt of Proposals, the Construction Contractor Selection Committee will review and evaluate the Proposals based on the following evaluation criteria:
6.2.2.1. Financial Evaluation: Pass/Fail (failure will disqualify Proposer from further consideration)
6.2.2.2. References: Pass/Fail (failure will disqualify Proposer from further consideration)
6.2.2.3. Pricing Evaluation: 40% of Score - *Total 40 points allowed.*
6.2.2.4. Technical Information: 60% of Score
6.2.2.4.1. Number of years providing commercial construction services based on the scope and size of the project indicated within this CSP. *Total 15 points allowed.*
6.2.2.4.2. Proposed Job Superintendent and Project Manager for this project. Resumes should be attached for the key individuals with emphasis on job knowledge and experience. *Total 20 points allowed*
6.2.2.4.3. Past Project Experience
6.2.2.4.3.1. A list of the last five projects completed by your Organization or other projects of similar size, type and complexity to this particular project; For each project, provide the name, nature of the project/function of the building, size (SF), location, cost, contractual completion date, actual completion date, owner and architect (and their telephone numbers). Experience references should be for the type of work referenced in this Proposal. – *Total 15 points allowed*
6.2.2.4.3.2. A listing of those clients who have provided repeat business to your company in the last five years under the Competitive Sealed Proposal process for projects totaling $25,000 or more for the last 5 years. – *Total 10 points allowed*
6.2.3. The District will review the Financials provided by the Proposer for all projects estimated at $1,000,000.00 and over and any other time the District feels it is necessary in order to determine the solvency of the Proposer. Proposers must receive a “Qualified” rating from the District’s Accounting representative in order for their Proposal to be considered.
6.2.4. Per Section 44.043, of the Education Code, (b) notwithstanding any other provision of this chapter, a school district:
6.2.4.1. May not consider whether a vendor is a member of or has another relationship with any organizations; and
6.2.4.2. Shall ensure that its bid specifications do not deny or diminish the right of a person to work because of the person’s membership or other relationship status with respect to any organization.
6.2.5. Minimum Standards for Responsible Contractors: contractors are required to affirmatively demonstrate their responsibility by meeting the following minimum requirements:
6.2.5.1. have adequate financial resources;
6.2.5.2. be able to comply with the required or proposed schedules;
6.2.5.3. have a satisfactory record of performance;

6.2.5.4. have a satisfactory record of integrity and ethics; and
6.2.5.5. be otherwise qualified and eligible to receive an award.

The District may require other information sufficient to determine contractor's ability to meet these minimum standards listed above.

6.2.6. In addition to requirements of this CSP, District may require additional information to establish responsibility of Proposer. District may further require identification of proposed subcontractors, suppliers and/or other persons and/or organizations proposed for portions of the work and substantial data to determine their qualifications and experience. If requested, Proposer must submit all data to District. District may also consider and use as part of the evaluation, the operating costs, maintenance requirements, performance data and guarantees of major items of materials and equipment proposed for incorporation in the work when such data is required to be submitted in the Proposal or prior to the award of any contract.

6.2.7. District may conduct such investigations as District deems necessary to assist in the evaluation of any Proposal and to establish the responsibility, qualifications and financial ability of Proposer, proposed subcontractors, suppliers and other persons and organizations to perform and furnish the work in accordance with this CSP to the District's satisfaction within the prescribed time.

6.2.8. Unbalanced Proposal - If the best Proposal is significantly unbalanced either in excess of or below reasonable cost analysis values normally associated with the work, the Proposal will be considered as non-responsive and will not be considered for award. The District reserves the right to evaluate and determine the next qualified Proposal for consideration of award.

6.2.9. As provided in this CSP, under state regulations and District policy, discussions may be conducted with responsible Proposers who submit Proposals determined to be reasonably susceptible to being selected for award for the purpose of clarification to assure full understanding of any responsiveness to this CSP's requirements. Proposals shall be accorded fair treatment with respect to any opportunity for discussion, and such revisions may be permitted after submission and before award for the purpose of obtaining the best and final Proposal. In conducting these discussions, there shall be no disclosure of any information derived from Proposals submitted by competing Proposers.

6.2.10. The District reserves the right to conduct interviews and/or other additional evaluation processes that are deemed necessary by the District to assist in a complete and thorough evaluation of the Proposals. These processes may include additional evaluation points as determined necessary by the District.

6.3. ***Award***.

6.3.1. The Construction Contractor Selection Committee is required to present the recommendation for award before the Board of Trustees in an open session for all projects exceeding $25,000.00. The Board of Trustees will approve or disapprove the recommendation.

6.3.2. GISD may make an award without discussion with any Proposer, after Proposals are received and evaluated. Proposals should therefore be submitted on the most favorable terms.

6.3.3. This CSP is not a contract. The District will begin negotiations with the Proposer selected as the highest ranked Proposer to execute a contract as described below. If a contract cannot be executed between the District and the highest ranked contractor, the District reserves the right to end negotiations and proceed to negotiate a contract with the next highest ranked contractor, and so on until a contract for this project is obtained.

6.3.4. GISD intends to use an amended AIA A101-2017 Standard Form of Agreement between Owner and Contractor, an amended AIA A201-2017 Exhibit A, and an amended AIA A201-2017 General Terms and Conditions as the contract for this project. Samples of these modified contracts are included with this CSP, and Proposers are encouraged to review these documents. Any deviation from the terms of the sample contract documents

must be submitted in writing with the Proposal, but such deviations may be considered a significant irregularity contrary to the District's best interest and a basis to reject a Proposal.

6.3.5. It is contemplated that the terms and conditions of this CSP along with the contents of the successful Proposal will become a part of the subsequent contract documents. The terms and conditions of the contract shall be governed in the following order:

6.3.5.1. The original Request for Competitive Sealed Proposal (CSP);
6.3.5.2. Any addenda submitted by the District prior to the opening of the CSP;
6.3.5.3. The accepted portions of the Proposer's submission to the CSP; and
6.3.5.4. Any subsequent contractual documents agreed upon by both parties.

6.3.6. Failure to accept the District's contract under these terms may result in the cancellation of any award and forfeiture of the Proposal Bond.

7. **PROPOSAL VALIDITY PERIOD**. GISD reserves the right to retain all Proposals for a period of forty-five (45) days after the CSP opening date for examination and comparison.

8. **OPEN RECORDS REQUIREMENT**. All documents submitted as part of the Contractor's Proposal will be deemed confidential during the evaluation process, and will not be available for review by anyone other than GISD staff or the Construction Contractor Selection Committee, to the extent permitted by law. Following award of contract, all Proposals become public documents and are available for public viewing upon written request to GISD except where Proposal information is considered to be confidential or a trade secret belonging to the Proposer and, if released would give advantage to a competitor. That information should be clearly marked: "CONFIDENTIAL – DO NOT DUPLICATE WITHOUT PERMISSION," and supported by proper legal authority as to why such information should not be released.

9. **CERTIFICATE OF INTERESTED PARTIES**. Effective January 1, 2016, Texas governmental entities must comply with the "Disclosure of Interested Parties" mandated by Texas HB 1295, as implemented by the Texas Ethics Commission. Briefly stated, all contracts requiring an action or vote by the governing body of the entity or agency before the contract may be signed (regardless of the dollar amount) or has a value of at least $1 million will require the on-line completion of Form 1295 "Certificate of Interested Parties," per Texas Government Code § 2252.908. Form 1295 is also required for any and all contract amendments, extensions or renewals made after January 1, 2016. Therefore, the Contractor will be required to create, electronically file, and present such Form 1295 to the District using the Texas Ethics Commission's online filing application at final execution of any contract with the District.

10. Pursuant to Texas Government Code §2269.053, the Greenville ISD Board of Trustees has delegated and authorized a Construction Contractor Selection Committee to receive and review Proposals, and recommend to the Board those Contractors it believes to provide the best value to the District based on the criteria and weights provided herein.

11. **NO ISRAEL BOYCOTT VERIFICATION**. The 85th Texas Legislature enacted House Bill 89 (codified in chapter 2270 of the Texas Government Code). As of September 1, 2017, state law requires written verification by a for-profit company before it enters a contract with a local government (i.e., a school district) that verifies that the company does not boycott Israel and will not boycott Israel during the term of the contract. "Boycott" means 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.

12. **COMPANIES ENGAGED IN BUSINESS WITH IRAN, SUDAN, OR A FOREIGN TERRIOST ORGANIZATION.** In accordance with Texas Government Code, Chapter 2252, Subchapter F, District is prohibited from entering into a contract with a company that is identified on a list prepared and maintained by the Texas Comptroller or the State Pension Review Board under Texas Government code Sections 806.051, 807.051, or 2252.153. By execution of a contract with the District, Contractor shall certify to District that it is not a listed company under any of those Texas Government Code provisions. By submitting a Proposal, Contractor voluntarily and knowing acknowledges and agrees that any resulting contract shall be null and void should facts arise leading the District to believe that the Contractor was a listed company at the time of this procurement.

13. **VERIFICATION REGARDING NO DISCRIMINATION OF FIREARM ENTITIES OR TRADE ASSOCIATIONS.** By submitting a proposal, the proposer certifies that does not have a practice, policy, guidance or directive that discriminates against a firearm entity or firearm trade association and will not discriminate against a firearm entity or firearm trade association during the term of any contract resulting from the solicitation. A “firearm entity” means a firearm, firearm accessory, or ammunition manufacture, distribute, wholesaler, supplier or retailer, or a sport shooting range. A “firearm trade association” means any person, corporation, unincorporated association, federation, business league or business organization that is not organized or operated for profit for which none of its net earning inures to the benefit of any private shareholder or an individual that has two or more firearm entities as members, or is exempt for federal income taxation under Section 501(c) of the Internal Revenue Code.

14. **VERIFICATION RELATING TO STATE CONTRACTS WITH AND INVESTMENT IN COMPANIES THAT BOYCOTT ENERGY COMPANIES.** By submitting a proposal, the proposer certifies that the proposer does not boycott energy companies and will not boycott energy companies during the term of any contract resulting from the solicitation. “Boycott energy companies” means, without any ordinary business purpose, 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 a company because the company 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.

15. **CONFLICT OF INTEREST**. Any person or entity, as well as agents of such persons, who contracts or seeks to contract with the District for the sale or purchase of property, goods, or services are required to file a Conflict of Interest Questionnaire with the District. A Conflict of Interest questionnaire is included in this CSP. The completed for must be returned as part of your Proposal.

16. **WAIVER OF CLAIMS: BY TENDERING A RESPONSE TO THIS CSP, THE CONTRACTOR ACKNOWLEDGES THAT IT HAS READ AND FULLY UNDERSTANDS THE REQUIREMENTS FOR SUBMITTING A PROPOSAL, AND THE PROCESS USED BY THE DISTRICT FOR SELECTING A CONTRACTOR. FURTHER, BY SUBMITTING A PROPOSAL, THE CONTRACTOR FULLY, VOLUNTARILY AND UNDERSTANDINGLY WAIVES AND RELEASES ANY AND ALL CLAIMS AGAINST DISTRICT, ARCHITECT AND ANY OF THEIR TRUSTEES, OFFICERS, AGENTS AND/OR EMPLOYEES THAT COULD ARISE OUT OF THE EVALUATION, REJECTION OR RECOMMENDATION OF ANY PROPOSAL SUBMITTED IN RESPONSE TO THIS CSP.**

17. The District reserves the right to reject, in its sole discretion, any or all Proposals submitted in response to this CSP #24-002, or any part of any Proposal and/or waive technicalities. The District reserves the right to seek clarification and/or request additional information. The District will award a contract, if any, that serves the best interests of the District. The District's waiver of any deviations in any Proposal will not constitute a modification of this CSP #24-002 and will not preclude the District from asserting all rights against Contractor for failure to fully comply with all terms and conditions of this CSP #24-002. Should a Proposal contain conflicting terms, the District reserves the right to enforce the term or terms in such Proposals that it determines to be in the best interest of the District, and Contractor agrees to

be bound by the terms it has proposed that are most favorable to the District. All Proposals in response to this CSP #24-002 become the property of the District and may be subject to release to any requestor under the provisions of the Texas Public Information Act, Chapter 552 of the Texas Government Code, and Attorney General Opinions issued under that statute. If Contractor believes any portion of its Proposal is excepted from release, it should clearly mark such portion as "CONFIDENTIAL," and provide written legal authority as to why Contractor believes such information should not be released.

18. The District may re-issue another CSP for the services as described in this CSP #24-002 or similar services at any time.

SECTION II - SCOPE OF SERVICE

1. **PROJECT SCOPE**. The District requires construction services for a Portables to be added at LP Waters Early Childhood Center and at Greenville Middle School, Renovations to Travis Intermediate, and replacement of the boilders at Greenville High School, as defined in the contract documents.

2. **ESTIMATED PROJECT BUDGET**. The total estimated budget for this project is $3,800,000 to $4,000,000.

3. **CONSTRUCTION SCHEDULE**. The estimated construction date and estimated substantial project complete date are listed below.

4.

Description	Est Construction Start Date	Est Substantial Project Completion Date
All projects	September 20, 2023	No later than April 15, 2024
NOTE: Proposal form allows for write in schedules for each scope of work		

NOTE: Liquidated damages will be assessed at $500 per day unless otherwise noted by the District.

5. **TEXAS GOVERNMENT CODE SECTION 2269.155**. Texas Government Code Section 2269.155 regarding selection of a Contractor shall be specifically incorporated herein by GISD.

6. **GENERAL CONTRACTOR**. The Contractor will occupy the position of General Contractor for the purposes of the Contract, and shall be wholly responsible for the Scope of Work (Work) presented herein. Wherever the terms General Contractor or Contractor are referred to in the Contract Documents, they all shall have the same meaning.

7. **PREVAILING WAGE**:. Utilize Davis Bacon Federal Guidelines for regional wage rates applicable to Greenville, Tx within the scope of work proposed.

8. **PERFORMANCE AND PAYMENT BONDS**.
   - 8.1. All Bonds shall be written by a bonding company (insurance company) that is duly authorized to do business in the State of Texas, and which meets all requirements of Texas law in connection with its issuance of Bonds hereunder.
   - 8.2. If any surety upon any Bond becomes insolvent or otherwise ceases to do business in the State of Texas, Proposer shall immediately furnish equivalent security to protect the interests of GISD and of persons furnishing labor and materials in the performance of the work under the Contract.
   - 8.3. If the amount of the Bond is in an amount in excess of ten percent (10%) of the surety company's capital and surplus, GISD, as a condition to accepting the Bond, will require written certification that the surety company has reinsured the portion of the risk that exceeds 10% of the surety company's capital and surplus with one or more reinsurers who are duly authorized, accredited, or trusteed to do business in the State of Texas.
   - 8.4. Prior to commencement of work hereunder, Proposer will provide a Performance Bond and a Payment Bond, each in principal amount equal to 100% of the contract amount, conditioned that Proposer will faithfully perform all undertakings in the contract and will fully pay all persons furnishing labor and material in the prosecution of the work provided for in the contract.
   - 8.5. The Performance Bond and Payment Bond are requested to be on forms supplied by GISD.
   - 8.6. If any surety upon any bond becomes insolvent or otherwise ceases to do business in this State, the Proposer shall promptly furnish equivalent security to protect the interests of GISD and of persons furnishing labor and materials in the prosecution of the work.

8.7. The Contractor shall deliver the bonds not later than the 10th day after the date the Contractor executes the contract unless the Contractor furnishes other financial security acceptable to the District.

SECTION III – PRICE PROPOSAL FORM

Proposers are to submit the price to provide construction services for the Greenville ISD – GMS & LP Waters Portables, Travis Renovation, and GHS Boilers per the contract document project manual specification and drawings.

1. ***Base Bid Proposal – 40 points***: Base Bid to allowances required by contract documents.

LP Waters Portables: $_____ Base Bid

_____ calendar days construction schedule

Greenville Middle School Portables: $_____ Base Bid

$_____ Add Alternate Bid

_____ calendar days construction schedule (note if additional needed for add alternate)

Travis Renovation: $_____ Base Bid

$_____ Add Alternate Bid

_____ calendar days construction schedule (note if additional needed for add alternate)

GHS Boiler Replacement: $_____ Base Bid

_____ calendar days construction schedule

Total CSP $_____ Base Bid

$_____ Add Alternates

$_____ Base Bid + Add Alternates

_____ _____

_____ _____

Acknowledgement of addenda received, if applicable, and included in Proposal Amounts (Proposer to write in the Addendum number):

_____

_____

_____

_____

2. ***Business History and Experience –***The Proposer shall provide the following information concerning companies business history and experience as follows:

a. Number of years providing commercial construction services based on the scope and size of the project indicated within this CSP. Total 15 points. | Years

b. Resumes. Proposed Job Superintendent and Project Manager for this project. Resumes should be attached for the key individuals with emphasis on job knowledge and experience. Total 20 points | Provided?

c.1 Past Project Experience. List of the last five projects completed by your Organization or other projects of similar size, type and complexity to this particular project. References relating to Proposer's experience should be for the type of work referenced in this Proposal. Total 15 points
For each project include the following:

- Project name
- Location
- Nature of the project
- Contractual completion date
- Actual completion date
- Size (square footage)
- Final budget
- Job Superintendent
- Owner
- Owner's phone number
- Owner's email address
- Architect
- Architect's phone number

c.2 Proposer to provide a listing of those clients who have provided repeat business to your company in the last five years under the Competitive Sealed Proposal process for projects totaling $250,000 or more for the last 5 years. Total 10 points.
Listing shall include

- Client:
- Contact:
- Phone #:
- Total project budget $:
- Nature of Project:

Additional Documentation. This information will be evaluated on a pass/fail basis only. No points will be assigned. Proposer shall initial each item to indicate acceptance or that the information was provided. *Initial*

3. ***Project Schedule.*** The Proposer shall read and acknowledge the construction start and substantial completion date indicated in Section II, Item 3. Failure to acknowledge or adjust the dates may disqualify the Proposal. ☐

4. ***Safety.*** The Proposer shall provide a statement of firm's safety record and/or history. ☐

5. ***Claims and suits***. The Proposer shall provide the following information under separate cover:

Are there any judgments, claims, arbitration proceedings or suits, pending or outstanding against your organization or its officers? If yes, please include details.

Has your organization filed or been involved in any lawsuits or requested arbitration with regard to construction contracts within the last five years?

Within the last five years, has any officer or principal of your organization been an officer or principal of another organization when it failed to complete a construction contract? If the answer is yes, please include details as to why the contract was not completed.

Within the last five years, has any worker's compensation claims been filed by any workers on any job sites managed by your organization? If yes, please provide details of the incident and the outcome of the claim.

6. ***Value Engineered Item (VEI).*** Based on the plans and specifications of this CSP, the Proposer may provide Value Engineered Items (VEI) they feel would be a benefit to the District. VEIs should be provided in a separate document attached to the Proposal. Proposal shall include how the items will affect the overall plan and provide an estimated cost. The plans and specifications provided shall be considered the "base bid".

PROPOSAL SUBMITTAL CHECKLIST

THE FOLLOWING ITEMS ARE TO BE SUBMITTED TO GREENVILLE ISD, AS DESCRIBED IN: SECTION I (5.1) - INSTRUCTIONS TO PROPOSERS:

1.01 NOTE: ALL PROPOSALS MUST BE HAND-DELIVERED.

1.02 PROPOSAL FORM PART "A"
SUBMITTED ON THURSDAY, AUGUST 24, 2023: NO LATER THAN 2:00 P.M.

A. Proposal Form – Part "A" – Base Bid and Alternates Proposal

B. ( ) Bid Bond or Bid Security (Include base bid and all alternates)

C. ( ) Vendor Compliance to State Law

1.03 PROPOSAL FORM PART "B" – QUALIFICATIONS
SUBMITTED ON THURSDAY, AUGUST 24, 2023: NO LATER THAN 4:00 P.M.

A. ( ) Proposal Part "B" – Qualifications – five (5) copies of the information as outlined in the Proposal, Tabbed, and Bound.

B. ( ) Contractor's Qualification Statement AIA Document A305 AND proposed sub-contractor list

C. ( ) Felony Conviction Notification Form

SECTION IV – APPENDICES AND ATTACHMENTS

GREENVILLE INDEPENDENT SCHOOL DISTRICT
GMS & LP WATERS PORTABLES, TRAVIS RENOVATION, AND GHS BOILER REPLACEMENT
Request for Competitive Sealed Proposal Number 24-002

CERTIFICATION SHEET

In order for a Proposal to be considered, the following information must be provided.
FAILURE TO COMPLETE MAY RESULT IN DISQUALIFICATION

Company Name _____

Mailing Address _____

City_____State_____Zip_____

Telephone _____ Fax _____Email address _____

In business under present name _____ years and _____ months

COMPLETE THE APPROPRIATE SECTION BELOW:

RESIDENT BIDDER

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

I CERTIFY THAT MY COMPANY IS A "RESIDENT BIDDER":

MR. MRS. MS. _____
(Circle One) NAME (PLEASE PRINT)

POSITION _____

SIGNATURE _____ DATE _____

OR

NONRESIDENT BIDDER

"Nonresident bidder" refers to a person who is not a resident.

IF YOU QUALIFY AS A "nonresident bidder", you must furnish the following information:
What is your resident state? (The state your principal place of business is located.) _____

Does your "residence state" require bidders whose principal place of business is in Texas to underbid vendors whose residence state is the same as yours by a prescribed amount or percentage to receive a comparable contract? "Residence state" means the state in which the principal place of business is located.

YES _____ NO _____ If "YES", What is that amount or percentage? _____ %

I CERTIFY THAT MY COMPANY IS A "NONRESIDENT BIDDER" AND THE ABOVE INFORMATION IS TRUE AND CORRECT:

MR. MRS. MS. _____
(Circle One) NAME (PLEASE PRINT)

POSITION _____

SIGNATURE _____ DATE _____

CERTIFICATION REGARDING LOBBYING

CERTIFICATION FOR CONTRACTS, GRANTS, LOANS,
AND COOPERATIVE AGREEMENTS

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

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

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

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

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

_____
_____
Company Authorized Representative (Print)

_____
_____
Signature

GREENVILLE INDEPENDENT SCHOOL DISTRICT
GMS & LP WATERS PORTABLES, TRAVIS RENOVATION, AND GHS BOILER REPLACEMENT
Request for Competitive Sealed Proposal Number 24-002

Agreement with Greenville Independent School District
Regarding Criminal History Background Searches with Vendors/Contractors

Greenville Independent School District has provided me with the information to be in compliance with the Texas Education Code §22.08341 and District Policy CJA (LEGAL) in regard to required background searches for all companies working with Greenville ISD on a public works project. My signature indicates that if I am selected as the Contractor, I will comply with such Policy by fingerprinting those employees who will have an opportunity for direct contact with students and I will conduct criminal history background checks with the DPS- Fingerprint Application Clearinghouse of Texas- FACT, and I will provide to Greenville ISD such certifications and take such other actions as may be required.

_____ _____
Print Name Signature

_____ _____
Company Name Date

Attached: Copy of Information from Texas Education Agency and State Board of Education:

Instructions to School District Contractors Regarding Criminal History Background Searches

Texas Education Code §22.08341 and District Policy CJA (LEGAL) direct school district contractors to obtain state and national criminal history record information on their employees who will have an opportunity for direct contact with students, and to obtain those results through the DPS criminal history clearinghouse (Fingerprint Application Clearinghouse of Texas – FACT). In order for contractors to receive the information through FACT, they must first establish an account with the DPS for FACT clearinghouse access. The Company owner must sign a user agreement with the DPS. To obtain the user agreement and more information, please contact:

Access and Dissemination Bureau
Texas Department of Public Safety
Crime Records Service
PO Box 149322
Austin, Texas 78714-9322
Email: FACT@txdps.state.tx.us
Phone: (512) 424-2365

GREENVILLE INDEPENDENT SCHOOL DISTRICT
GMS & LP WATERS PORTABLES, TRAVIS RENOVATION, AND GHS BOILER REPLACEMENT
Request for Competitive Sealed Proposal Number 24-002

For fastest service, please email or call. State in the message that you are a school district contractor and need to have an account established for DPS FACT clearinghouse access. Please include:

Company Name
Company Address
Company Phone
Name of Company point of contact
Phone of Company point of contact
Company email to be used for notification of FACT records and messages

The information in the DPS FACT Clearinghouse is confidential, and access must be restricted to the least number of persons needed to review the records. The account must include at least one designated supervisor to make necessary changes and to monitor the site's security and the access to the criminal history data retrieved. Additional users must be limited to those who need to request, retrieve, or evaluate data regarding the individual applicants.

PLEASE NOTE: After you sign the DPS User Agreement for FACT, DPS will provide you with a revised **FAST Fingerprint Pass** that you will have to provide to your employees and applicants. Your employees and applicants will use the **FAST Fingerprint Pass** when scheduling their FAST fingerprinting.

GREENVILLE INDEPENDENT SCHOOL DISTRICT
GMS & LP WATERS PORTABLES, TRAVIS RENOVATION, AND GHS BOILER REPLACEMENT
Request for Competitive Sealed Proposal Number 24-002

Request for Competitive Sealed Proposal Certification

The undersigned, by signing and executing this Proposal, certifies and represents to the Greenville Independent School District that: the Proposer has not offered, conferred or agreed to confer any pecuniary benefit, as defined by §1.07(a)(6) of the Texas Penal Code, or any other thing of value, as consideration for the receipt of information or any special treatment or advantage relating to this Proposal. The Proposer also certifies and represents that Proposer has not offered, conferred or agreed to confer any pecuniary benefit or other things of value as consideration for the recipient's decision, opinion, recommendation, vote or other exercise of discretion concerning this Proposal. The Proposer also certifies and represents that Proposer has neither coerced nor attempted to influence the exercise of discretion by any officer, trustee's agent or employee of the Greenville Independent School District concerning this Proposal on the basis of any consideration not authorized by law. The Proposer also certifies and represents that Proposer has not received any information not available to other Proposers so as to give the undersigned a preferential advantage with respect to this Proposal. The Proposer also certifies and represents that Proposer has not violated any state, federal or local law, regulation or ordinance relating to bribery, improper influence, collusion or the like and that Proposer will not in the future, offer, confer, or agree to confer any pecuniary benefit or other thing of value of any officer, trustees agent or employee of the Greenville Independent School District in return for the person having exercised the person's official discretion, power or duty with respect to this Proposal. The Proposer also certifies and represents that it has not now and will not in the future offer, confer, or agree to confer a pecuniary benefit or other thing of value to any officer, trustee, agent or employee of the Greenville Independent School District in connection with information regarding this Proposal, the submission of this Proposal, the award of this Proposal or the performance, delivery or sale pursuant to this Proposal.

FAILURE TO SIGN AND SUBMIT THIS DOCUMENT WILL BE GROUNDS FOR DISQUALIFICATION.

Firm Name:_____ Telephone: 1-800 -_____

Address:_____ Or_____

City: _____ Fax: _____

State: _____ Zip: _____ email: _____

_____ Date: _____
(Signature of Person Authorized to Sign Proposal)

Printed Name: _____ Title:_____
(Please print or type)

GREENVILLE INDEPENDENT SCHOOL DISTRICT
GMS & LP WATERS PORTABLES, TRAVIS RENOVATION, AND GHS BOILER REPLACEMENT
Request for Competitive Sealed Proposal Number 24-002

Felony Conviction Notice

Statutory citation covering notification of criminal history of contractor is found in the Texas Education Code §44.034.

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 a contract with a school district must give advance notice to the district if the person or an owner or operator of the business entity has been convicted of a felony. The notice must include a general description of the conduct resulting in the conviction of a felony." Subsection (b) states "a school district may terminate a contract with a person or business entity if the district determines that the person or business entity failed to give notice as required by Subsection (a) or misrepresented the conduct resulting in the conviction. The district must compensate the person or business entity for services performed before the termination of the contract."

THIS NOTICE IS NOT REQUIRED OF A PUBLICLY-HELD CORPORATION

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

PROPOSER'S NAME: _____

AUTHORIZED COMPANY OFFICIAL'S NAME: _____

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

Signature of Company Official: _____

B. My firm is not owned nor operated by anyone who has been convicted of a felony.

Signature of Company Official: _____

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

Name of Felon(s): _____
(attach additional sheet if necessary)

Details of Conviction(s): _____
(attach additional sheet if necessary)

Signature of Company Official: _____

GREENVILLE INDEPENDENT SCHOOL DISTRICT
GMS & LP WATERS PORTABLES, TRAVIS RENOVATION, AND GHS BOILER REPLACEMENT
Request for Competitive Sealed Proposal Number 24-002

NON-COLLUSIVE BIDDING CERTIFICATION

The undersigned affirms that they are duly authorized to execute a contract, that this company, corporation, firm, partnership or individual has not prepared this bid/proposal in collusion with any other bidder, and that the contents as to prices, terms and conditions have not been communicated by the undersigned nor by any employee or agent to any other person engaged in this type of business prior to the official opening of this bid/proposal.

Proposer: _____

Street Address:_____ City, State, Zip _____

Phone:_____ Fax: _____

Proposer Signature: _____

Proposer (Print Name): _____

Position with Company: _____

Signature of Company Officer: _____

Company Officer Printed Name: _____

Title: _____

GREENVILLE INDEPENDENT SCHOOL DISTRICT
GMS & LP WATERS PORTABLES, TRAVIS RENOVATION, AND GHS BOILER REPLACEMENT
Request for Competitive Sealed Proposal Number 24-002

VERIFICATION OF COMPLIANCE WITH STATE AND FEDERAL LAWS

Certification of Eligibility
By submitting a Proposal in response to the solicitation, Contractor certifies that at the time of submission, they are not on the Federal Government's list of suspended, ineligible, or debarred entities. In the event of placement on the list between the time of bid submission and time of award, the Contractor will notify the District. Failure to do so may result in terminating the contract for default.

Certification Regarding Employment Assistance Prohibited
Contractor certifies and agrees that it shall not assist an employee, contractor or agent of the Owner or of any other school district in obtaining a new job if the proposer knows or has probable cause to believe that the individual engaged in sexual misconduct regarding a minor or student in violation of the law. Routine transmission of an administrative or personal file does not violate this prohibition

Relating to State Contracts with and Investments in Companies that Boycott Israel
Effective September 1, 2017, Contractor verifies that it/he/she does not boycott Israel and will not boycott Israel during the term of this contract. The term "boycott Israel" is defined by Texas Government Code Section 808.001, effective September 1, 2017[1].

Relating to State Contracts with and Investment in Companies that do Business with Iran, Sudan, or any known foreign terrorist organizations
Effective September 1, 2017, Contractor verifies that it/he/she does not do business with Iran, Sudan, or any known foreign terrorist organizations and will not do business with Iran, Sudan, or any known foreign terrorist organizations during the term of this contract. The term "foreign terrorist organization" is defined by Texas Government Code Section 806.001, effective September 1, 2017.

Verification Regarding No Discrimination of Firearm Entities or Trade Associations
By submitting a proposal, the proposer certifies that does not have a practice, policy, guidance or directive that discriminates against a firearm entity or firearm trade association and will not discriminate against a firearm entity or firearm trade association during the term of any contract resulting from the solicitation. A "firearm entity" means a firearm, firearm accessory, or ammunition manufacture, distribute, wholesaler, supplier or retailer, or a sport shooting range. A "firearm trade association" means any person, corporation, unincorporated association, federation, business league or business organization that is not organized or operated for profit for which none of its net earning inures to the benefit of any private shareholder or an individual that has two or more firearm entities as members, or is exempt for federal income taxation under Section 501(c) of the Internal Revenue Code.

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[1] *Definition:* "boycott" means 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.

GREENVILLE INDEPENDENT SCHOOL DISTRICT
GMS & LP WATERS PORTABLES, TRAVIS RENOVATION, AND GHS BOILER REPLACEMENT
Request for Competitive Sealed Proposal Number 24-002

Verification Relating to State Contracts with and Investments in Companies that Boycott Energy Companies

Pursuant to Texas Government Code, 2274, as enacted in SB13 by the 87th Legislature, if Contractor is a for-profit organization, 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 those entities or business associations (specifically excluding sole proprietorships) that exists to make a profit, which has ten (10) or more full-time employees and the value of the contract with District is $100,000 or more, the Contractor represents and warrants to the District that the Contractor does not boycott energy companies2 and will not boycott energy companies during the term of any contract resulting from the solicitation.

Certification of Compliance with Texas Family Code

As per Section 14.52 of the Texas Family Code, added by S.B. 84, Acts, 73rd Legislature, R.S. (1993), all Contractor certifies as follows: I, the undersigned proposer, do hereby acknowledge that NO sole proprietor, partner, majority shareholder of a corporation or an owner of 10% or more of another business entity is 30 days or more delinquent in paying child support under a court order or a written repayment agreement. I understand that under this provision, a sole proprietorship, partnership, corporation or other entity in which a sole proprietor, partner, majority shareholder or a corporation or other entity in which a sole proprietor, partner, majority shareholder or a corporation or an owner of 10% or more of another entity is 30 days or more delinquent in paying child support under a court order or a written repayment agreement is NOT eligible to bid or receive a state contract.

_____

Company Name:

_____

Signature of Company's Authorized Official:

_____

Print Name: _____

Title _____ **Date:** _____

GREENVILLE INDEPENDENT SCHOOL DISTRICT
GMS & LP WATERS PORTABLES, TRAVIS RENOVATION, AND GHS BOILER REPLACEMENT
Request for Competitive Sealed Proposal Number 24-002

CONFLICT OF INTEREST QUESTIONNAIRE

FORM CIQ

For vendor doing business with local governmental entity

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

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

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

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

OFFICE USE ONLY
Date Received

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

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

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

_____
Name of Officer

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

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

☐ Yes ☐ No

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

☐ Yes ☐ No

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

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

7

_____ _____
Signature of vendor doing business with the governmental entity Date

Form provided by Texas Ethics Commission www.ethics.state.tx.us Revised 11/30/2015

DOCUMENT 00 72 00

GENERAL CONDITIONS

A. The General Conditions of the Contract for Construction, AIA Document A201, 2017 Edition, referenced as the General Conditions, are a part of the Contract Documents.

1. A draft of AIA Document A201 is available for inspection as Document 00 72 00.10 "AIA A201 General Conditions of the Contract for Construction."
2. A draft of AIA Document A101 is available for inspection as Document 00 72 00.20 "AIA A101 Standard Form of Agreement Between Owner and Contractor."
3. A draft of AIA Document A101 Exhibit A is available for inspection as Document 00 72 00.20 "AIA A101 Exhibit A Insurance and Bonds."

B. The Contractor is directed, as a condition of the Contract, to acquaint itself-with the Articles of the General Conditions and to notify and apprise its subcontractors and other entities of the conditions governing the Contract for Construction.

C. No contractual adjustments shall be due for failure of each entity to fully acquaint itself-with the General Conditions.

D. The General Conditions of the Contract is amended by Supplementary Conditions.

E. The provisions of the General and Supplementary Conditions and Division 1 General Requirements together apply to the work specified in each Section of the Contract Specifications and indicated on the Contract Drawings.

F. Where conflicts occur concerning the Architect's duties and responsibilities between the General Conditions and the Agreement between the Owner and Architect, the Agreement takes precedence.

G. If not included in the Owner/Contractor Agreement or specifically included in the bidding documents, obtain the Owner’s insurance requirements prior to submitting a bid.

END OF DOCUMENT

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DRAFT

AIA® Document A201® – 2017

General Conditions of the Contract for Construction

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

THE OWNER:
(Name, legal status and address)
Greenville Independent School District

THE CONTRACTOR:

THE ARCHITECT:
(Name, legal status and address)

Corgan Associates, Inc.
401 North Houston Street
Dallas, Texas 75202
(214) 748-2000

TABLE OF ARTICLES

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.

For guidance in modifying this document to include supplementary conditions, see AIA Document A503™, Guide for Supplementary Conditions.

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.

14 TERMINATION OR SUSPENSION OF THE CONTRACT

15 CLAIMS AND DISPUTES

INDEX
(Topics and numbers in bold are Section headings.)

ARTICLE 1 GENERAL PROVISIONS

§ 1.1 Basic Definitions

§ 1.1.1 The Contract Documents

The Contract Documents are enumerated in the Agreement between the Owner and Contractor (hereinafter the Agreement) and consist of the Agreement, Conditions of the Contract (General, Supplementary and other Conditions), 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. Contractor and Owner represent that they are not relying on any such prior communications, negotiations, representations or agreements in entering into this Contract. 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.

§ 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.

§ 1.2 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. Contractor's review of the Contract Documents is solely in its capacity as a contractor.

§ 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 within the Contract Documents, (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 Subject to any separate agreement between the Owner and the relevant parties, all Drawings, Specifications, plans, including those in electronic form, and buildings, and the architectural works (as defined by 17 U.S.C. 101) embodied thereby, prepared in connection with the Project by the Architect, Owner, Contractor, Subcontractor, any Sub-subcontractor, consultant, supplier, materialman, or other contractor and copies thereof furnished by any of them are and shall remain, or are herein conveyed to become, the Owner's property upon creation, and the Owner shall hold all common law, statutory and other reserved rights, including copyrights, rights in them, including all copyright rights (collectively "Work Product"); provided, however, that Work Product shall not include proprietary financial and administrative information developed in the ordinary course of business or documents of any type outside the scope of this Agreement. Contractor agrees and does hereby assign, grant, transfer and convey to Owner, its successors and assigns, Contractor's entire right, title, interest and ownership in and to such Work Product, including, without limitation, all rights relating to copyright arising under 17 U.S.C. Section 101 et. seq. and any and all copyright registrations or applications associated therewith. Contractor confirms that Owner and its successors and assigns shall own Contractor's right, title and interest in and to, including the right to use, reproduce, make derivative works, distribute by sale, rental, lease or lending or by other transfer of ownership, to perform publicly, and to display, all such Work Product, whether or not such Work Product constitutes a "work made for hire" as defined in 17 U.S.C. Section 101 or was created by or for Contractor under 17 U.S.C. Section 201(b). Contractor shall use diligent efforts to obtain similar assignments and confirmations from all of its Subcontractors, Sub-subcontractors, consultants, suppliers, and materialmen; provided, however, that Contractor shall not be required to obtain assignment of pre-existing intellectual property rights of any Subcontractor, Sub-subcontractor, consultants, supplier, or materialman and, pursuant to Section 5.3.1, must promptly inform the Owner of any inability to obtain the assignments and confirmations required by this Section. The Work Product is to be used only by the Contractor, its Subcontractors, Sub-subcontractors, consultants, suppliers, and materialmen with respect to this Project and is not to be used on any other project. The Contractor, Subcontractors, Sub-subcontractors, and material or equipment suppliers shall not own or claim a copyright in the Instruments of Service. Contractor, Subcontractors, and material or equipment suppliers are granted a limited license to use and reproduce applicable portions of the Work Product prepared by the Architect appropriate to and for use in the execution of their Work under the Contract Documents. Submission or distribution to meet official regulatory requirements or for other purposes in connection with this Project is not to be construed as publication in derogation of the Architect's or Architect's consultants' reserved rights, Owner's copyright or other reserved right. Contractor shall deliver all copies of the Work Product to Owner upon the earlier to occur of the Owner's request, completion of the Work, or termination of the Contract.

§ 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. The Contractor confirms and agrees that the Owner has and shall retain all rights, title, and interest in and to such drawings, documents, designs and information, including, without limitation, any copyright or other intellectual property rights, and that by use of such drawings, documents, designs and information, the Contractor shall not acquire any right, title, or interest in such drawings, documents, designs and information, including, without limitation, any copyright or other intellectual property rights.

§ 1.5.3 License. To the extent necessary or appropriate to allow Owner to receive the benefit of the Work, Contractor hereby grants to Owner and its affiliates a non-exclusive, irrevocable, worldwide, fully paid-up, royalty-free, assignable license (a) to access and use the software, processes and other intellectual property used to perform the Work under, and (b) to permit Owner's designees to access and use such software, processes and other intellectual property in connection with providing goods or services to, or purchasing goods or services from, Owner.

§ 1.5.4 Ownership. Contractor agrees that, as between Contractor and Owner, all Work Product is the sole property of Owner. Contractor hereby does, and will cause its employees, contractors and subcontractors to, irrevocably, perpetually and unconditionally assign to Owner without further consideration all worldwide rights, title, and interest each may have in any Work Product, including any Proprietary Rights relating thereto of any sort throughout the world, except for any Contractor Intellectual Property contained in any Work Product. Such rights will vest in Owner upon the development, construction, implementation, completion, design, delivery, integration, attachment, incorporation or installation of the relevant Work Product. If any Proprietary Rights, including artists' rights and moral rights, in any Work Product cannot (as a matter of Law) be assigned by Contractor or Contractor's employees, contractors or subcontractors to Owner, then: (a) Contractor irrevocably, perpetually and unconditionally does, and will cause its employees, contractors and subcontractors to, waive the enforcement of such rights and all Claims of any kind against Owner with respect to such rights; and (b) to the extent Contractor or any of its employees, contractors or subcontractors cannot (as a matter of Law) make the waiver in subsection (a) of this Section, Contractor irrevocably, perpetually and unconditionally grants, and will cause its employees, contractors and subcontractors to irrevocably, perpetually and unconditionally grant, to Owner an exclusive (without reservation), perpetual, irrevocable, worldwide, fully paid-up, royalty-free, transferable, assignable license, with the right to sublicense through multiple levels of sublicensees, under any and all such rights: (i) to reproduce, create derivative works of, distribute, publicly perform, publicly display, and digitally perform, and otherwise use and exploit such Work Product in any medium or format, whether now known or hereafter discovered; (ii) to use, make, have made, sell, offer to sell, import, and otherwise exploit such Work Product and any product or service based on, embodying, incorporating, or derived from such Work Product; and (iii) to exercise any and all other present or future rights not yet known in such Work Product. Contractor hereby assigns, and will cause its employees, contractors and subcontractors to assign, to Owner any and all Claims, past, present, or future, of any nature whatsoever, that Contractor or its employees, contractors or subcontractors may have for infringement, misappropriation, or violation of any Proprietary Right assigned to Owner pursuant to this Section.

§ 1.5.5 Contractor Intellectual Property. Owner acknowledges that the Work Product may include Contractor Intellectual Property, and agrees, as between Owner and Contractor, that Contractor will retain ownership of all such Contractor Intellectual Property, including all Proprietary Rights therein and thereto. To the extent that any Contractor Intellectual Property is contained in any Work Product, or necessary for Owner to use or fully exploit any Work Product, then Contractor irrevocably, perpetually and unconditionally grants, and will cause its employees, contractors and subcontractors to irrevocably, perpetually and unconditionally grant, to Owner a non-exclusive, perpetual, irrevocable, worldwide, fully paid-up, royalty-free, transferable, assignable license, with the right to sublicense through multiple levels of sublicensees: (a) to reproduce, create derivative works of, distribute, publicly perform, publicly display, and digitally perform, and otherwise use and exploit such Contractor Intellectual Property in any medium or format, whether now known or hereafter discovered; (b) to use, make, have made, sell, offer to sell, import, and otherwise exploit such Contractor Intellectual Property and any product or service based on, embodying, incorporating, or derived from such Contractor Intellectual Property; and (c) to exercise any and all other present or future rights not yet known in such Contractor Intellectual Property; provided, however, that this license will not permit the commercial exploitation of such Contractor Intellectual Property on a stand-alone basis.

§ 1.5.6 Further Assurances. Subsequent to the execution and delivery of the Contract Documents, and without any additional consideration, Contractor will execute and deliver, and will cause its employees, contractors and subcontractors to execute and deliver, any further legal instruments (in such form as is acceptable to Owner and Contractor) and perform reasonable acts that in each case are or may become reasonably necessary to effectuate the purposes of this Article.

§ 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.

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 (15) 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 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 in accordance with Tex. Bus. and Comm. Code §56.054.

§ 2.2.2 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. The Contractor shall assist the Owner in obtaining any such approvals as may be reasonably requested by the Owner.

§ 2.3.2 If required by applicable law or prudent practice, 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, and if required by applicable law or prudent practice, the Owner shall employ a successor 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. Notwithstanding the foregoing, the Contractor may not rely upon such information or any other information provided by or on behalf of the Owner when the Contractor knows or reasonably should know that the information is inaccurate, inadequate, incomplete, or otherwise unfit for its intended purpose. The Owner makes no representation or warranty that any information provided to Contractor by or on behalf of the Owner is accurate, correct, complete, fit for its intended purpose or can be used without infringing any patent, copyright, trademark, or other Intellectual Property Rights of third parties. The Contractor shall exercise proper precautions relating to the safe performance of the Work, particularly with respect to the location of utilities and pre-existing conditions.

§ 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 necessary 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 commence correction of Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or provide a reasonable plan for correction of such defective work within ten-days after receipt of written notice from the Owner to commence and continue correction of such defective work 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 (10)day period after receipt of notice from the Owner to commence and continue correction or provide a reasonable plan for 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. 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, the nature or the cause of such default or neglect, or the amounts claimed as costs to the Owner, the Contractor may file a Claim pursuant to Article 15. Notwithstanding the notice requirements of this section, in the event of an emergency, Owner and Contractor shall be entitled to take remedial and other necessary action immediately and without prior notice. In no event shall the Owner's exercise of any rights or remedies under this Article 2 or the Contract Documents relieve the Contractor from any liabilities arising from any default, violation or failure to abide by the Contract Documents.

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. 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, without limitation, (1) the location, condition, layout and nature of the Project site and surrounding areas including all access, hoisting requirements and conditions, site logistics, and the geotechnical report, (2) generally prevailing climatic conditions, (3) anticipated labor supply and costs, (4) availability and cost of materials, tools and equipment, (5) any applicable rules and restrictions of Owner relating to construction on the real property and other buildings located in the vicinity of the Project, (6) applicable codes and laws, and (7) other similar issues. 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 and its Subcontractors shall be solely responsible for providing a safe place for the performance of their Work. The Owner shall not be required to make any adjustment in either the Contract Sum or Contract Time in connection with any failure by the Contractor or any Subcontractor to comply with the requirements of this section.

§ 3.2.2. It is recognized that the Contractor's review obligations are 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 except to the extent that it would be expected to do in its capacity as a contractor and not as a licensed design professional, but the Contractor shall promptly report to the Architect and Owner any nonconformity discovered by or made known to the Contractor as a request for information in such form as the Architect or Owner 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, except to the extent that Contractor knew or should have known of such matters and failed to promptly notify Owner and/or the Architect as provided herein.

§ 3.3 Supervision and Construction Procedures

§ 3.3.1 The Contractor shall supervise and direct the Work in accordance with the Contract Documents, 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, if practical, 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.

§ 3.3.4 Contractor shall ensure that all material suppliers and Subcontractors adhere to the Contract Documents and that they order and provide materials to the jobsite on time, taking into account the current market and delivery conditions. Contractor shall coordinate its Work with that of all persons or entities performing portions of the Work on the Project, including deliveries, storage, installations and construction of utilities.

§ 3.3.5 Contractor shall develop and implement a system and procedures for reviewing its own Work and the work of its Subcontractors for defects and deficiencies, including the preparation of all appropriate quality control documentation, to assure that all such defects and deficiencies are discovered and corrected. The Contractor shall be responsible for inspection of portions of Work already performed under this Contract to determine that such portions are in proper condition to receive subsequent Work.

§ 3.3.6 Contractor shall develop and implement a system and procedures for preparing, reviewing and processing Change Orders which fully complies with Article 7 and assures that the preparation of change proposals and responses to Construction Change Directives include the submittal of: (a) an explanation of the reasons for any requested changes in the Contract Sum; (b) identification of supporting documents to verify any requested cost changes; and (c) a detailed explanation of any critical path schedule impacts.

§ 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 or who Contractor knows or through diligence should know is not authorized to work under applicable laws. At no time shall any individual engage in any illegal activities at the site, consume or possess alcoholic beverages at the site, or use illegal drugs at the site. Contractor understands and agrees that if its employees or any other person carrying out the Work engage in unsafe, inappropriate, offensive or disorderly conduct or harasses Owner, its guests, employees or patrons, Owner may require Contractor to permanently remove such offending employees from site.

§ 3.4.3 The Contractor shall deliver, handle, store and install materials in accordance with the manufacturers' instructions or the Contract Documents.

§ 3.5 Warranty

§ 3.5.1 The Contractor warrants to the Owner and Architect that it will perform all elements of the Work in accordance with the Contract Documents and 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 or Owner, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment. Contractor's express warranties contained herein are not limited by the provisions of Section 12.2 and shall be in addition to any warranties, indemnities, claims, rights, actions or remedies that Owner may have in the Contract Documents or at law or in equity for defective Work or breach of the Contract Documents.

§ 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. Contractor shall be responsible for providing all such warranties to Owner regardless of any dispute with Owner or with any Subcontractor.

§ 3.5.3 Contractor shall assign Subcontractor, manufacturer and supplier warranties and guarantees directly to the Owner. During the one (1) year period for correction of the Work, Contractor shall enforce the Subcontractors', manufacturers' and suppliers' warranties for the benefit of Owner or its assigns. After expiration of such period, the Contractor shall make reasonable efforts to continue to aid Owner in enforcing any continuing warranties assigned to Owner. Contractors' obligations under this section shall survive the expirations or earlier termination of the Contract.

§ 3.5.4 All guarantees and warranties of materials and services furnished to Contractor or Subcontractors by any Subcontractor, manufacturer or supplier shall be deemed to run for the benefit of the Owner. Contractor hereby assigns to Owner the benefits of all guarantees and warranties of all Subcontractors, manufacturers and suppliers engaged for the Project, but such assignment shall not relieve Contractor of its warranty obligations to Owner under the Contract Documents or Applicable Laws. The Contractor further agrees to perform the Work in such a manner so as to preserve any and all such guarantees and warranties.

§ 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. The Contractor shall procure all certificates of occupancy (and similar certificates and permits), and pay all charges and fees, and give all notices necessary and incidental to the due and lawful prosecution of the Work. Contractor shall deliver to Owner certificates of inspection, use, and occupancy upon completion of the Work in sufficient time for occupation of the Project in accordance with the approved schedule for the Work.

§ 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. Notwithstanding the foregoing, the Contractor shall be responsible for complying with all laws, statutes, ordinances, building codes and rules and regulations affecting the means and methods of how the Work is to be performed.

§ 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 fourteen (14) days after first observance of the conditions. The Architect will promptly investigate such conditions and, if the Architect determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time

required for, performance of any part of the Work, will recommend that an equitable adjustment be made in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and Contractor, stating the reasons. If either party disputes the Architect's determination or recommendation, that party may submit a Claim as provided in Article 15.

§ 3.7.5 If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall notify the Owner and Architect. Upon receipt of such notice, the Owner shall promptly take any action necessary to obtain governmental authorization required to resume the operations. The Contractor shall continue to suspend such operations until otherwise instructed by the Owner but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 15.

§ 3.8 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. Contractor shall obtain written approval from Owner of the actual cost of any item covered by allowances before incurring such costs. The Contractor shall keep separate and adequate records of all allowances and submit records of the allowances to the Owner no less than monthly and with each Application for Payment.

§ 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 will include the superintendent in its list of Key Personnel.

§ 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, except when necessitated by the voluntary or involuntary termination of the superintendent's employment or other customary or temporary absences in the course of superintendent's employment where the Contractor has provided a qualified substitute. The Owner' consent to any change of the superintendent which shall not unreasonably be withheld or delayed.

§ 3.10 Contractor's Construction and Submittal Schedules

§ 3.10.1 The Contractor, prior to being awarded the Contract, shall have submitted for the Owner's and Architect's information a Contractor's initial construction schedule for the Work. The schedule shall contain customary information appropriate for the Project, including (1) the date of commencement of the Work, Milestone Completion Dates (if required), 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. Schedule details may be added or deleted for clarity during the life of the project for Contractor's convenience and without prior approval from the Owner, provided established and approved contract turn/acceptance dates are not negatively impacted.

§ 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.

§ 3.10.4 Contractor must prepare and maintain the progress schedule in a detailed precedence-style critical path management ("CPM") format reasonably satisfactory to the Owner that shall also (i) provide a graphic representation of all activities and events that will occur during performance of the Work; (ii) identify each phase of construction and occupancy; and (iii) set forth dates that are critical in ensuring the timely and orderly completion of the Work in accordance with the requirements of the Contract Documents. The Contractor shall monitor the progress of the Work for conformance with the requirements of the Schedule and shall promptly advise the Owner of any delays or potential delays. In the event of any delay, the Contractor shall propose an affirmative plan to correct the delay, including overtime and/or additional labor, if necessary. In no event shall any progress report or written notice delivered to the Owner of a delay constitute an adjustment in the Contract Time, any Milestone Completion Date, or the Contract Sum unless any such adjustment is agreed to by the Owner and authorized pursuant to a Change Order.

§ 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 ("As Built Drawings"), 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. These documents shall be available to Architect and Owner during the progress of the Work for review to ensure general conformance with the Project and the requirements of the Contract Documents. As-Built Documents shall contain, but not be limited to: (i) the actual location of the underground utilities and appurtenances as referenced to permanent surface improvements; (ii) the location of internal utilities and appurtenances concealed in building structures; and (iii) significant changes during the construction process and significant detail not shown in the original Contract Documents. The As-Built Documents are to be kept accurately and no work shall be permanently concealed until the required information has been recorded. As part of the Project closeout submittals, and prior to release by Owner of Final Payment, Contractor shall submit one (1) set of accurate and complete As-Built Documents to Architect for Architect's review for general conformance with the Project.

§ 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.

§ 3.13.1 The Contractor will obtain from the applicable authorities any permits or licenses in order to swing cranes over City streets. Contractor shall not swing any cranes over adjacent property without written consent from adjacent property owners. All cranes, scaffolding, personnel lifts and accompanying equipment shall be adequately secured and stabilized according to all applicable laws, regulations, and codes and adequate safety measures shall be taken in connection with extraordinary weather events.

§ 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 arising from the Contractor's infringement of any copyright or patent and shall hold the Owner and Architect harmless from loss on account thereof, but shall not be responsible for defense or loss when a particular design, process, or product of a particular manufacturer or manufacturers is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications, or other documents prepared by the Owner or Architect. However, if an infringement of a copyright or patent is discovered by, or made known to, the Contractor, the Contractor shall be responsible for the loss unless the information is promptly furnished to the Architect.

§ 3.18 Indemnification

§ 3.18.1 To the fullest extent permitted by law, Contractor shall defend, indemnify, and hold Owner and its officers, directors, shareholders, members, managers, partners, agents, affiliates, employees and independent contractors (collectively, the "Indemnitees"), harmless from and against all demands, claims, causes of action, lawsuits, proceedings, investigations, liabilities, damages, penalties, losses, expenses, and costs (including, but not limited to, reasonable attorneys' fees and court costs) (collectively, the "Claims") to the extent arising or alleged to arise out of or result from (i) bodily injury or the death of any person , or property damage, including loss of use of the property,

which arise out of the Contract Documents or the performance of Work under the Contract Documents by the Contractor, its agents or employees, or its Subcontractors of any tier; (ii) the violation of any ordinance, regulation, statute or other applicably law by the Contractor or any Subcontractor of any tier (or any of their respective employees or agents), or (iii) any lien claim asserted by any Subcontractor or supplier of any tier for work or materials provided to the Project. This defense, indemnity, and hold harmless agreement shall include, but is not limited to, any Claim for damages or injuries occurring after completion of the Work under the Contract Documents. Except as provided for in Section 3.18.2, the foregoing shall not apply to any Claims to the extent that such Claims are caused by the negligence or willful misconduct of the Indemnitees or their respective agents (other than Contractor, its agents, employees, or subcontractors of any tier) and employees.

§ 3.18.2 Notwithstanding the foregoing, to the fullest extent permitted by the law, Contractor shall defend, indemnify and hold harmless the Indemnitees from and against all Claims arising, directly or indirectly, from, or in any way relating to, the bodily injury or death of an employee of Contractor, its agents, or its subcontractors of any tier, WHETHER OR NOT SUCH CLAIMS ARE CAUSED, IN PART, BY THE FAULT OF THE INDEMNITEES; IT BEING THE EXPRESSED INTENT OF OWNER AND CONTRACTOR THAT, IN SUCH EVENT, CONTRACTOR IS TO DEFEND, INDEMNIFY AND HOLD HARMLESS THE INDEMNITEES FROM AND AGAINST THE CONSEQUENCES OF THE INDEMNITEES' OWN NEGLIGENCE OR FAULT, BREACH OR VIOLATION OF A STATUTE, ORDINANCE, GOVERNMENTAL REGULATION, STANDARD, OR RULE, OR BREACH OF CONTRACT, WHETHER IT IS THE SOLE OR CONCURRING CAUSE OF THE BODILY INJURY OR DEATH OF THE EMPLOYEE OF CONTRACTOR, ITS AGENTS, OR ITS SUBCONTRACTORS OF ANY TIER. This defense, indemnity, and hold harmless agreement shall include, but is not limited to, any Claim for damages or injuries occurring after completion of the Work under the Contract documents.

§ 3.18.3 In addition to the indemnification obligations provided for in Section 3.18.1 and 3.18.2 above, the Contractor shall defend, indemnify and hold harmless the Indemnitees from and against all Claims arising, directly or indirectly, from, or in any way relating to any claim against the Indemnitees asserting infringement or alleged infringement of a patent, trademark, copyright or other Intellectual Property Right in connection with the instruments of service furnished by or through Contractor or its Subcontractors of any tier.

§ 3.18.4 To the fullest extent permitted by the law, Contractor shall require its subcontractors of any tier to agree to defend, indemnify and hold harmless the Indemnitees from and against all Claims to the extent arising or alleged to arise out of or result from (i) bodily injury or the death of any person , or property damage, including loss of use of the property which arise out of the Contract Documents or the performance of Work under the Contract Documents, by the Subcontractor, its agents or employees, or its sub-subcontractors of any tier; (ii) the violation of any ordinance, regulation, statute or other applicably law by the Subcontractor or any sub-subcontractor of any tier (or any of their respective employees), or (iii) any lien claim asserted by any sub-subcontractor or supplier of any tier for work or materials provided to the Project. This defense, indemnity, and hold harmless agreement shall include, but is not limited to, any Claim for damages or injuries occurring after completion of the Work under Contract Documents. Except as provided for in Section 3.18.5, the foregoing shall not apply to any Claims to the extent that such Claims are caused by the negligence, fault, or breach of statute or contract of the Indemnitees or their respective agents (other than Contractor, its agents, employees, or subcontractors of any tier) and employees.

§ 3.18.5 Notwithstanding the foregoing, to the fullest extent permitted by the law, Contractor shall also require its subcontractors of any tier to agree to defend, indemnify and hold harmless the Indemnitees from and against all Claims arising, directly or indirectly, from, or in any way relating to, the bodily injury or death of an employee of such subcontractor, its agents, or its subcontractors of any tier, WHETHER OR NOT SUCH CLAIMS ARE CAUSED, IN WHOLE OR IN PART, BY THE NEGLIGENCE, FAULT, OR BREACH OF STATUTE OR CONTRACT OF THE OWNER OR ITS AGENTS (OTHER THAN CONTRACTOR, ITS AGENTS, EMPLOYEES, OR SUBCONTRACTORS OF ANY TIER) AND EMPLOYEES; IT BEING THE EXPRESSED INTENT OF OWNER AND CONTRACTOR THAT, IN SUCH EVENT, THE SUBCONTRACTOR IS TO DEFEND, INDEMNIFY AND HOLD HARMLESS THE INDEMNITEES FROM AND AGAINST THE CONSEQUENCES OF THE INDEMNITEES' OWN NEGLIGENCE OR FAULT, BREACH OR VIOLATION OF A STATUTE, ORDINANCE, GOVERNMENTAL REGULATION, STANDARD, OR RULE, OR BREACH OF CONTRACT, WHETHER IT IS THE SOLE OR CONCURRING CAUSE OF THE BODILY INJURY OR DEATH OF THE EMPLOYEE OF SUCH SUBCONTRACTOR, ITS AGENTS, OR ITS SUBCONTRACTORS OF ANY TIER. This defense, indemnity, and

hold harmless agreement shall include, but is not limited to, any Claim for damages or injuries occurring after completion of the Work under Contract Documents.

§ 3.18.6 Contractor agrees, and shall require its subcontractors of any tier to agree, that the defense, indemnity, and hold harmless obligations in this Section shall not be waived, limited, or in any way affected by any limitation on the amount or type of damages, compensation, or benefits payable by or for Contractor, or its subcontractors of any tier, under any workers' compensation law, disability benefits law, or other employee benefits law.

§ 3.18.7 Contractor shall notify, and require its subcontractors of any tier to notify, Owner of any claim made against it for money or damages relating to any Work performed under the Contract Documents. Contractor shall include, and require its subcontractors of any tier to include, Owner in any release obtained by Contractor, or its subcontractors, from their subcontractors, suppliers, or any third party, and shall provide such a copy of such release to Owner within ten days following receipt.

§ 3.18.8 Contractor agrees and shall require its subcontractors of any tier to agree, that their defense, indemnity, and hold harmless obligations contained in this section shall not be relieved or diminished by securing insurance coverage in accordance with this Agreement.

§ 3.18.9 The defense, indemnity, and hold harmless obligations contained in this Section 3.18 shall survive expiration or termination of this Agreement.

§ 3.18.10 It is agreed with respect to any legal limitations now or hereafter in effect and affecting the validity or enforceability of the indemnification obligations under this Section 3.18 or the additional insured requirements of the Contract Documents, such legal limitations are made a part of the contractual obligations and shall operate to amend the obligations to the minimum extent necessary to bring the provision into conformity with the requirements of such limitations, and as so modified, the obligations shall continue in full force and effect. Should any provision in this Agreement be held invalid, unenforceable or contrary to public policy, law, statute or ordinance, then the remainder of the provision, paragraph, Section and/or Agreement shall not be affected thereby and shall remain valid and fully enforceable.

§ 3.18.11 Contractor shall incorporate Sections 3.18.3 through 318.10 into its subcontracts.

§ 3.18.3 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 obligations 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 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 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. No act or omission of the Architect shall be considered or deemed to be a waiver of any of the Owner's rights or interests. All functions of the Architect identified in this Agreement, with the exception of providing design services, may be performed by the Owner in addition to and/or instead of the Architect.

§ 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. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and suppliers shall be through the Contractor. Communications by and with Separate Contractors shall be through the Owner. The Contract Documents may specify other communication protocols.

§ 4.2.5 Based on the Architect's evaluations of the Contractor's Applications for Payment, the Architect will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

§ 4.2.6 The Architect or the Owner has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable and Owner agrees, the Architect or 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. 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, 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 or Owner 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 and so as not to delay the progress of the Work.

§ 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 so as not to delay the progress of the Work. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

ARTICLE 5 SUBCONTRACTORS

§ 5.1 Definitions

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a Separate Contractor or the subcontractors of a Separate Contractor.

§ 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 fourteen (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 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 conditionally 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 Owner assumes those obligations under the subcontract that the Owner agrees in writing with Subcontractor to assume. In no event shall Owner assume any obligation for which a breach occurred prior to the assignment. In no event shall Owner be obligated to pay subcontractors amounts that Owner has already paid to Contractor or for which Owner would not have been obligated to pay Contractor obligations under the subcontract.

§ 5.4.2 Upon such assignment, if the Work has been suspended for more than ninety days (90) days, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension.

§ 5.4.3 Upon assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 6.1 Owner's Right to Perform Construction and to Award Separate Contracts

§ 6.1.1 The term "Separate Contractor(s)" shall mean other contractors retained by the Owner under separate agreements. The Owner reserves the right to perform 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.

§ 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 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 with written approval from the Owner.

§ 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, Contractor, or Owner 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.

§ **7.2.1.1** Disagreement on Cost of Change Order Work. If Owner and Contractor cannot agree on the cost of any Change Order Work, Contractor shall proceed with the performance of the Change Order Work if Owner issues a written Construction Change Directive. Contractor will maintain cost records with respect to the Construction Change Directive and payment with respect to such Work will be calculated in accordance with Article 7 regarding Cost of the Work to be reimbursed together with the contractor's fee attributable to the Work on a monthly basis. Pending final determination of the cost of such Construction Change Directive, properly documented amounts shall be included in Applications for Payment.

§ 7.2.1.2 Disagreement on Extension of Contract Time. If Owner and Contractor cannot agree on the extension of the Contract Time caused by any Change Order Work, or the method of determining such extension, Contractor shall proceed with the performance of the Change Order Work if Owner Architect issues a written Construction Change Directive. In such event, the extension of the Contract Time due to such Construction Change Directive shall be referred to the Architect for a recommendation, who shall (within five (5) business days of receipt of such request for recommendation) reasonably recommend a proposed extension to the Contract Time, if any, or method of determining same. If Owner and Contractor do not in good faith agree with Architect's recommendation or Architect does not timely issue a recommendation, either party may submit the issue to mediation.

§ 7.2.1.3 Accurate Change Order Pricing Information. Contractor agrees that it is obligated to mitigate the impacts of any change order by using best efforts to secure fair and reasonable pricing and to submit accurate documentation to support any change order proposals or other contract price adjustments in accordance with the terms of the Contract with respect to pricing of Change Orders.

§ 7.2.1.4 It is understood and agreed that refinement and detailing will be accomplished from time to time with respect to the Drawings and Specifications set forth in the Contract Documents. Notwithstanding any other provision, Contractor shall not be entitled to an adjustment to the Cost of the Work, contractor's fee, GMP, or the date required for Substantial Completion unless (i) such refinement or detailing results in changes in the scope of the Work, quality, function, and/or intent of the Drawings and Specifications not reasonably inferable or anticipated by Contractor using reasonable judgment, industry standard practices, experience and expertise and (ii) such adjustment to the Cost of the Work, the contractor's fee, the GMP, or the date required for Substantial Completion, is first approved in writing by the Owner.

§ 7.2.2 Written agreement on any Change Order shall constitute a final settlement on all matters related to the change in the Work that is the subject of the Change Order, including, but not limited to, all direct and indirect Costs associated with such change and any and all adjustments to the Contract Sum, the Contract Time, and/or the construction schedule.

§ 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 Owner and 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.

§ 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 The Contractor acknowledges and agrees that adjustments in the Contract Time will not be permitted for Inexcusable Delays. The Contractor acknowledges and agrees that adjustments in the Contract Time will be permitted for Excusable Delays, but only to the extent (a) such delay (i) is not caused by the Contractor, (ii) could not be limited or avoided by the Contractor's timely notice to the Owner of the delay or reasonable likelihood that a delay will occur, which notice in any event must be provided within five (5) business days after the occurrence of such event, or (iii) is of a duration not less than one (1) day, and (b) the Contractor demonstrates that it has used its best efforts to minimize the consequences of any such delay. In no event shall an extension of the Contract Time be granted unless the activity for which an extension is requested is on the critical path of the most current revision of the schedule that was accepted by the Owner prior to the occurrence of the event for which the extension is requested; provided, however, an extension of the Contract Time may be granted if the activity for which an extension is requested is not on the critical path of the most current revision of the schedule, but the delay causes the activity to fall on the critical path and there is no reasonable alternative to schedule such activity off the critical path.

§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article 15.

§ 8.3.3 "Excusable Delay" shall mean a delay which is caused by (i) a change in the Work pursuant to a Change Order executed in accordance with the Contract Documents including Change Orders due to unforeseen conditions in accordance with the General Conditions, (ii) a delay caused by Owner, or (iii) a "force majeure event" (defined below). The term "force majeure event" shall refer to a delay in the performance of the Work caused by an event beyond the Contractor's reasonable control or which the Contractor could not have reasonably anticipated and avoided, including Abnormal Weather Conditions as defined in Article 15, unavoidable casualties, strikes, acts of God, moratoriums, or other abnormal governmental restrictions, war, fire or other casualty. Contractor must notify Owner within the time requirements of Section 15.1.3 of the General Conditions of any Claim for Excusable Delay hereunder and must include that Claim in the applicable Monthly Report otherwise Contractor waives that Claim.

§ 8.3.4 "Inexcusable Delay" shall mean a delay in any stage of the Progress Schedule caused by an event other than an Excusable Delay. In the event of Inexcusable Delay, Owner may direct that the Work be accelerated by means of overtime, additional crews or restructuring of the Work until such time as the Work has progressed so that it complies with the stage of completion required by the Progress Schedule. Contractor shall promptly provide a plan including a recommendation for the most effective and economical acceleration (a "Recovery Plan").

§ 8.3.5 Acceleration Plan. In the event of any acceleration requested by Owner due to an Excusable Inexcusable Delay, Contractor shall promptly provide a plan including a recommendation for the most effective and economical acceleration (an "Acceleration Plan") and the costs of same. If accepted by Owner, the implementation of such an Acceleration Plan shall be as a Change Order.

§ 8.3.6 In the event Contractor is entitled to an extension of the Contract Time pursuant to Section 8.3 and the cause of delay is intentional interference by the Owner or other events for which the Texas Supreme Court has held that a

waiver of delay damages would be against public policy, Contractor shall be entitled to an increase in the Contract Sum in an amount equal to the general conditions actually incurred by the Contractor during the period of such delay, but in no event shall Contractor be entitled to recover for lost profits, lost opportunity costs, home office overhead, or any other indirect costs.

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 may submit a proposed revision to schedule of values to the Architect and Owner 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 or Owner. This schedule, if approved in writing by the 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 Owner and supported by such data to substantiate its accuracy as the Architect or Owner may require, and if approved in writing by Owner, shall be used as a basis for reviewing the Contractor's subsequent Applications for Payment.

§ 9.2.2 It is understood and agreed that the value of the various line items comprising the Contractor's initial schedule of values may not necessarily correspond to the exact cost of such line item during Contractor's performance of the Work. Consequently, the Contractor's schedule of values shall not be considered a line-item guarantee by the Contractor of the costs of any individual line-item set forth therein. To the extent any actual cost overruns and/or underruns in the cost of the Work are encountered by the Contractor during the performance of the Work, then Contractor may reallocate line-item values to reflect such overruns and/or underruns. Such reallocation shall be supported by such data to substantiate its accuracy as the Architect or Owner may reasonably require.

§ 9.3 Applications for Payment

§ 9.3.1 At least ten (10) days before the date established for each progress payment, the Contractor shall submit to the Architect and Owner 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, 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 the Contractor or 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. The Contractor agrees to indemnify, defend and hold harmless the Owner form any and all liens, claims, security interest and other encumbrances to the extent they relate to Work for which Owner has already paid the Contractor, and will have all such liens, claims, security interests and other encumbrances immediately released and/or removed.

§ 9.4 Certificates for Payment

§ 9.4.1 The Architect will, within seven (7) 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 or Owner 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 or Owner's opinion the representations 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 Owner cannot agree on a revised amount, the Architect or Owner will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner or for which the Owner agrees. The Architect or Owner 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** so long as Owner has complied with its payment obligations, 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** failure, after having received notice of such failure from the Owner, 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. The payment of funds previously withheld pursuant to Section 9.5.1 shall be made by Owner within ten (10) days after confirmation that the basis for withholding funds has been removed or discharged.

§ 9.5.4 If the Architect withholds certification for payment under Section 9.5.1.3, and the Owner has complied with the payment provisions set forth herein, the Owner may, after providing ten (10) days' prior notice to the Contractor of its intent to make any such joint payment, 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. Owner will not make any payments directly to Subcontractors that are reasonably disputed in writing by Contractor, unless Contractor fails to promptly remove any liens filed on the Property in which case Owner shall have the right to make such payments and secure a lien release. 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. The delivery of a joint check to the Contractor shall constitute payment to Contractor under this Contract, and Contractor shall be responsible for the disbursement of any joint payment.

§ 9.6 Progress Payments

§ 9.6.1 After the Architect or Owner 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 (7) 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.

When permitted by applicable law, the Contractor may substitute a surety bond for the property against which the lien or other claim for payment has been asserted.

§ 9.6.9 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 undisputed payment due the Owner, or if the Owner incurs any costs and expenses to cure any default of the Contractor or to correct defective Work, the Owner shall have an absolute right to offset such amount against the Contract Sum.

§ 9.7 Failure of Payment

If the Architect or Owner does not issue a Certificate for Payment, through no fault of the Contractor, within seven (7) 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 has the definition provided in the Agreement.

§ 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 and Owner 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 and/or Owner will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the 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 or Owner. In such case, the Contractor shall then submit a request for another inspection by the Architect or Owner 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 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.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Contractor, and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

§ 9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

§ 9.10 Final Completion and Final Payment

§ 9.10.1 Upon receipt of the Contractor's notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment and other documents required for final payment, the Architect and/or Owner will promptly make such inspection. When the Architect and Owner find 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, (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, (7) a certificate from the Contractor that it has performed all of its obligations under the Contract, (8) a final, unconditional certificate of occupancy and all construction-related approvals, licenses and requirements for the Project enabling it to be occupied and operated for its intended use, unless such certificates have not been issued solely as a result of the acts or omissions of the Owner, (9) certification that all of the requirements for Substantial Completion under Section 9.8 have been met and all Work, including all punch list items, has been fully and finally completed, (10) a complete list of all Subcontractors and principal material and equipment suppliers, including addresses, telephone numbers, and names of individuals to contact who are familiar with the Project, (11) digital files of all maintenance and operating manuals, (12) digital files of all written guarantees and warranties in the form prescribed in the Contract Documents, (13) one digital file copy of all as-built drawings and other documentation required under the Contract Documents, and (14) all other documentation required by the Contract Documents, including required certifications. 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 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;
- **.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;
- .4 Subcontractors and materialmen;
- .5 pedestrians and vehicles and their occupants; and
- .6 surrounding neighborhoods.

§ 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, after it has been given notice of the accident, all accidents arising out of or in connection with the Work that cause death, personal injury, or property damage, giving full details and statements of any witnesses.

§ 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 negligent acts or omissions of the Owner , or by anyone for whose acts Owner 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 twenty-one (21) days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

10.2.9 Contractor shall be responsible for the security of the Work, the Site and all materials stored at the Site or at any other location by Contractor with the consent of Owner and shall maintain adequate insurance for same. Subject to Section 6.1 of the Agreement, Contractor shall be responsible for all losses and expenses incurred by reason of failure to maintain reasonable security at the Site or at the location where materials are stored, and such expenses incurred shall not increase the Contract Sum. Contractor shall comply with all reasonable security requirements of Owner.

§ 10.2.10 Contractor shall be responsible for any fines, penalties or charges by any regulatory body by reason of any violation of safety or health regulations by Contractor or its Subcontractors in the performance of the Work.

§ 10.2.11 Contractor shall employ such practices as are necessary to protect all completed and partially completed Work and all existing improvements located on the Site from loss and damage, including theft or damage by weather and, if necessary, shall provide suitable shelter therefor. Contractor shall correct at its own expense any damage or disfigurement to the Work or property (whether or not located on the Site) resulting from any act or omission of Contractor, any Subcontractor, or any other person or entity for whom any of them is legally responsible.

§ 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 Not Used.

§ 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.

§ 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 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.

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 or Owner, be uncovered for the Architect's or Owner'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 Owner agrees in writing. 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 Owner 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 reasonable 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 (1) 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. 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 (1) 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 (1) 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 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. Contractor shall furnish any required Storm Water Pollution Permit and plan, and shall provide all required notices.

§ 13.4.2 If the Architect, Owner, or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection, or approval not included under Section 13.4.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection, or approval, by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.4.3, shall be at the Owner's expense.

§ 13.4.3 If procedures for testing, inspection, or approval under Sections 13.4.1 and 13.4.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure, including those of repeated procedures and compensation for the Architect's services and expenses, shall be at the Contractor's expense.

§ 13.4.4 Required certificates of testing, inspection, or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect.

§ 13.4.5 If the Architect is to observe tests, inspections, or approvals required by the Contract Documents, the Architect will do so promptly and, where practicable, at the normal place of testing.

§ 13.4.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

§ 13.5 Interest

Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at the rate the parties agree upon in writing or, in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

§ 13.6 Additional Contractor Warranties

The Contractor represents and warrants the following to the Owner (in addition to any other representations and warranties contained in the Contract Documents), as an inducement to the Owner to execute this Agreement, which representations and warranties will survive the execution and delivery of this Agreement, any termination of this Agreement, and the Final Completion of the Work:

(i) that it and its Subcontractors are financially solvent, able to pay all debts as they mature, and have sufficient working capital to complete the Work and perform all obligations hereunder;

(ii) that it is able to furnish the tools, materials, supplies, equipment, and labor required to complete the Work within the Contract Time and Contract Sum;

(iii) that it is authorized to do business in Texas and properly licensed by all necessary governmental and public and quasi-public authorities having jurisdiction over it and over the Work and the Project; and

(iv) that it possesses a high level of experience and expertise in the business administration, construction, construction management, and superintendence of projects of the size, complexity, and nature of this particular Project, and it will perform the Work with the care, skill, and diligence of such a contractor.

The foregoing warranties are in addition to, and not in lieu of, any and all other liability imposed upon the Contractor by law with respect to the Contractor's duties, obligations, and performance hereunder. The Contractor acknowledges that the Owner is relying upon the Contractor's skill and experience in connection with the Work called for hereunder.

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 thirty (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, or 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; or
- **.3** Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of a reasonable basis for withholding certification as provided in Section 9.4.1, or because the Owner has without good cause failed to make payment on a Certificate for Payment within the time stated in the Contract Documents.

§ 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 one hundred (100%) percent of the total number of days scheduled for completion, or one hundred twenty (120) days in any three hundred sixty five (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 thirty () days' notice to the Owner and Architect, terminate and provided Owner has not taken reasonable steps to remedy the breach, the Contract and recover from the Owner payment for Work executed, as well as costs incurred by reason of such termination. In no event shall Owner be liable for lost profits, lost opportunity costs, overhead, or any other costs incurred by reason of the termination.

§ 14.1.4 If the Work is stopped for a period of thirty (30) 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 thirty 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 as set forth in Section 14.1.2 of the Agreement.

§ 14.2.2 When any of the reasons described in Section 14.1.2 of the Agreement exist, 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, after seven (7) days' written notice, if Contractor has not cured, or commenced and continue correction 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.

Notwithstanding the foregoing, if Owner reasonably determines that Contractor's acts or omissions pose an immediate and substantial threat or danger of injury to persons or damage to the Work or other property, Owner may, without prejudice to any other rights or remedies granted by this Contract or by law, immediately suspend Contractor's performance of the Work, take immediate possession of the Project site, take such further action

reasonably necessary to prevent, mitigate against, remove, or repair such threat or damage, and deduct such costs and expenses it reasonably incurs from any sums due and owing to the Contractor or, in the absence thereof, to recover such costs and expenses from the Contractor

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.1.2 of the Agreement, the Contractor shall not be entitled to receive further payment until the Work is finished. Upon receipt of any such written notice of termination of the right to proceed, the Contractor shall, at its expense, for that Work affected by any such termination:

.1 Make an inventory of all materials and equipment in storage at the site, in route to the site, in storage or manufacture away from the site, and on order from suppliers;

.2 Assign to the Owner, subcontracts, supply contracts, and equipment rental agreements all as designated by the Owner;

.3 Remove from the site all construction materials, equipment, and plant listed in said inventory other than such construction materials, equipment, and plant which are designated in writing by the Owner to be used by the Owner in completing such Work;

.4 Promptly provide to Owner any and all records, plans, drawings, data, permits, specifications, sketches, reports and other information relating to the terminated Work;

.5 Transfer to Owner all data and information contained within the Project Management Software.

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's reasonable 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 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; and costs incurred by reason of the termination, including costs attributable to termination of Subcontracts. In no event shall Owner be liable for lost profits, lost opportunity costs, overhead, or any other costs incurred by reason of the termination.

§ 14.4.4 If Owner terminates the Contract under Section 14.2 but it should be determined that Contractor was not in default hereunder, then such termination shall be deemed, as of the date made, to have been made under Section 14.4.

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 ten (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 with a copy sent to the Architect. Claims by either party under this Section 15.1.3.1 shall be initiated within twenty-one (21) days after occurrence of the event giving rise to such Claim or within twenty-one (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.

§ 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.

§ 15.1.5 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. Owner and Contractor agree that the critical path of the project schedule shall allow for anticipated delays due to adverse weather conditions as follows: _____. Lost days due to adverse weather shall include any day on which critical path work cannot be performed for at least four continuous hours, or on which production on critical path activities is reduced to less than four hours of normal production within an 8-hour work day due to rain, snow, freezing rain, fog, low and high temperatures, or high winds. The actual number of lost days due to adverse weather encountered on the project shall be documented by the Contractor recording their occurrence in the Contractor's project management software within twenty-four (24) hours of the lost day. Monthly and in conjunction with the pay application process, Owner and Contractor shall come to agreement on the number of lost days due to adverse weather for the preceding month in excess of the anticipated number of weather days ("Abnormal Weather Conditions"), and calendar day extensions of time shall be accordingly based and granted on monthly account. No weather days unused for previous months may be carried over or accountable for future periods of time.

§ 15.1.7 Waiver of Claims for Consequential Damages

NOTWITHSTANDING ANYTHING TO THE CONTRARY, BUT SUBJECT TO THE NEXT SENTENCE, IN NO EVENT WILL EITHER PARTY BE LIABLE TO THE OTHER PARTY FOR ANY INDIRECT, INCIDENTAL, SPECIAL, CONSEQUENTIAL, PUNITIVE OR EXEMPLARY DAMAGES OF ANY NATURE ARISING OUT OF OR IN CONNECTION WITH A PARTY'S PERFORMANCE OR FAILURE TO PERFORM UNDER THE AGREEMENT, INCLUDING LOST PROFITS OR REVENUES, LOSS OF CUSTOMER GOODWILL, BUSINESS INTERRUPTION COSTS, OVERHEAD COSTS, COSTS OF CAPITAL OR LOSS OF USE OF MONEY, REGARDLESS OF THE FORM OF THE ACTION OR CLAIM OR THE THEORY OF RECOVERY, EVEN IF ADVISED IN ADVANCE OF THE POSSIBILITY OF SUCH DAMAGES. HOWEVER, IT IS EXPRESSLY UNDERSTOOD THAT THE LIMITATION ON LIABILITY PROVIDED FOR IN THIS ARTICLE WILL BE SUBJUGATED TO, AND WILL NOT LIMIT OR OTHERWISE AFFECT IN ANY MANNER, CONTRACTOR'S REMEDIAL AND WARRANTY OBLIGATIONS OR CONTRACTOR'S INDEMNIFICATION OBLIGATIONS.

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.

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 «» day of « » in the year «2023
(In words, indicate day, month and year.)

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

«Greenville Independent School District »« »
«4004 Moulton Street »
«Greenville, Texas 75403 »
« »

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

« »« »
« »
« »
« »

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

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

«Corgan Associates, Inc. «
401 North Houston Street
Dallas, Texas 75202
214-748-2000»

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

ARTICLE 1 THE CONTRACT DOCUMENTS

The Contract Documents consist of this Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to execution of this Agreement, other documents listed in this Agreement, and Modifications issued after execution of this Agreement, all of which form the Contract, and are as fully a part of the Contract as if attached to this Agreement or repeated herein. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. An enumeration of the Contract Documents, other than a Modification, appears in Article 9.If there is any inconsistency, ambiguity, or discrepancy in the Contract Documents, precedence shall be given to the Contract Documents in the following order of priority: (1) fully executed written Modifications issued after execution of this Agreement; (2) this Agreement; (3) Addenda issued prior to the execution of this Agreement, with the Addenda bearing the latest date taking precedence; (4) any Supplementary General Conditions; (5) the AIA Document A201™–2017, Modified General Conditions of the Contract for Construction as modified for this Project; (6) the Final Drawings and Specifications and (7) the Preliminary Drawings and Specifications, with those bearing the latest date taking precedence.

ARTICLE 2 THE WORK OF THIS CONTRACT

§ 2.1 The Contractor shall fully execute the Work (as defined in Article 1 of AIA Document A201-2017) described in the Contract Documents, except as specifically indicated in the Contract Documents to be the responsibility of others. The Contractor agrees to perform the Work in a good and workmanlike manner, consistent with the requirements of the Contract Documents, according to construction industry standards, and in compliance with applicable law. Contractor will perform all Work described in the Contract Documents, including Work which, although not specifically shown or described, can be reasonably inferred by a competent contractor from the Contract Documents to be required for the completion of the Work.

§ 2.2 The Contractor will cooperate with the Owner and the Architect, and exercise the Contractor's skill and judgment to furnish efficient project administration and supervision; to retain at all times an appropriate number of qualified workers and sufficient materials; and to ensure the Work is performed in an expeditious and economical manner consistent with the Contract Documents.

§ 2.3 It is recognized that the Contractor's review obligations are made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents. Contractor will make reasonable efforts consistent with construction industry standards to diligently, carefully and thoroughly study and compare all Contract Documents, take field measurements and verify field conditions, compare them to the Drawings and Specifications, and will report in writing to Architect and Owner any questions, errors, inconsistencies, inadequacies, insufficiencies, or omissions (collectively "Deficiencies") in the plans,

specifications, or other design documents that are identified by Contractor. Throughout Contractor's performance of the scope of work, Contractor will necessarily review the Contract Documents on a continuous basis for purposes of discovering Deficiencies. Contractor's review of the Contract Documents for Deficiencies under this Section includes review for clarity, consistency, constructability, maintainability/operability and coordination among trades. When reasonable and appropriate under the circumstances, Contractor shall consult with Architect regarding the selection of materials, building systems and equipment, and shall recommend alternative solutions whenever design details affect construction feasibility, schedules, cost or quality and shall provide other value engineering services.

§ 2.4 Contractor shall promptly report in writing to Owner and Architect any Deficiencies Contractor identifies in the Contract Documents based on its review of the Contract Documents as set forth above in Section 2.3. Contractor acknowledges that it may be liable, in whole or part, to Owner for consequences that are the direct result of Contractor's failure to promptly disclose Deficiencies in writing to Owner and Architect. Nothing in Section 2.3 or 2.4 shall be construed to modify or affect legal, contractual and/or professional obligations of Architect and/or Owner regarding plans, designs, Drawings or Specifications, or identification and/or handling of Deficiencies.

§ 2.5 Contractor shall communicate with Owner's Key Personnel as shown on Exhibit B. However, if a Project Manager is identified on the cover page, Contractor acknowledges that the Owner has retained an outside Project Manager to provide project management services pursuant to a separate written agreement by and between the Owner and the Project Manager. Except as may otherwise be requested by the Owner in writing, the Contractor shall communicate with the Owner and Architect through the Project Manager and shall take into account the time required for inclusion of the Project Manager in the communication and decision-making process. Notwithstanding any other provision regarding communications, any notice of default must be sent via email and certified mail to Rachel Bryen.

§ 2.6 The Contractor shall furnish only skilled, properly trained, and appropriately licensed staff to perform the Work. Owner shall have the right to require Contractor to dismiss from the Project any employee of Contractor whose performance is not reasonably satisfactory to Owner. The key members of the Contractor's staff for the Work shall be persons agreed upon with Owner and identified in Exhibit B ("Owner/Contractor Key Personnel"). Contractor Key Personnel shall not be changed without the written consent of the Owner (not to be unreasonably withheld, delayed, or conditioned), unless the person becomes unable to perform any such duties due to death, disability, or termination of employment with the Contractor. Owner may reject any proposed individual or subcontractor in his or her sole discretion. Except as expressly authorized by this Agreement, Contractor has no right or authority of any kind to act as the representative of or on behalf of the Owner. Contractor is an independent contractor and not an agent of Owner.

ARTICLE 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

§ 3.1 The date of commencement of the Work shall be:
(Check one of the following boxes.)

[« »] The date of this Agreement.

[« X »] A date set forth in a notice to proceed issued by the Owner.

[« »] Established as follows:
(Insert a date or a means to determine the date of commencement of the Work.)

« »

If a date of commencement of the Work is not selected, then the date of commencement shall be the date of this Agreement.

§ 3.2 The Contract Time shall be measured from the date of commencement of the Work, and, subject to adjustments of the Contract Time as provided in the Contract Documents, the Contract Time shall end on the Substantial Completion Date (as defined below).

§ 3.3 Substantial Completion

§ 3.3.1 Subject to adjustments of the Contract Time as provided in the Contract Documents, the Contractor shall diligently prosecute the Work and shall achieve Substantial Completion (as defined below) of the entire Work: *(Check one of the following boxes and complete the necessary information.)*

[« »] Not later than « » (« ») calendar days from the date of commencement of the Work.

[« »] By the following date: « » (the "Substantial Completion Date")»

Final Completion of the Work shall be achieved within a reasonable time thereafter but in no event later than thirty (30) days after Substantial Completion of the Work.

§ 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	Milestone Completion Date

§ 3.3.3 If the Contractor fails to achieve Substantial Completion as provided in this Section 3.3, liquidated damages, if any, shall be assessed as set forth in Section 4.5.

§3.3.4 "Substantial Completion" means the date certified by the Architect when (i) construction of the Work is sufficiently complete in accordance with the Contract Documents (e.g., full completion in accordance with the Contract Documents, except for minor details of construction, landscaping, decoration, mechanical adjustment, or installation, as applicable, and all testing has been completed so that utilities, operational systems, and equipment are fully operational), so that the Owner can beneficially occupy and use the Project for its intended purpose; (ii) the Architect has determined (with Contractor's written assurance and commitment) that all punch list work can be completed within thirty (30) days; (iii) all required governmental inspections applicable to the Work have been conducted and all final approvals required for beneficial occupancy have been obtained from authorities with jurisdiction over the Project, including a Certificate of Occupancy issued by appropriate authorities, unless failure to obtain such approvals is due to reasons other than the fault of the Contractor, its Subcontractors, or suppliers; and (iv) all other conditions precedent to Substantial Completion as set forth in the Contract Documents have been satisfied. In general, the only remaining Work shall be minor in nature so that the Owner could occupy the Work, it can be certified as having achieved Final Completion (as defined below) within thirty (30) days following the date of Substantial Completion, and the completion of the remaining Work by Contractor would not materially interfere with or hamper the Owner's normal use of the Work or pose any safety risk to anyone entering the Project.

§3.3.5 "Final Completion" means the date certified by the Architect when (i) construction of the Work is fully complete in accordance with the Contract Documents, including all minor details of construction, landscaping, decoration, mechanical adjustment, or installation, as applicable (i.e. punch list is complete) and (2) all requirements of §9.10 of the General Conditions have been achieved by Contractor.

§3.3.6 Project Schedule. Contractor shall provide scheduling and periodic updating of the progress of the Work and other necessary schedules in the interest of completing the Work in the most expeditious and economic manner and as otherwise required by the General Conditions. Exhibit C is an approved progress schedule (the "Progress Schedule") for performance of the Work. The Progress Schedule will at all times provide that Substantial Completion of the entire Work will be achieved on or before the Substantial Completion Date. The Progress Schedule will indicate the dates for the start and completion of the various stages of the Work and will be revised as required by the conditions of the Work. Each month, the Contractor will provide the Owner with a written update comparing actual progress of the Work with the Progress Schedule and informing the Owner of any deviations from the Progress Schedule. Within thirty (30) days of the date of this Agreement, Contractor will provide Owner with a more detailed progress schedule that comports with the deadlines in the Progress Schedule. Once Owner has approved the more detailed Progress Schedule from Contractor, the more detailed progress schedule will be the Progress Schedule for all purposes. Schedule details may be added or deleted for clarity during the life of the project for Contractor's convenience and without prior approval from the Owner, provided established and approved contract turn/acceptance dates are not negatively impacted. Contractor represents that Contractor has consulted, or will consult with all necessary public, governmental and private entities, and all necessary utilities prior to the

preparation of the Progress Schedule and performance of the Work in order to plan for and coordinate necessary lead times for the various stages of the Work to be substantially completed on or before each Milestone Completion Date and the Substantial Completion Date, as applicable. Owner hereby advises Contractor that long lead times may be required by such entities where applicable stages of the Work impact public facilities and/or utilities.

§3.3.7 Continuity. Contractor acknowledges that the timely and complete performance of its obligations pursuant to this Agreement is critical to the business, operations, and prospects of Owner. Accordingly, in the event of a dispute between Owner and Contractor, Contractor will continue to so perform its obligations under this Agreement and Owner will continue to make undisputed payments (including payments on undisputed portions of pay applications) during the resolution of such dispute until Final Completion or termination of the contract.

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), subject to additions and deductions as provided in the Contract Documents. Owner is qualified for exemption from State and Local Sales Tax pursuant to the provisions of Article 20.04(F) of the Texas Limited Sales, Excise and Use Applicable State Sales Taxes by complying with such procedures as may be prescribed by the State Comptroller of Public Accounts.

§ 4.2 Alternates

§ 4.2.1 Alternates, if any, included in the Contract Sum:

Item	Price

§ 4.2.2 Subject to the conditions noted below, the following alternates may be accepted by the Owner following execution of this Agreement. Upon acceptance, the Owner shall issue a Modification to this Agreement.
(Insert below each alternate and the conditions that must be met for the Owner to accept the alternate.)

Item	Price	Conditions for Acceptance

§ 4.3 Allowances, if any, included in the Contract Sum:
(Identify each allowance.)

Item	Price

§ 4.4 Unit prices, if any:
(Identify the item and state the unit price and quantity limitations, if any, to which the unit price will be applicable.)

Item	Units and Limitations	Price per Unit ($0.00)

§ 4.5 Liquidated damages, if any:
(Insert terms and conditions for liquidated damages, if any.)

« All time limits stated in the Contract Documents are of the essence. Contractor agrees to perform its obligations with due diligence and within such time limits set forth in the Contract Documents and shall use reasonable efforts to mitigate any risk of delays. The Contractor acknowledges and agrees that if the Contractor fails to reach Substantial Completion of the Work within the Contract Time, the Owner will sustain damages and loss because of such failure and the exact amount of such damages will be difficult to ascertain. The Owner and the Contractor, therefore, agree that if the Contractor fails to achieve Substantial Completion of the Work within the Contract Time and such failure to achieve Substantial Completion is not the result of Excusable Delay, the Owner shall be entitled to retain or recover from the Contractor, as liquidated damages and not as a penalty, the sum of _____dollars ($XX.XX) per day for each day beginning on the 10th day after the scheduled Substantial Completion date until Contract achieves Substantial Completion. Contractor agrees that the liquidated damages are a reasonable pre-estimate of damages the Owner will incur because of delayed completion of the Work. The Owner

may deduct liquidated damages described in this Section from any unpaid amounts due the Contractor under this Agreement. Any liquidated damages not deducted from any unpaid amounts due the Contractor shall be payable to the Owner at the demand of the Owner. In the event a Court determines that the liquidated damages amount is a penalty, then, Owner shall be entitled to seek recovery from Contractor of all damages suffered as a result of the delay regardless of whether such damages are indirect, incidental, special, or consequential damages, so long as such damages are consistent with damages recoverable under the Contract Documents and Texas law. »

§ 4.6 Other:

« The Contractor's initial schedule of values allocating the entire Contract Sum to the various portions of the Work and assumptions and clarifications is attached as Exhibit D. »

ARTICLE 5 PAYMENTS

§ 5.1 Progress Payments

§ 5.1.1 Based upon Applications for Payment submitted to the Architect by the Contractor and Certificates for Payment issued by the Architect, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided below and elsewhere in the Contract Documents.

§ 5.1.2 The period covered by each Application for Payment shall be one calendar month ending on the last day of the month, or as follows:

§ 5.1.3 Provided that an Application for Payment is received by the Architect not later than the «30th » day of a month, the Owner shall make payment of the amount certified to the Contractor not later than thirty (30) days from the date Contractor delivers the Application for Payment, and documentation required herein, to Architect. If an Application for Payment is received by the Architect after the application date fixed above, payment of the amount certified shall be made by the Owner not later than «thirty» («30») days after the date the Contractor delivers the Application for Payment to Architect. Contractor shall submit the draft Application for Payment to Architect not later than the 25th day of the month and Architect shall promptly review and approve same, or provide Contractor with a reasonable basis any portion of the Application for Payment cannot be certified and the requested revisions to same.
(Federal, state or local laws may require payment within a certain period of time.)

§ 5.1.4 Each Application for Payment shall be based on the most recent schedule of values submitted by the Contractor in accordance with the Contract Documents. The schedule of values shall allocate the entire Contract Sum among the various portions of the Work. The schedule of values shall be prepared in such form, and supported by such data to substantiate its accuracy, as the Owner, Project Manager, or Architect may reasonably require. This schedule of values shall be used as a basis for reviewing the Contractor's Applications for Payment.
Notwithstanding the reference in this Agreement to the Contractor's schedule of values, it is understood that the individual line-items appearing in any such schedule are included as a tool for budget and accounting purposes and to facilitate payment to the Contractor. The schedule of values shall not be deemed a line-item guarantee for any particular line-item. Upon notice to the Owner, the Contractor may redistribute line items to reflect the progress of the Work and to facilitate completion of the Project.

§ 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. In addition to other required items, each Application for Payment shall be accompanied by the following documentation, statements and information, in form and substance reasonably satisfactory to the Owner and in compliance with applicable state statutes:

.1 statement, under oath, by Contractor that all bills or obligations incurred by Contractor, for which previous Applications for Payment have been submitted and paid by Owner, have been paid by Contractor, or, if any bill or obligation remains outstanding, the statement shall fully disclose the outstanding bill or obligation by stating the name of the person or entity to whom the bill or obligation remains outstanding, the amount of the outstanding bill or obligation, and the reason why such bill or obligation has not been paid; Contractor's sworn statement must include Contractor's

Subcontractor list in Excel electronic format and must reflect the amount of change orders entered into, by Contractor with Subcontractors;

.2 a duly executed Conditional Waiver and Release on Progress Payment (as shown in Exhibit K-1) from the Contractor and each Subcontractor waiving all such liens or Claims (as defined in Article 15 of AIA Document A201-2017) for payment for the work covered by the Application for Payment being submitted conditioned upon receipt of payment;

.3 for any payments made by Owner to Contractor at least seven days prior to submission of the pending Application for Payment ("Prior Payments"), a duly executed Unconditional Waiver and Release on Progress Payment (as shown in Exhibit K-2) from each Subcontractor waiving all liens or Claims for payment for the work covered by such Prior Payments;

.4 for any payments made by Owner to Contractor prior to submission of the pending Application for Payment a duly executed Unconditional Waiver and Release on Progress Payment (as shown in Exhibit K-2) from Contractor waiving all liens or Claims for payment for the work covered by the previous Application for Payment; and

.5 such other reasonable information, documentation, and material as the Owner or Owner's lender of any may request. Owner shall furnish to Contractor any policies, procedures, or other requirements of Owner, or any construction finance lender or lenders needed to approve and/or authorize payments to Contractor.

§ 5.1.6 In accordance with AIA Document A201™–2017, General Conditions of the Contract for Construction, as modified by the parties, and subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

§ 5.1.6.1 The amount of each progress payment shall first include:

.1 That portion of the Contract Sum properly allocable to completed Work as determined by multiplying the percentage completion of each portion of the Work by the share of the Contract Sum allocated to that portion of the Work in the schedule of values;

.2 That portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction, or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing; and

.3 That portion of Construction Change Directives that the Architect determines, in the Architect's professional judgment, to be reasonably justified.

§ 5.1.6.2 The amount of each progress payment shall then be reduced by:

.1 The aggregate of any amounts previously paid by the Owner;

.2 The amount, if any, for Work that remains uncorrected and for which the Architect has previously withheld a Certificate for Payment as provided in Article 9 of AIA Document A201–2017;

.3 Any amount for which the Contractor does not intend to pay a Subcontractor or material supplier, unless the Work has been performed by the Contractor or others the Contractor intends to pay;

.4 For Work performed or defects discovered since the last payment application, any amount for which the Architect may withhold payment, or nullify a Certificate of Payment in whole or in part, as provided in Article 9 of AIA Document A201–2017; and

.5 Retainage withheld pursuant to Section 5.1.7.

Notwithstanding any provisions in the Contract Documents to the contrary, the Owner may withhold payment to the Contractor to the extent reasonably necessary to protect its interests hereunder if any one or more of the following conditions exist:

.1 Contractor is in default of any of its material obligations hereunder or otherwise is in material default under any of the Contract Documents, in which event Owner shall provide Contractor with written notice and five (5) business days opportunity to cure such default;

.2 Any part of such payment is attributable to Work which is defective or not performed in accordance with the Drawings and Specifications (as such terms are defined in Article I of AIA Document 201-

2017); provided, however, such payment will be made as to the part thereof attributable to Work which is performed in accordance with the Drawings and Specifications and is not defective (unless otherwise specified herein, only that portion of the Work which is defective will not be paid);

.3 Contractor has failed to make payments promptly to Subcontractors for material or labor used in the Work for which the Owner has made payment to the Contractor per the terms of this Agreement and the General Conditions; or

.4 Contractor fails to deliver the above-required affidavits, releases and waivers of lien, but only as to the portions attributable to the missing affidavits, releases and waivers of lien.

In the event Owner withholds payment for any of the aforementioned reasons .2 through .4, Owner will provide Contractor with a written notice and explanation of the basis for withholding payment to facilitate meaningful discussion between Owner and Contractor in furtherance of resolving the conditions supporting the withholding of payment by Owner.

§ 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 until 30 days after final completion »

§ 5.1.7.1.1 The following items are not subject to retainage:
(Insert any items not subject to the withholding of retainage, such as general conditions, insurance, etc.)

« »

§ 5.1.7.2 Reduction or limitation of retainage, if any, shall be as follows:
(If the retainage established in Section 5.1.7.1 is to be modified prior to Substantial Completion of the entire Work, including modifications for Substantial Completion of portions of the Work as provided in Section 3.3.2, insert provisions for such modifications.)

»

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

Notwithstanding Contractor's inclusion of retainage in an Application for Payment, Owner shall have the right to withhold retainage for more than thirty days after Final Completion for the amounts of any liens or claims by Contractor's subcontractors, materialmen and mechanics performing work on the Project. »

§ 5.1.8 If Final Completion of the Work is materially delayed through no fault of the Contractor, the Owner shall pay the Contractor any additional amounts in accordance with Article 9 of AIA Document A201–2017.

§ 5.1.9 Except with the Owner's prior approval, the Contractor shall not make advance payments to suppliers for materials or equipment which have not been delivered and stored at the site.

§ 5.2 Final Payment

§ 5.2.1 Final payment, constituting the entire unpaid balance of the Contract Sum, shall be made by the Owner to the Contractor when

.1 the Contractor has fully performed the Contract except for the Contractor's responsibility to correct Work as provided in Article 12 of AIA Document A201–2017, and to satisfy other requirements, if any, which extend beyond final payment;

.2 a final Certificate for Payment has been issued by the Architect;

.3 receipt of confirmation of approval of such completion by local government authorities, as evidenced by a certificate of occupancy or similar final inspection certificate; provided, however, that if the Contractor has only obtained a temporary certificate of occupancy due to (i) Owner's failure to complete Owner's obligations which are conditions precedent to obtaining a permanent certificate of occupancy, or (ii) additional requirements made by governmental authorities covering items not in the Contract; then final payment shall be made on the basis of such temporary certificate of occupancy;

.4 receipt by Owner of a Bills Paid Affidavit in the form provided as Exhibit K-5 and conforming to statutory requirements;.5 a Conditional Waiver and Release of Lien of Final Payment in the form provided as Exhibit K-3 waiving the Contractor's constitutional and statutory mechanic's lien or any other Claim for payment, conditioned upon receipt of payment.

.6 a Conditional Waiver and Release of Lien on Final Payment in the form provided as Exhibit K-3 from each Subcontractor or supplier, waiving, upon receipt of Final Payment, any and all mechanic's liens or any other Claim for payment; and

.7 satisfaction by Contractor of the remaining close-out procedures and other final payment requirements described in the Contract Documents.

§ 5.2.2 The Owner's final payment to the Contractor shall be made no later than 30 days after the date Contractor submits its final Certificate for Payment to Architect, provided that all specified requirements of 5.2.1 have been satisfied.

§ 5.2.2.1 If any subcontractor or supplier refuses to furnish the release required above or in the event that a Claim for payment or lien has been asserted by a subcontractor or supplier furnishing work to the Project, and unless a payment bond has been previously furnished by Contractor, Contractor shall furnish a surety bond reasonably acceptable to Owner to release such Claim against Owner and the lien, if any, and otherwise fully comply with the provisions of the Texas Property Code.

§ 5.2.2.2 If Contractor allows any undisputed indebtedness to accrue to any of its subcontractors on the Project and fails to pay or discharge that indebtedness within fifteen (15) days after receipt of written demand from Owner, then Owner may withhold payment until that indebtedness is paid or pay the indebtedness and deduct that amount from Contractor's fees. If Contractor allows any Third-Party Liens by its subcontractors on the Project, whether valid or invalid, to be placed on any property owned, controlled or encumbered by Owner, any and all Claims for payment to Contractor of any amount owed Contractor may be denied by Owner until the Third-Party Lien is removed. If the Third Party Lien is not removed by way of payment, bond or such other means that removes the Third Party Lien in compliance with applicable Laws within thirty (30) days after the date of Owner notice to Contractor thereof, Owner may pay the associated Claim and deduct the amount paid, together with all related expenses, including attorneys' fees, from any amount owed Contractor, or at Owner's election, Contractor will reimburse Owner for such amounts within fifteen (15) days of receiving an invoice therefor. Any payment made in good faith by Owner will be binding on Contractor.

§ 5.2.2.3 Contractor will, within twenty-one (21) days after Owner makes Final Payment, provide to Owner original, fully executed final, Unconditional Waiver and Release of Lien of Final Payment in the form provided as Exhibit K-4 from Contractor, all Subcontractors, sub-subcontractors and material suppliers (the "Final Release").»

§ 5.3 Interest

Payments due and unpaid under the Contract shall bear interest from the date payment is due at the rate stated below, or in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

(Insert rate of interest agreed upon, if any.)

«» « »

ARTICLE 6 DISPUTE RESOLUTION

§ 6.1 NOT USED

§ 6.2 Binding Dispute Resolution
For any Claim subject to, but not resolved by, mediation pursuant to Article 15 of AIA Document A201–2017, the method of binding dispute resolution shall be as follows:
(Check the appropriate box.)

[« »] Arbitration pursuant to Section 15.4 of AIA Document A201–2017

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

[« »] Other *(Specify)*

« »

If the Owner and Contractor do not select a method of binding dispute resolution, or do not subsequently agree in writing to a binding dispute resolution method other than litigation, Claims will be resolved by litigation in a court of competent jurisdiction.

ARTICLE 7 TERMINATION OR SUSPENSION
§ 7.1 The Contract may be terminated by the Owner or the Contractor as provided below and in Article 14 of AIA Document A201–2017.

§ 7.1.1 Termination by the Owner for Cause
§ 7.1.1.1 Owner may terminate the Agreement, in whole or in part, for cause effective as of the date specified by Owner in a termination notice to Contractor, if any one or more of the following occurs: (a) Contractor files a voluntary petition in bankruptcy or an involuntary petition is filed against it, Contractor is adjudged bankrupt, a court assumes jurisdiction of the assets of Contractor under a federal reorganization act or other statute, a trustee or receiver is appointed by a court for all or a substantial portion of the assets of Contractor, Contractor becomes insolvent, suspends business or ceases to conduct its business in the ordinary course, or Contractor makes an assignment of its assets for the benefit of its creditors; (b) any negligence, gross negligence or willful misconduct by Contractor or persons for whom it is responsible; (c) failure of any Work or, or by Contractor, to comply with any Law; (d) Contractor fails to make timely payment to any of its contractors or subcontractors, or timely pay for any materials or other resources utilized in the performance of the Work; or (e) any breach of any of Contractor's representations, warranties or covenants under the Agreement. If the Owner terminates the Contract for cause. The amount, if any, to be paid to the Contractor under Article 14 of AIA Document A201–2017 shall not cause the Stipulated Price to be exceeded, nor shall it exceed an amount calculated as follows:

.1 Take the Cost of the Work incurred by the Contractor to the date of termination;
.2 Add the Contractor's Fee, computed upon the Cost of the Work to the date of termination;
.3 Subtract the aggregate of previous payments made by the Owner; and
.4 Subtract the costs and damages incurred, or to be incurred, by the Owner under Article 14 of AIA Document A201–2017.

§ 7.1.1.2 The Owner shall also pay the Contractor fair compensation, either by purchase or rental at the election of the Owner, for any equipment owned by the Contractor that the Owner elects to retain and that is not otherwise included in the Cost of the Work. To the extent that the Owner elects to take legal assignment of subcontracts and purchase orders (including rental agreements), the Contractor shall, as a condition of receiving the payments referred to in this Article, execute and deliver all such papers and take all such steps, including the legal assignment of such subcontracts and other contractual rights of the Contractor, as the Owner may require for the purpose of fully vesting in the Owner the rights and benefits of the Contractor under such subcontracts or purchase orders.

§ 7.1.1.3 If it is determined that Owner did not have cause for termination, then the termination for cause shall be treated as a termination for convenience. In the event of a termination for convenience, Contractor shall only be entitled to recover amounts, damages and costs permitted by 7.1.2

§ 7.1.2 **Termination by the Owner for Convenience**
Owner may terminate the Agreement in whole or in part for any reason or no reason effective as of the date specified by the Owner in a termination notice to Contractor. If the Contract is terminated for the Owner's convenience in accordance with Article 14 of AIA Document A201–2017, then the Owner's only liability will be to

pay Contractor the unpaid balance due Contractor for Work actually performed in accordance with the Agreement up to the termination date, less any outstanding Claim amount Owner has against Contractor.
(Insert the amount of, or method for determining, the fee, if any, payable to the Contractor following a termination for the Owner's convenience.)

« »

§ 7.2 The Work may be suspended by the Owner as provided in Article 14 of AIA Document A201–2017.

ARTICLE 8 MISCELLANEOUS PROVISIONS

§ 8.1 Where reference is made in this Agreement to a provision of AIA Document A201–2017 or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

§ 8.2 The Owner's representative:
(Name, address, email address, and other information)

« »
« »
« »
« »
« »
« »

§ 8.3 The Contractor's representative:
(Name, address, email address, and other information)

« »
« »
« »
« »
« »
« »

§ 8.4 Neither the Owner's nor the Contractor's representative shall be changed without ten days' prior notice to the other party.

§ 8.5 Insurance and Bonds

§ 8.5.1 The Owner and the Contractor shall purchase and maintain insurance as set forth in AIA Modified Exhibit A, Insurance and Bonds ("AIA Modified Exhibit A"), and elsewhere in the Contract Documents.

§ 8.5.2 The Contractor shall provide bonds as set forth in AIA Modified Exhibit A, and elsewhere in the Contract Documents.

§ 8.6 Notice in electronic format, pursuant to Article 1 of AIA Document A201–2017, may be given in accordance with AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, if completed, or as otherwise set forth below:
(If other than in accordance with AIA Document E203–2013, insert requirements for delivering notice in electronic format such as name, title, and email address of the recipient and whether and how the system will be required to generate a read receipt for the transmission.)

«
§ 8.7 Other provisions:

« **§ 8.7.1** Owner in its sole discretion may, pursuant to the procedures set forth in Article 7 of the AIA Document A201-2017, authorize changes in the Work, issue additional instructions, require additional Work or direct the

omission of Work previously ordered. Contractor will use commercially reasonable efforts to implement and perform such modifications without impacting the established schedule for performing and completing any Work. If it is not possible to avoid such an impact, Contractor will promptly notify Owner of the anticipated impact and obtain Owner's consent prior to implementing the applicable modification. Owner, in its sole discretion, may forego or delay such modifications or temporarily adjust the Work to be performed by Contractor, or the schedules associated with such work, to permit Contractor's implementation and performance of such modifications.

§ 8.7.2 Contractor shall include in each Subcontract a provision permitting Contractor to assign to Owner each Subcontract upon termination of this Agreement in good faith pursuant to Section 14.2 of the General Conditions. Upon termination, Contractor agrees, upon Owner's written request, to execute an assignment of any or all Subcontracts to Owner. Each Subcontract shall contain provisions stating that: (1) upon assignment of each Subcontract to Owner, Subcontractor shall assume toward the Owner all of the obligations and responsibilities which the Contractor by the Contract Documents, assumes toward the Owner; (2) Owner's liability to Subcontractor for any costs incurred by Subcontractor prior to the assignment shall be limited to Subcontractor's lien or bond claims unless otherwise agreed to in writing by Owner following the assignment.

§ 8.7.3 Promptly after the Commencement Date, Contractor shall enter into written contracts upon commercially reasonable terms with each subcontractor or supplier (and require each subcontractor or supplier to do the same with lower tiered subcontractors or suppliers) who is to provide, directly or indirectly, the materials specified in the Contract Documents for use on the Project as soon as it is practical for Contractor to do so and use good faith and commercially reasonable efforts to require subcontractors and suppliers (of any tier) to perform in accordance with the terms of such written contracts for the provision of the specified materials for the Project.

§ 8.**7.4** Contractor shall provide prompt written notice to Owner of any information from or communications with the subcontractors or suppliers (of any tier) relating to such subcontractor or supplier's actual or anticipated failure or inability to timely provide the specified materials in accordance with the terms of such subcontractor or supplier's written contract for the provision of such materials and/or labor for the Project

§ 8.**7.5** Contractor shall provide prompt written notice to Owner of any potential delays in procurement and delivery due to unavailability of materials or labor, delay in delivery, or subcontractor or supplier's failure or refusal to deliver the specified materials in accordance with the terms of its written contract and provide an outline of the actions Contractor has taken or proposes to take to mitigate or resolve the impact of such delay or failure or inability of the Contractor or supplier.

§ 8.7.6 If Contractor has complied with all these obligations and is unable to mitigate the delay, then it may submit for Owner's consideration a properly supported request for extension of time for completion of the work impacted by such delay but shall not be entitled to an increase in the Contract Sum.

»

ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

§ 9.1 This Agreement is comprised of the following documents:

.1 AIA Document A101™–2017, Modified Standard Form of Agreement Between Owner and Contractor

.2 AIA Document A101™-2017 Modified Exhibit A, Insurance and Bonds

.3 AIA Document A201™–2017, Modified General Conditions of the Contract for Construction

.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
Exhibit E		

.6 Specifications

Section	Title	Date	Pages
Exhibit E			

.7 Addenda, if any:

Number	Date	Pages
Exhibit E		

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

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

[« »] AIA Document E204™–2017, Sustainable Projects Exhibit, dated as indicated below:
(Insert the date of the E204-2017 incorporated into this Agreement.)

«

[« »] The Sustainability Plan:

Title	Date	Pages

[« »] Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages

.9 Other documents, if any, listed below:
(List here any additional documents that are intended to form part of the Contract Documents. AIA Document A201™–2017 provides that the advertisement or invitation to bid, Instructions to Bidders, sample forms, the Contractor's bid or proposal, portions of Addenda relating to bidding or proposal requirements, and other information furnished by the Owner in anticipation of receiving bids or proposals, are not part of the Contract Documents unless enumerated in this Agreement. Any such documents should be listed here only if intended to be part of the Contract Documents.)

« « Exhibit A – Insurance Exhibit
Exhibit B – Owner and Contractor Key Personnel
Exhibit C – Initial Project Schedule
Exhibit D – Schedule of Values
Exhibit E – List of Drawings and Specifications
Exhibit F – Reserved
Exhibit G – Reserved
Exhibit H – Reserved
Exhibit I – Reserved
Exhibit J – Reserved
Exhibit K – Waiver and Release Documents
Exhibit K-1 – Conditional Waiver and Release on Progress Payment
Exhibit K-2 – Unconditional Waiver and Release on Progress Payment
Exhibit K-3 – Conditional Waiver and Release on Final Payment
Exhibit K-4 – Unconditional Waiver and Release on Final Payment
Exhibit K-5 – Bills Paid Affidavit
»

»

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

OWNER *(Signature)*	**CONTRACTOR** *(Signature)*
« »« »	« »« »
(Printed name and title)	*(Printed name and title)*

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 day of in the year 2023
(In words, indicate day, month and year.)

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

Greenville ISD - Portables, Travis Reno and GHS Boiler Replacement - Boiler Plate Spec Docs

THE OWNER:
(Name, legal status and address)

Greenville Independent School District
4004 Moulton Street
Greenville, Texas 75403

THE CONTRACTOR:
(Name, legal status and address)

TABLE OF ARTICLES

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.

ARTICLE A.2 BUILDER'S RISK AND PROPERTY INSURANCE

§ A.2.1 General

Prior to commencement of the Work, the Contractor shall secure the insurance, and provide evidence of the coverage, required under this Article A.2. Owner in its sole discretion may elect to provide builders risk coverage or property insurance through its own property insurance program and will provide written notification of that decision to Contractor.

(Paragraphs deleted)

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.

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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§ A.2.2 Not used.

§ A.2.3 Required Property Insurance

§ A.2.3.1 The Contractor shall purchase and maintain, from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located, property insurance written on a builder's risk "all-risks" completed value or equivalent policy form and sufficient to cover the total value of the entire Project on a replacement cost basis. This insurance shall include the interests of the Owner, Contractor, Subcontractors of all tiers in the Project as insureds. This insurance shall include the interests of mortgagees as loss payees.

§ A.2.3.1.1 Causes of Loss. The insurance required by this Section A.2.3.1 shall provide coverage for direct physical loss or damage, and shall not exclude the risks of fire, explosion, theft, vandalism, malicious mischief, collapse, earthquake, flood, or windstorm. The insurance shall also provide coverage for ensuing loss or resulting damage from error, omission, or deficiency in construction methods, design, specifications, workmanship, or materials. Sub-limits will be present for specific perils. These will be reviewed and vetted between Owner and Contractor on a project specific basis if needed.
(Indicate below the cause of loss and any applicable sub-limit.)

Causes of Loss	Sub-Limit

§ A.2.3.1.2 Specific Required Coverages. The insurance required by this Section A.2.3.1 shall provide coverage for loss or damage to falsework and other temporary structures, and to building systems from testing and startup. The insurance shall also cover debris removal, including demolition occasioned by enforcement of any applicable legal requirements, and reasonable compensation for the Architect's and Contractor's services and expenses required as a result of such insured loss, including claim preparation expenses.
(Paragraphs deleted)
Sub-limits will be present for specific perils. These will be reviewed and vetted between Owner and Contractor on a project specific basis if needed.

Coverage	Sub-Limit

§ A.2.3.1.3 Unless the parties agree otherwise, upon Substantial Completion, the Owner shall replace the insurance policy required under Section A.2.3.1 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.2.3.1.4 Deductibles and Self-Insured Retentions. If the insurance required by this Section A.2.3 is subject to deductibles or self-insured retentions, the Contractor shall be responsible for all loss not covered because of such deductibles or retentions.

§ A.2.3.2 Occupancy or Use Prior to Substantial Completion. The Owner's occupancy or use of any completed or partially completed portion of the Work prior to Substantial Completion shall not commence until the insurance company or companies providing the insurance under Section A.2.3.1 have consented in writing to the continuance of coverage. The Owner and the Contractor shall take no action with respect to partial occupancy or use that would cause cancellation, lapse, or reduction of insurance, unless they agree otherwise in writing.

§ A.2.3.3 Insurance for Existing Structures

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.2.3.1, notwithstanding the undertaking of the Work, unless notified by Owner in writing that Owner will purchase and maintain such insurance. The Owner shall be responsible for all co-insurance penalties.

§ A.2.4 Optional Extended Property Insurance.

The Contractor shall purchase and maintain the insurance selected and described below.

(Select the types of insurance the Owner is required to purchase and maintain by placing an X in the box(es) next to the description(s) of selected insurance. For each type of insurance selected, indicate applicable limits of coverage or other conditions in the fill point below the selected item.)

[ ] **§ A.2.4.1 Loss of Use, Business Interruption, and Delay in Completion Insurance**, to reimburse the Owner for loss of use of the Owner's property, or the inability to conduct normal operations due to a covered cause of loss.

[ ] **§ A.2.4.2 Ordinance or Law Insurance**, for the reasonable and necessary costs to satisfy the minimum requirements of the enforcement of any law or ordinance regulating the demolition, construction, repair, replacement or use of the Project.

[ ] **§ A.2.4.3 Expediting Cost Insurance**, for the reasonable and necessary costs for the temporary repair of damage to insured property, and to expedite the permanent repair or replacement of the damaged property.

[ ] **§ A.2.4.4 Extra Expense Insurance**, to provide reimbursement of the reasonable and necessary excess costs incurred during the period of restoration or repair of the damaged property that are over and above the total costs that would normally have been incurred during the same period of time had no loss or damage occurred.

[ ] **§ A.2.4.5 Civil Authority Insurance**, for losses or costs arising from an order of a civil authority prohibiting access to the Project, provided such order is the direct result of physical damage covered under the required property insurance.

[ ] **§ A.2.4.6 Ingress/Egress Insurance**, for loss due to the necessary interruption of the insured's business due to physical prevention of ingress to, or egress from, the Project as a direct result of physical damage.

[ ] **§ A.2.4.7 Soft Costs Insurance**, to reimburse the Owner for costs due to the delay of completion of the Work, arising out of physical loss or damage covered by the required property insurance: including construction loan fees; leasing and marketing expenses; additional fees, including those of architects, engineers, consultants, attorneys and accountants, needed for the completion of the construction, repairs, or reconstruction; and carrying costs such as property taxes, building permits, additional interest on loans, realty taxes, and insurance premiums over and above normal expenses.

§ A.2.5 Other Optional Insurance.

The Owner shall purchase and maintain the insurance selected below.

(Select the types of insurance the Owner is required to purchase and maintain by placing an X in the box(es) next to the description(s) of selected insurance.)

[ ] **§ A.2.5.1 Cyber Security Insurance** for loss to the Owner due to data security and privacy breach,

including costs of investigating a potential or actual breach of confidential or private information.
(Indicate applicable limits of coverage or other conditions in the fill point below.)

[ ] **§ A.2.5.2 Other Insurance**
(List below any other insurance coverage to be provided by the Owner and any applicable limits.)

Coverage	Limits

ARTICLE A.3 LIABILITY AND OTHER INSURANCE AND BONDS

§ A.3.1 General

§ A.3.1.1 Certificates of Insurance. The Contractor shall provide 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. An additional certificate evidencing continuation of commercial liability coverage, 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 as an additional insured on the Contractor's Commercial General Liability and excess or umbrella liability policy or policies.

§ A.3.1.2 Deductibles and Self-Insured Retentions. The Contractor shall disclose to the Owner any deductible or self-insured retentions applicable to any insurance required to be provided by the Contractor.

§ A.3.1.3 Additional Insured Obligations. To the fullest extent permitted by law, the Contractor shall cause the commercial general liability coverage to include (1) the Owner, the Architect, and the Architect'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 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. The additional insured coverage shall be primary and non-contributory to any of the Owner's general liability insurance policies and shall apply to both ongoing and completed operations. 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.

§ 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 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.)

Each of the policies above, except workers' compensation and employers' liability insurance, if written on a claims-made basis, will be maintained in full force and effect for two (2) years after final acceptance or completion of the Work, whichever is later.

§ 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 policy limits of not less than one million dollars ($ 1,000,000.00) each occurrence, two million dollars ($ $2,000,000.00) general aggregate, and two million dollars ($ 2,000,000.00) aggregate for products-completed operations hazard, providing coverage for claims including

.1 damages because of bodily injury, sickness or disease, including occupational sickness or disease, and death of any person;

.2 personal injury and advertising injury;

.3 damages because of physical damage to or destruction of tangible property, including the loss of use of such property;
.4 bodily injury or property damage arising out of completed operations; and
.5 the Contractor's indemnity obligations under Section 3.18 of the General Conditions.

§ 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 Automobile Liability covering vehicles owned, and non-owned vehicles and trailers used, by the Contractor, with policy limits of not less than one million dollars ($ 1,000,000.00) per accident, for bodily injury, death of any person, and property damage arising out of the ownership, maintenance and use of those motor vehicles or trailers along with any other statutorily required automobile coverage.

§ A.3.2.4 Excess or Umbrella Liability for the coverages outlined in A.3.2.2.1, A.3.2.3, and A.3.2,6 in the amount of five million dollars ($5,000,000.00). The excess or umbrella insurance policies must result in the same or greater coverage as the coverages required under Section A.3.2.2, A.3.2.3, and A.3.2.6 and in no event shall any excess or umbrella liability insurance provide narrower coverage than the primary policy. The excess policy shall not require the exhaustion of the underlying limits only through the actual payment by the underlying insurers.

§ A.3.2.5 Workers' Compensation at statutory limits and in accordance with the laws and regulation of the State of Texas or state of jurisdiction as appliable.

§ A.3.2.6 Employers' Liability with policy limits not less than one million dollars ($ 1,000,00.00) each accident, one million dollars ($ 1,00,000.00) each employee, and two million dollars ($ 2,000,000.00) policy limit.

§ 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 one million dollars ($ 1,000,000.00) per claim and two million dollars ($ 2,000,000.00) 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.3.3 Contractor's Other Insurance Coverage

§ A.3.3.1 Insurance selected and described in this Section A.3.3 shall be purchased 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 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.)

Each of the policies above, except workers' compensation and employers' liability insurance, if written on a claims-made basis, will be maintained in full force and effect for two (2) years after final acceptance or completion of the Work, whichever is later.

§ 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.)

[X] **§ A.3.3.2.1** Property insurance of the same type and scope satisfying the requirements identified in Section A.2.3, which, if selected in this section A.3.3.2.1, relieves the Owner of the responsibility to purchase and maintain such insurance except insurance required by Section A.2.3.1.3 and Section A.2.3.3. The Contractor shall comply with all obligations of the Owner under Section A.2.3 except to the extent provided below. The Contractor shall disclose to the Owner the amount of any deductible, and the Contractor shall be responsible for losses within the deductible. Upon request, the Contractor shall provide the Owner with a copy of the property insurance policy or policies required. The Owner shall adjust and settle the loss with the insurer and be the trustee of the proceeds of the property insurance in accordance with Article 11 of the General Conditions unless otherwise set forth below:
(Where the Contractor's obligation to provide property insurance differs from the Owner's obligations as described under Section A.2.3, indicate such differences in the space below. Additionally, if a party other than the Owner will be responsible for adjusting and settling a loss with the insurer and acting as the trustee of the proceeds of property insurance in accordance with Article 11 of the General Conditions, indicate the responsible party below.)

[ ] **§ 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.

[X] **§ 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.

[X] **§ 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	Penal Sum ($0.00)
Payment Bond	Contract sum
Performance Bond	Contract sum

Payment and Performance Bonds shall be AIA Document A312™, Payment Bond and Performance Bond, or contain provisions identical to AIA Document A312™, current as of the date of this Agreement.

ARTICLE A.4 SPECIAL TERMS AND CONDITIONS

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

1) The required limits of insurance can be satisfied by any combination of primary and excess coverage.

2) Each of the policies in section A., above, except workers' compensation and employers' liability insurance, will contain provisions that specify that the policies are primary and will apply without consideration for other policies separately carried and will state each insured is provided coverage as though a separate policy had been issued to each, except with respects to limits of insurance, and that only one deductible will apply per occurrence regardless of the number of insureds involved in the occurrence. Contractor will be responsible for any deductibles or retentions.

3) All policies must be issued by carriers having an *A.M. Best's* rating of "A-" or better, and an *A.M. Best's* financial size category of "VIII", or better. If requested in writing by Owner, Contractor will make available a certified copy of any or all insurance policies or endorsements required of Contractor.

4) Owner will receive thirty days advance written notice prior to non-renewal or cancellation. This notice of cancellation should be included in the Contractors respective policies and a copy of the endorsement included in the certificate of insurance.

5) Certificates of insurance (COI) must show "Greenville Independent School District" as the certificate holder, and as an additional insured (including completed operations) to the extent Contractor has agreed to indemnify Greenville Independent School District pursuant to the provision of indemnity therein. The additional insured requirement shall apply to all of the required coverages except workers' compensation and professional liability. All of the required coverages must provide a waiver of subrogation in favor of the certificate holder.

6) Limitation of Liability. The requirements contained herein as to the types and limits of all insurance to be maintained by Contractor are not intended to and will not, in any manner, limit or qualify the liabilities and obligations assumed by Contractor under the Agreement.

7) Carrier/Agent to Provide Proof of Insurance. Prior to execution of the Agreement, at each renewal, and when requested by Owner, Contractor will instruct its insurance carrier/agent to submit directly to Owner valid certificate(s) of insurance, evidencing the coverage required herein. Valid certificates of insurance utilize ACORD 25 form dated 2010/05 or later and other Texas Department of Insurance (TDI) approved forms which properly addresses each requirement referenced in this document (as depicted in Owner's Sample COI, available on request). If Contractor's insurance carrier/agent provides to Owner a certificate of

insurance that is not an ACORD 25 form dated 2010/05 or later, insurance carrier/agent must also submit sufficient documentation directly to Owner indicating that certificate is approved by TDI. Owner's review of certificates or policies will not be construed as accepting any deficiencies in Contractor's insurance or relieve Contractor of any obligations set forth herein. In addition, Contractor will require each of its subcontractors to provide adequate insurance. Any deficiencies in the insurance provided by subcontractors will be the responsibility of Contractor.

8) Description of Operations Language. The following language or language substantially in the form of such language, must be included in the Description of Operations section of the COI or otherwise indicated on the form:

"Certificate holder is included as an additional insured (including completed operations) as respects all of the required coverages except workers' compensation."

All of the required coverages provide a waiver of subrogation in favor of the certificate holder.

9) Certificate Holder Detail. The certificate holder must be shown on the COI as follows:

Greenville Independent School District
[Insert Risk/Claims Dept Address]

10) Reporting of Damage and Accidents. Contractor agrees to report to the manager of the claims department (address shown below) of the Owner in writing as soon as practical all instances of damage to the Work and all accidents or occurrences which may result in injuries to any person, including death, and any property damage, arising out of the performance of the Work.

Greenville Independent School District
Attention: Claims
[Insert Address]

11) Maximum Limits of Insurance. If the insurance obligations required in the Agreement exceed the maximum limits permitted by law or do not otherwise conform with any applicable law, then this Agreement will be deemed amended so as to only require Contractor to provide insurance to the maximum extent allowed by law.

Additions and Deletions Report for

AIA® Document A101® – 2017 Exhibit A

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 15:27:09 ET on 07/28/2023.

PAGE 1

This Insurance and Bonds Exhibit is part of the Agreement, between the Owner and the Contractor, dated the day of in the year 2023

...

Greenville ISD - Portables, Travis Reno and GHS Boiler Replacement - Boiler Plate Spec Docs

...

Greenville Independent School District
4004 Moulton Street
Greenville, Texas 75403

...

A.2 ~~OWNER'S~~ BUILDER'S RISK AND PROPERTY INSURANCE

A.3 ~~CONTRACTOR'S~~ LIABILITY AND OTHER INSURANCE AND BONDS

...

~~ARTICLE A.2 OWNER'S INSURANCE~~
ARTICLE A.2 BUILDER'S RISK AND PROPERTY INSURANCE

Prior to commencement of the Work, the ~~Owner~~ Contractor shall secure the insurance, and provide evidence of the coverage, required under this Article ~~A.2 and, upon the Contractor's request, provide a copy of the property insurance policy or policies required by Section A.2.3. The copy of the policy or policies provided shall contain all applicable conditions, definitions, exclusions, and endorsements.~~A.2. Owner in its sole discretion may elect to provide builders risk coverage or property insurance through its own property insurance program and will provide written notification of that decision to Contractor.

~~§ A.2.2 Liability Insurance~~
~~The Owner shall be responsible for purchasing and maintaining the Owner's usual general liability insurance.~~

§ A.2.2 Not used.
§ A.2.3.1 ~~Unless this obligation is placed on the Contractor pursuant to Section A.3.3.2.1, the Owner~~ The Contractor shall purchase and maintain, from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located, property insurance written on a builder's risk "all-risks" completed value or equivalent policy form and sufficient to cover the total value of the entire Project on a replacement cost basis. ~~The Owner's property insurance coverage shall be no less than the amount of the initial Contract Sum, plus the value of subsequent Modifications and labor performed and materials or equipment supplied by others. The property insurance shall be maintained until Substantial Completion and thereafter as provided in Section A.2.3.1.3, unless otherwise provided in the Contract Documents or otherwise agreed in writing by the parties to this Agreement.~~

This insurance shall include the interests of the Owner, Contractor, ~~Subcontractors, and Sub-subcontractors~~ Subcontractors of all tiers in the Project as insureds. This insurance shall include the interests of mortgagees as loss payees.

§ A.2.3.1.1 Causes of Loss. The insurance required by this Section A.2.3.1 shall provide coverage for direct physical loss or damage, and shall not exclude the risks of fire, explosion, theft, vandalism, malicious mischief, collapse, earthquake, flood, or windstorm. The insurance shall also provide coverage for ensuing loss or resulting damage from error, omission, or deficiency in construction methods, design, specifications, workmanship, or materials. ~~Sub-limits, if any, are as follows:~~Sub-limits will be present for specific perils. These will be reviewed and vetted between Owner and Contractor on a project specific basis if needed.

PAGE 2

§ A.2.3.1.2 Specific Required Coverages. The insurance required by this Section A.2.3.1 shall provide coverage for loss or damage to falsework and other temporary structures, and to building systems from testing and startup. The insurance shall also cover debris removal, including demolition occasioned by enforcement of any applicable legal requirements, and reasonable compensation for the Architect's and Contractor's services and expenses required as a result of such insured loss, including claim preparation expenses. ~~Sub-limits, if any, are as follows:~~
~~*(Indicate below type of coverage and any applicable sub-limit for specific required coverages.)*~~
Sub-limits will be present for specific perils. These will be reviewed and vetted between Owner and Contractor on a project specific basis if needed.

...

§ A.2.3.1.3 Unless the parties agree otherwise, upon Substantial Completion, the Owner shall ~~continue the insurance required by Section A.2.3.1 or, if necessary,~~ replace the insurance policy required under Section A.2.3.1 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.2.3.1.4 Deductibles and Self-Insured Retentions. If the insurance required by this Section A.2.3 is subject to deductibles or self-insured retentions, the ~~Owner~~ Contractor shall be responsible for all loss not covered because of such deductibles or retentions.

...

If the Work involves remodeling an existing structure or constructing an addition to an existing structure, the ~~Owner~~ 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.2.3.1, notwithstanding the undertaking of the ~~Work.~~ Work, unless notified by Owner in writing that Owner will purchase and maintain such insurance. The Owner shall be responsible for all co-insurance penalties.

...

The ~~Owner~~ Contractor shall purchase and maintain the insurance selected and described below.

PAGE 4

~~ARTICLE A.3 CONTRACTOR'S INSURANCE AND BONDS~~
ARTICLE A.3 LIABILITY AND OTHER INSURANCE AND BONDS

...

Each of the policies above, except workers' compensation and employers' liability insurance, if written on a claims-made basis, will be maintained in full force and effect for two (2) years after final acceptance or completion of the Work, whichever is later.

...

§ A.3.2.2.1 Commercial General Liability insurance for the Project written on an occurrence form with policy limits of not less than one million dollars ($ 1,000,000.00) each occurrence, two million dollars ($ $2,000,000.00) general aggregate, and two million dollars ($ 2,000,000.00) aggregate for products-completed operations hazard, providing coverage for claims including

PAGE 5

§ A.3.2.3 Automobile Liability covering vehicles owned, and non-owned vehicles and trailers used, by the Contractor, with policy limits of not less than one million dollars ($ 1,000,000.00) per accident, for bodily injury, death of any person, and property damage arising out of the ownership, maintenance and use of those motor vehicles or trailers along with any other statutorily required automobile coverage.

§ A.3.2.4 ~~The Contractor may achieve the required limits and coverage for Commercial General Liability and Automobile Liability through a combination of primary and excess or umbrella liability insurance, provided such primary and excess or umbrella insurance policies~~ Excess or Umbrella Liability for the coverages outlined in A.3.2.2.1, A.3.2.3, and A.3.2.6 in the amount of five million dollars ($5,000,000.00). The excess or umbrella insurance policies must result in the same or greater coverage as the coverages required under ~~Section A.3.2.2 and A.3.2.3,~~ Section A.3.2.2, A.3.2.3, and A.3.2.6 and in no event shall any excess or umbrella liability insurance provide narrower coverage than the primary policy. The excess policy shall not require the exhaustion of the underlying limits only through the actual payment by the underlying insurers.

§ A.3.2.5 Workers' Compensation at statutory ~~limits.~~limits and in accordance with the laws and regulation of the State of Texas or state of jurisdiction as appliable.

§ A.3.2.6 Employers' Liability with policy limits not less than one million dollars ($ 1,000,00.00) each accident, one million dollars ($ 1,00,000.00) each employee, and two million dollars ($ 2,000,000.00) policy limit.

...

§ 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 one million dollars ($ 1,000,000.00) per claim and two million dollars ($ 2,000,000.00) in the aggregate.

PAGE 6

Each of the policies above, except workers' compensation and employers' liability insurance, if written on a claims-made basis, will be maintained in full force and effect for two (2) years after final acceptance or completion of the Work, whichever is later.

...

[X] **§ A.3.3.2.1** Property insurance of the same type and scope satisfying the requirements identified in Section A.2.3, which, if selected in this section A.3.3.2.1, relieves the Owner of the responsibility to purchase and maintain such insurance except insurance required by Section A.2.3.1.3 and Section A.2.3.3. The Contractor shall comply with all obligations of the Owner under Section A.2.3 except to the extent provided below. The Contractor shall disclose to the Owner the amount of any deductible, and the ~~Owner~~ Contractor shall be responsible for losses within the deductible. Upon request, the Contractor shall provide the Owner with a copy of the property insurance policy or policies required. The Owner shall adjust and settle the loss with the insurer and be the trustee of the proceeds of the property insurance in accordance with Article 11 of the General Conditions unless otherwise set forth below:

...

[X] **§ 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.

[X] **§ 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.

PAGE 7

Payment Bond	Contract sum
Performance Bond	Contract sum

...

1) The required limits of insurance can be satisfied by any combination of primary and excess coverage.

2) Each of the policies in section A., above, except workers' compensation and employers' liability insurance, will contain provisions that specify that the policies are primary and will apply without consideration for other policies separately carried and will state each insured is provided coverage as though a separate policy had been issued to each, except with respects to limits of insurance, and that only one deductible will apply per occurrence regardless of the number of insureds involved in the occurrence. Contractor will be responsible for any deductibles or retentions.

3) All policies must be issued by carriers having an *A.M. Best's* rating of "A-" or better, and an *A.M. Best's* financial size category of "VIII", or better. If requested in writing by Owner, Contractor will make available a certified copy of any or all insurance policies or endorsements required of Contractor.

4) Owner will receive thirty days advance written notice prior to non-renewal or cancellation. This notice of cancellation should be included in the Contractors respective policies and a copy of the endorsement included in the certificate of insurance.

5) Certificates of insurance (COI) must show "Greenville Independent School District" as the certificate holder, and as an additional insured (including completed operations) to the extent Contractor has agreed to indemnify Greenville Independent School District pursuant to the provision of indemnity therein. The additional insured requirement shall apply to all of the required coverages except workers' compensation and professional liability. All of the required coverages must provide a waiver of subrogation in favor of the certificate holder.

6) Limitation of Liability. The requirements contained herein as to the types and limits of all insurance to be maintained by Contractor are not intended to and will not, in any manner, limit or qualify the liabilities and obligations assumed by Contractor under the Agreement.

7) Carrier/Agent to Provide Proof of Insurance. Prior to execution of the Agreement, at each renewal, and when requested by Owner, Contractor will instruct its insurance carrier/agent to submit directly to Owner valid certificate(s) of insurance, evidencing the coverage required herein. Valid certificates of insurance utilize ACORD 25 form dated 2010/05 or later and other Texas Department of Insurance (TDI) approved forms which properly addresses each requirement referenced in this document (as depicted in Owner's Sample COI, available on request). If Contractor's insurance carrier/agent provides to Owner a certificate of insurance that is not an ACORD 25 form dated 2010/05 or later, insurance carrier/agent must also submit sufficient documentation directly to Owner indicating that certificate is approved by TDI. Owner's review of certificates or policies will not be construed as accepting any deficiencies in Contractor's insurance or relieve Contractor of any obligations set forth herein. In addition, Contractor will require each of its subcontractors to provide adequate insurance. Any deficiencies in the insurance provided by subcontractors will be the responsibility of Contractor.

8) Description of Operations Language. The following language or language substantially in the form of such language, must be included in the Description of Operations section of the COI or otherwise indicated on the form:

"Certificate holder is included as an additional insured (including completed operations) as respects all of the required coverages except workers' compensation."

All of the required coverages provide a waiver of subrogation in favor of the certificate holder.

9) Certificate Holder Detail. The certificate holder must be shown on the COI as follows:

Greenville Independent School District

[Insert Risk/Claims Dept Address]

10) Reporting of Damage and Accidents. Contractor agrees to report to the manager of the claims department (address shown below) of the Owner in writing as soon as practical all instances of damage to the Work and all accidents or occurrences which may result in injuries to any person, including death, and any property damage, arising out of the performance of the Work.

Greenville Independent School District
Attention: Claims
[Insert Address]

11) Maximum Limits of Insurance. If the insurance obligations required in the Agreement exceed the maximum limits permitted by law or do not otherwise conform with any applicable law, then this Agreement will be deemed amended so as to only require Contractor to provide insurance to the maximum extent allowed by law.

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SECTION 01 11 00

SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Project Information
2. Work covered by Contract Documents
3. Work Contract Method.
4. Work by Owner.
5. Work under separate contracts.
6. Owner furnished products.
7. Access to site; Contractor use of site.
8. Work restrictions.
9. Specification and Drawing conventions.
10. Miscellaneous provisions.
11. Owner occupancy.

1.2 PROJECT INFORMATION

A. Project Information:
1. Project Identification: Greenville Middle School & LP Waters Early Childhood Portables, Travis Renovation, and Greenville High School Boiler Replacement for Greenville ISD, Greenville, Texas.
2. Code Requirements: This project is governed by the Codes as indicated on the Drawings, with local amendments applicable to Greenville, Texas. The Contractor shall comply with all requirements of the Codes and the Local Authority Having Jurisdiction.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and consists of the following:
1. Greenville MS & LP Waters Portables, Travis Renovation, and GHS Boiler Replacement
a. Greenville Middle School: 3611 Texas Street, Greenville, TX 75401
b. LP Waters Early Childhood: 2504 Carver Street, Greenville, TX 75401
c. Travis Intermediate: 3201 Stanford St., Greenville, TX 75401
d. Greenville High School: 3515 Lions Lair, Greenville, TX 75401

B. Type of Contract: Single Prime Competitive Sealed Proposal
1. Project is Tax Exempt

2. Contract: AIA A101 - Standard Form of Agreement Between Owner and Contractor, 2017 Edition Agreement.

1.4 WORK CONTRACT METHOD

A. Type of Contract: Single prime contract.

B. Items noted "NIC" (Not in Contract) are provided by Owner.

1.5 WORK BY OWNER OR ALTERNATE CONTRACTS

A. Cooperate fully with Owner so work may be carried out smoothly, without interfering with or delaying work under this Contract or work by Owner. Coordinate the work of this Contract with work performed by Owner.

B. Preceding Work: The Owner reserves the right to perform certain construction operations at Project site. Those operations are scheduled to be substantially complete before work under this Contract begins. Cooperate and coordinate fully with the Owner to permit preceding Work to be completed without disruption.

C. Concurrent Work: The Owner reserves the right to perform concurrent construction operations and Work at the Project site. Those operations may be conducted simultaneously with Work under this Contract. Cooperate and coordinate fully with the Owner to permit concurrent Work to be completed without disruption.

D. Work under Separate Contracts: The Owner reserves the right to award separate contracts for portions of the Work. Cooperate fully with separate contractors so Work under 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.

E. Purchase (Assign) Contracts: The Owner reserves the right to negotiate Purchase contracts with suppliers of material and equipment to be incorporated into the Work. Owner will assign the Purchase contracts to Contractor. Include costs for purchasing, receiving, handling, storage if required, and installation of material and equipment in the Contract Sum unless otherwise indicated.

1. Contractor's responsibilities are same as if Contractor had negotiated Purchase contracts, including responsibility to renegotiate purchase and to execute final purchasing agreements.

1.6 OWNER FURNISHED PRODUCTS

A. Owner furnished items shall be as indicated on the Drawings as Owner Furnished Contractor Installed (OFCI) items.

B. Owner Responsibilities: Owner reserves the right to furnish certain products. The Work includes receiving, unloading, handling, storing, protecting, and installing Owner furnished products and making building services connections.

1. Owner will arrange for and deliver Shop Drawings, Product Data, and Samples to Contractor.

2. Owner will arrange and pay for delivery of Owner furnished items according to Contractor's Construction Schedule.
3. Upon delivery, Owner and Contractor will inspect delivered items for damage. Assist Owner with inspection.
   a. If Owner furnished items are damaged, defective, or missing, Owner will arrange for replacement.
4. Owner will arrange for manufacturer's field services and for delivery of manufacturer's warranties to Contractor.
5. Owner will furnish Contractor a potential delivery date for Owner furnished products.

C. Contractor Responsibilities: Using Owner furnished delivery dates, incorporate delivery dates of Owner furnished items in Contractor's Construction Schedule.
1. Review Shop Drawings, Product Data, and Samples and return to Architect noting discrepancies or anticipated problems in use of product.
2. Receive, unload, and store Owner furnished items at site.
3. Upon delivery, inspect delivered items with owner for damage.
4. Protect Owner furnished items from damage during storage and handling, including damage from exposure to the elements.
5. If Owner furnished items are damaged as a result of Contractor's operations, repair or replace items.
6. Install and incorporate Owner furnished items into the Work.

1.7 CONTRACTOR'S USE OF PREMISES AND SITE

A. Restricted Use: Contractor shall have coordinate site access and areas of construction with the owner an architect prior to mobilization. Contractors will be working on occupied campuses and access to the existing buildings to execute scoped work will have to coordinated with the owner no less than one week (7 calendar days) prior to needed access. To the extent possible, limit use of site to areas within the Contract limits if so indicated. Do not disturb portions of site beyond areas in which the Work is indicated and protect all items to remain from damage.
1. Driveways, Walkways and Entrances: Keep driveways, loading areas, entrances, fire exits or lanes, or delivery routes serving premises clear and available to Owner, Owner's employees, the public, and emergency vehicles. Do not use these areas for parking or for storage of materials.
   a. The Contractor shall protect all driveways, walkways and paving from damage during construction. Any damaged driveways, walkways and entrances shall be repaired by the Contractor at no additional cost to the Owner.
2. Coordinate use of premises under direction of Architect and Owner. Contractor shall be responsible for monitoring use of premises by employees and subcontractors.
3. Back ground checks of contractors needing access to occupied areas of the existing campuses will be required prior to those workers needing access.

B. Existing Utility Interruptions: Do not interrupt utilities serving facilities unless permitted under the following conditions and after providing temporary utility services according to requirements indicated:

1. Notify Architect and Owner not less than fourteen (14) days in advance of proposed utility interruptions. Include length of service outages and intended scope of Work in all such notifications.
2. Obtain Owner's written permission before proceeding with utility interruptions.

C. Access routes for delivery of materials and equipment shall be as indicated on drawings by Contractor. Do not use access routes other than those indicated without permission of Owner and Contractor.

D. Assume full responsibility for protection and safekeeping of products stored on project site, including but not limited to all salvaged items. Store materials and products in areas indicated for staging and protect from damage.

E. Move stored products, under Contractor's control, which interfere with operations of Owner or as required by Architect. Do not unnecessarily encumber project site with materials and equipment.

F. Store all salvaged items and protect from damage and weather conditions.

G. Staging and material storage shall be limited to areas indicated. Obtain specific permission from Owner for use of other areas for storage and staging.

H. Do not overload existing or new structures with weight that would compromise safety. Verify design loads for structure if necessary prior to loading structure.

I. Obtain and pay for use of additional secured storage or Work areas needed for operations, material storage for new and salvaged items.

J. Protect existing lawns, landscaping, sidewalks, pavements, curbs and utilities subject to damage by Work under this Contract. Repair or replace existing Work damaged by Contractor. Replace existing lawns damaged by Contractor's activities with hydromulched lawn seed to provide full stand of replacement grass.

K. Parking areas for Contractor's personnel shall be coordinated in advance of mobilization with Owner and Architect.

1.8 PARTIAL OWNER OCCUPANCY

A. Schedule construction operations for completion of portions of Work for any Owner's occupancy prior to Substantial Completion of entire Work.

B. Contractor agrees to use and occupancy of portion of Project by Owner prior to Substantial Completion of entire Project, provided Owner:

1. Secures written consent of Contractor except when, in opinion of Architect, Contractor is chargeable with unwarranted delay in final completion of uncompleted items or other Contract requirements.

2. Secures endorsement from insurance carrier and consent of surety permitting partial occupancy of Project or use of Project during remaining period of construction.

C. Use and occupancy prior to Substantial Completion of entire Project does not relieve Contractor of responsibility to maintain specified insurance coverage on 100 percent basis for benefit of Owner, Contractor and subcontractors until Project is complete and accepted by Owner.

D. After Owner occupancy, allow following:
1. Access for Owner's personnel.
2. Operation of heating, ventilating, air-conditioning and electrical systems.

E. During partial occupancy, mutually acceptable arrangements shall be negotiated between Owner and Contractor regarding warranties and insurance requirements respecting portion of Work affected by partial occupancy and regarding operation and cost of building services so that costs attributable to partial occupancy shall be borne by Owner and costs attributable to performance of Work shall be borne by Contractor.

F. Prior to occupancy, execute Certificate of Substantial Completion, designating areas to be occupied by Owner.

1.9 WORK SEQUENCE

A. Construct Work in phases to accommodate Work to be completed on schedule and as agree with Owner; coordinate construction schedule and operations with Owner's representative.

B. Construct Work to minimize school district and campus operations inconvenience. Do not close off public use travel paths until completion of one stage of construction will provide alternative usage.

C. Owner may require certain Work to be performed after normal Working hours or on holidays or weekends. Negotiate all such Work with Owner prior to final Agreement.

1.10 WORK RESTRICTIONS

A. Work Restrictions: Comply with restrictions on construction operations.
1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.

B. On-Site Work Hours: No limitation of work hours, Monday through Friday, unless otherwise indicated or required by the Authority Having Jurisdiction.
1. Weekend Hours: As permitted by Owner written authorization and in compliance with Local Ordinances.
2. Early Morning Hours: Comply with time restrictions set forth by the Local Authority Having Jurisdiction for restrictions.
3. Hours for Utility Shutdowns: Only during hours agreed to in writing by the Owner 2 weeks (14 calendar days) in advance.

4. Hours for Core Drilling or other noisy activity: During times unrestricted by the Owner and in accordance with Local Ordinances.

C. Nonsmoking Building: Smoking is not permitted within the building or on the project site.

D. Restricted Substances and Firearms: Use of tobacco products and other controlled substances and firearms on Project site is not permitted.

E. Employee Identification: Owner will require identification tags for Contractor personnel Working on site. If so required, insure all personnel onsite use identification tags at all times.

F. Comply with all Work Restrictions imposed by the Local Authority.

G. Abide by all road cleaning and other requirements imposed by the Local Authority.

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 1 General Requirements: Requirements of Sections in Division 1 apply to the Work of the specification sections.

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 and scheduled on Drawings.

PART 2 - PRODUCTS

2.1 HAZARDOUS MATERIALS - ASBESTOS

A. Owner requires that products and materials used meet the following requirements:

1. Contain not more than 1.0% of any kind or combination of asbestos, as determined by the Environmental Protection Agency (EPA) recommended test methods as listed in EPA/600R-93/116 July 1993 “Method for the Determination of Asbestos in Bulk Building Materials." This means one material component or a structure or layer of a material sample. Composite sample analysis is not allowed.

B. Contractor, by executing this Contract, accepts responsibility for prohibiting materials or products containing asbestos from being used on this Project.

C. Should Contractor furnish, use, or install products or materials containing asbestos, knowingly or otherwise, he has not met the requirements of this Contract.

D. Asbestos Survey: Provide an asbestos survey, meeting the same criteria as required for new building permits, by an inspector licensed by the State.
   1. Preliminary Survey: Contractor shall submit preliminary survey of materials installed at time of Substantial Completion with request for Substantial Completion to the Architect.
   2. Final Survey: Contractor shall submit revised survey reflecting materials install after Substantial Completion to the Architect for transmittal to the Owner prior to release of Retainage.

2.2 HAZARDOUS MATERIALS – MOLD

A. If mold is present on the inside of the building; determine source of moisture and correct prior to performing the following:
   1. Nonporous Surfaces: Mold growing on steel, aluminum or other nonporous materials may be cleaned using methods recommended by an Environmental Inspector licensed by the State.
   2. Porous Surfaces: Entire mold contaminated surface must be removed and disposed of using methods recommended by an Environmental Inspector licensed by the State.
   3. Following elimination of mold provide a report prepared by an Environmental Inspector licensed by the State that the building is free from mold contamination.

PART 3 - EXECUTION
Not used.

END OF SECTION

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SECTION 01 21 00

ALLOWANCES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Include in contract sum allowances stated in Contract Documents.
2. Designate in construction progress schedule delivery dates for Products specified under each allowance.
3. Designate in Schedule of Values quantities of materials required under each unit cost allowance.

1.2 ALLOWANCES FOR PRODUCTS

A. Amount of Each Allowance Includes:
1. Cost of Product to Contractor or subcontractor, less applicable trade discounts.
2. Delivery to site.
3. Labor required under allowance, except when labor is specified not to be included in allowance.

B. In addition to amount of each allowance, include in contract sum Contractor's costs for:
1. Handling at site, including unloading, uncrating, and storage.
2. Protection from elements and from damage.
3. Labor for installation and finishing where labor is specified not to be a part of allowance.
4. Other expenses required to complete installation.
5. Contractor’s and Subcontractor's overhead and profit.

1.3 SELECTION OF PRODUCTS UNDER ALLOWANCES

A. Architect's Duties:
1. Consult with Contractor in consideration of Products and suppliers or installers.
2. Make selection in consultation with Owner. Obtain Owner's written decision, designating:
a. Product, model, and finish.
b. Accessories and attachments.
c. Supplier and installer as applicable.
d. Cost to Contractor, delivered to site or installed, as applicable.
e. Manufacturer's Warranties.
3. Transmit Owner's decision to Contractor.
4. Prepare Change Orders.

B. Contractor's Duties:
   1. Assist Architect and Owner in determining qualified suppliers or installers.
   2. Obtain proposals from suppliers and installers when requested by Architect.
   3. Make appropriate recommendations for consideration of Architect.
   4. Notify Architect promptly of:
      a. Reasonable objections Contractor may have against supplier, or party under consideration for installation.
      b. Effect on Construction Schedule anticipated by selections under consideration.

1.4 CONTRACTOR RESPONSIBILITY FOR PURCHASE, DELIVERY, AND INSTALLATION

A. On notification of selection, execute purchase agreement with designated supplier.

B. Arrange for and process Shop Drawings, Product Data and Samples, as required.

C. Make arrangements for delivery.

D. Upon delivery, promptly inspect products for damage or defects.

E. Submit claims for transportation damage.

F. Install and finish products in compliance with requirements of referenced specification sections.

1.5 ADJUSTMENT OF COSTS

A. Should net cost be more or less than specified amount of allowance, contract sum will be adjusted accordingly by Change Order.
   1. Amount of Change Order will recognize changes in handling costs at site, labor, installation costs, overhead, profit, and other expenses caused by selection under allowance.
   2. For products specified under unit cost allowance, unit cost shall apply to quantity listed in Schedule of Values.
   3. For products specified under unit allowance, unit cost allowance shall apply to quantities actually used with nominal amount for waste, as determined by receipts, invoices or by field measurement.

B. Submit claims for anticipated additional costs at site, or other expenses caused by selection under allowance, prior to execution of work.

C. Submit documentation for actual additional costs at site, or other expenses caused by selection under allowance within 60 days after completion of execution of Work.

D. Failure to submit claims within designated time will constitute waiver of claims for additional costs.

E. At contract closeout, reflect approved changes in contract amounts in final statement of accounting.

1.6 CONSTRUCTION CONTINGENCY

A. Following shall apply to construction contingency allowance:
   1. It shall be used only to cover cost of hidden, concealed or otherwise unforeseen conditions that develop during project.
   2. Work which is clearly change in scope shall be authorized and paid for only by means of change order executed in accordance with established Owner procedures.
   3. Bidder shall include in his base bid on project his profit and overhead to cover amount of contingency; as each contingency authorization is processed, it will not include profit or overhead for Contractor.
   4. Contractor shall proceed with accomplishing work only after receiving properly executed contingency authorization executed by Owner.
   5. Contractor shall not bill Owner for work authorized by this procedure until work has been accomplished.
   6. Balance of contingency allowance which is not used during construction of project shall be returned to Owner.
   7. At completion of project, Architect will reconcile work accomplished through properly executed contingency allowance authorizations, and provide for refund of unused portion of contingency to Owner through properly executed change order.

PART 2 - PRODUCTS
Not Used.

PART 3 - EXECUTION

3.1 SCHEDULE OF ALLOWANCES

A. Sum of $50,000 for Construction Contingency Allowance.

B. Sum of $10,000 for Signage Allowance (excludes construction related signage).

END OF SECTION

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SECTION 01 22 00

UNIT PRICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Administrative and procedural requirements for unit prices.

1.2 DEFINITIONS

A. Unit price is an amount incorporated into the Agreement, applicable during the duration of the work as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

1.3 PROCEDURES

A. Unit prices include necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.

B. Measurement and Payment: Refer to the individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.

C. Owner reserves the right to reject Contractor's measurement of work in place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.

D. List of Unit Prices: A schedule of unit prices is included. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES

A. Unit Price No. 1: Cutting and patching of concrete floor slabs on grade.
   1. Description: Cutting of new or existing concrete floor slabs up to 6 inches thick, removal and excavation as required, and subsequent backfill, compaction, and patching of concrete in accordance with Section 01 73 29 "Cutting and Patching." not otherwise indicated in the Contract Documents.
   2. Unit of Measurement: Square feet of concrete removed.

B. Unit Price No. 2: Topical moisture vapor emission and alkalinity control of concrete floor slabs in moisture sensitive flooring areas including but not limited to areas having floor finishes of tile carpet, resinous flooring, resilient flooring, tile flooring and other floor finish systems sensitive to moisture.
   1. Description: Installation of topical moisture vapor emission and alkalinity control products to new or existing concrete floor slabs where the moisture vapor emissions and/or the alkalinity of the concrete floor slab exceeds the limits recommended by the manufacturer of the finished flooring product(s) to be installed. Preparation and installation of the topical moisture vapor emission and alkalinity control product are to be completed in accordance with requirements of Section 09 61 05 "Moisture Vapor Emission and Alkalinity Control."
   2. Unit of Measurement: Square foot of product installed.

END OF SECTION

SECTION 01 23 00

ALTERNATES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for alternates.

1.2 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 the Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. Alternates described 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 alternates into the work. No other adjustments are made to the Contract Sum.

1.3 PROCEDURES

A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.

1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.

B. Execute accepted alternates under the same conditions as other work of the Contract.

C. Schedule: A schedule of alternates is included. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. Alternate: GMS Portables – 2 additional Classrooms
   1. Reference Drawings for location of scope

B. Alternate: Travis - SPED Classrooms Renovation End of Section
   1. Reference Drawings for location of scope

SECTION 01 25 00

SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Administrative and procedural requirements for substitutions.

1.2 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 Project requirements but may offer advantage to Contractor or Owner.

B. Comparable Products: Products demonstrated and approved through the product substitution process to have similar qualities related to type, function, dimension, in service performance, physical properties, appearance, and characteristics equivalent to or exceeding those of the specified product and incorporated into the Contract Documents.

C. Substitutions submitted and accepted prior to the award of the Contract for Construction are deemed part of the Contract Documents and are not subject to substitution requirements.

1.3 ACTION SUBMITTALS

A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Identify the Specification Section number and title and Drawing numbers and titles.
   1. Substitution Request Form: Use facsimile of form provided in Section 01 25 00.10 "Substitution Request Form."
   2. Documentation: Demonstrate compliance with requirements for substitutions and the following, as applicable:
      a. Statement indicating the reason the specified product, fabrication, or installation method cannot be provided, if applicable.
      b. Coordination of 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 substitutions with those of the work specified. Include annotated copy of applicable

Specification Section. Significant qualities may include attributes, such as performance, physical characteristics, weight, size, durability, visual effect, noise levels, color and texture, vibration generation, interchangeability of parts or components, maintenance, compatibility with other materials, products, assemblies and components, equipment capacities and performance characteristics, 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. Mark cut sheet to indicate specific model or product.
e. Samples, where applicable or requested.
f. Certificates and manufacturer/installer/fabricator qualification data, where applicable.
g. List of similar installations for completed projects, with project names and addresses as well as 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, from ICC-ES and local regulations.
j. Detailed comparison of Contractor's construction schedule using proposed substitutions 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.

3. 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. Form of Acceptance During Bidding: Addenda.
   b. Form of Rejection During Bid Period: No response.
   c. Forms of Acceptance During Construction: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the work.
   d. Form of Rejection During Construction: Written rejection on Substitution Request Form.
4. No response will be given for substitutions submitted by individual subcontractors or material suppliers.
5. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

B. Substitution requests are not allowed when disguised as a submittal. Request substitutions in accordance with substitution procedures. Substitutions submitted as a Submittal will be returned without review or comment.
   1. Contractor assumes full and complete responsibility for installing substitutions that have not been formally submitted and approved by the Architect.

1.4 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.

1.5 COORDINATION

A. Revise or adjust affected work necessary to integrate work of the approved substitutions.

1.6 PRODUCT SUBSTITUTIONS

A. Conditions for Consideration: Substitution requests will be considered when the request is submitted in writing on the Request for Substitution form by the Contractor.

B. 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. 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 the 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.
         1) A warranty based on the same warranty period only is not considered equivalent to the 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 each contractor involved.

C. Substitutions for Convenience: Architect will consider requests for substitution if received within 60 days after the Notice to Proceed. Requests received after that time may be considered or rejected at discretion of 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.
   1) 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 the 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 or better 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.

D. Requests for substitutions will not be considered when:
   1. Products are indicated or implied on Shop Drawings, Product Data Submittals, or Requests for Information (RFIs).
   2. Requested directly by subcontractor or supplier.
   3. Acceptance requires substantial revisions to Contract Documents or Contract time.
   4. Additional cost to Owner is involved.
   5. Substitute products shall not be ordered or installed without written acceptance of Architect. If proposed substitution is not accepted, provide specified product or materials.
   6. Burden of proof for merits of proposed substitute is upon proposer. Architect's decision of acceptance or rejection of proposed substitution is final.
   7. Review of Architect, acceptance, or failure to take exceptions to substitutions or other review documents, shall not relieve Contractor of its responsibility for compliance with performance or requirements of Contract Documents.
   8. Contractor shall be responsible for and pay for all expenses incurred by Owner or Architect for changes to Contract Documents ultimately required by accepted Contractor requests for substitutions.

1.7 SUBMISSION PROCEDURES

A. Submit each product substitution as a separate request.

B. The burden of proof of compliance to requirements lies with the proposer.

C. Documentation: Submit supporting documentation indicating compliance with requirements for substitutions and the following:

1. Identify product by specification section and article numbers. Provide manufacturer's name and address, trade name of product, and model or catalog number. List fabricators and suppliers as appropriate.
2. Include a statement indicating the reason specified product is unavailable.
   a. Contractor’s failure to order specified product in sufficient time for delivery to site is not a valid reason for a substitution.
3. Coordination information, including list of modifications necessary for related work, existing conditions, and to construction performed by Owner and separate contractors necessary to accommodate proposed substitution.
4. Detailed comparison of significant properties of proposed substitution with quality of work specified. Significant properties may include but are not limited to attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated. Identify variations from contract requirements.
5. Detailed comparison of warranties of proposed substitution and specified product note variations.
6. Shop drawings and product data, including drawings and descriptions of products, fabrication and installation procedures, certified test results, and similar data.
7. Samples, where applicable or requested.
8. Indicate availability of product in quantities required and availability of approved/certified, trained, and skilled installers.
9. Indicate availability of maintenance services and replacement materials as applicable.
10. Material test reports from qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
11. ICC-ES Evaluation Reports evidencing compliance with building code.
12. Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for work, including effect on overall Contract Time. If specified product or method of construction cannot be provided within Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.
13. Cost information, including proposal of change, if any, in Contract Sum.
14. Contractor's certification that proposed substitution complies with requirements of Contract Documents and is appropriate for applications indicated.
15. 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.
16. Contractor agreement to assume full responsibility for additional costs and time associated with substitution that may become necessary during the work.
17. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.

D. Unsigned submittals are considered incomplete and will not be reviewed.

E. For accepted products, submit formal shop drawings, product data, and samples under provisions of Section 01 33 00 "Submittal Procedures" and the individual specification section.

1.8 ARCHITECT DUTIES

A. Architect will determine acceptability of proposed substitutions.

B. Review Contractor's requests for substitutions with reasonable promptness.

C. Notify Contractor, in writing, of decision to accept or reject requested substitution.

PART 2 - PRODUCTS

2.1 PRODUCT SUBSTITUTIONS

A. Product Properties: Properties of substituted products considered include but are not limited to:
   1. Physical dimension requirements to satisfy space limitations.
   2. Static and dynamic weight limitations, structural properties.
   3. Audible noise levels.
   4. Vibration generation.
   5. Interchangeability of parts or components.
   6. Accessibility for maintenance, possible removal, or replacement.
   7. Colors, textures and compatibility with other materials, products, assemblies, and components.
   8. Equipment capacities and performance characteristics.
   9. Warranty conditions.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REPRESENTATION

A. In making a formal request for substitution Contractor represents that:
   1. It has thoroughly investigated proposed product and has determined it is equivalent to or superior in respects to that specified.
   2. It will provide same warranties or bonds for substitution as for product specified.
   3. It will coordinate installation of accepted substitution into the work and will make necessary changes for the work to be complete.
   4. It waives claims for additional costs caused by the requested substitution which may subsequently become apparent.
   5. Cost data is complete and includes related costs under the Contract, but not costs under separate contracts.

END OF SECTION

FORM 01 25 00.10 - SUBSTITUTION REQUEST FORM

To Architect: Corgan Associates, Inc.
Project Name: Greenville MS & LP Waters Portables, Travis Renovation, and GHS Boiler Replacement

Specified Item: _____

Section	Page	Paragraph	Description

The undersigned Contractor requests consideration of the following:

Proposed Substitution: _____

1. 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, both on the proposed substitution and the original specified product.
2. Attached data includes description of changes to Contract Documents, which proposed Substitution will require for its proper installation.

The undersigned Contractor states that the following paragraphs, unless modified on attachments, are correct.

1. The proposed substitution does not affect dimensions on Drawings.
2. The undersigned Contractor agrees to pay for changes to the building design, including architectural or engineering design, detailing, and construction costs caused by the requested substitution.
3. The proposed substitution has no adverse effect on other trades, the construction schedule, or specified warranty requirements.
4. Maintenance and service parts are locally available for the proposed substitution.

The Contractor further states that the function, appearance, and quality of the Proposed Substitution are equivalent or superior to the Specified Item. The Contractor further warrants that the intent of specification Section 01 25 00 "Substitution Procedures," Article Contractor's Representation has been met.

1. Cost Reduction to the Owner: $ _____

ACCEPTANCES:

1. Contractor Acceptance: Representing:

_____ Date: _____ _____

2. Owner Acceptance: Representing

_____ Date: _____ Greenville ISD

3. Architect Acceptance: Representing

_____ Date: _____ Corgan Associates, Inc.

_____ Accepted as Noted _____ Received too late

_____ Not Accepted _____ Resubmit with complete documentation

END OF FORM

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SECTION 01 26 00

CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Administrative and procedural requirements for handling and processing Contract modifications.

1.2 MINOR CHANGES IN THE WORK

A. Architect will issue supplemental instructions authorizing minor changes in the work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710.

1.3 PROPOSAL REQUESTS

A. Owner Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the work that require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
   1. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
   2. Within time specified in Proposal Request or 20 days, when not otherwise specified, after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
      a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
      b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
      c. Include costs of labor and supervision directly attributable to the change.
      d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
      e. Quotation Form: Use forms acceptable to Architect.

B. Contractor Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect.
   1. Include a statement outlining reasons for the change and the effect of the change on the work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
   2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.

3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.
5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
6. Comply with requirements in Section 01 25 00 "Substitution Procedures" if proposed change requires substitution of one product or system for product or system specified.
7. Proposal Request Form: Use form acceptable to Architect.

1.4 ADMINISTRATIVE CHANGE ORDERS

A. Allowance Adjustment: See Section 01 21 00 "Allowances" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect actual costs of allowances.

B. Unit Price Adjustment: See Section 01 22 00 "Unit Prices" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect measured scope of unit price work.

1.5 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Work Change Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on AIA Document G701.

1.6 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the work, for subsequent inclusion in a Change Order.
   1. Construction Change Directive contains a complete description of change in the work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
   1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS
Not used.

PART 3 - EXECUTION
Not used.

END OF SECTION

SECTION 01 29 00

PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Administrative and procedural requirements necessary to prepare and process Applications for Payment.

1.2 DEFINITIONS

A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the work and used as the basis for reviewing Contractor's Applications for Payment.

1.3 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction progress schedule.
   1. Coordinate line items in the schedule of values with required administrative schedules and forms including:
      a. Construction Progress Schedule, in CPM or bar chart format.
      b. Application for Payment form.
      c. List of subcontractors.
      d. Schedule of alternates.
      e. List of products.
      f. List of principal suppliers and fabricators.
      g. Schedule of submittals.
   2. Submit initial Schedule of Values to Architect within 14 days of Notice to Proceed.
   3. Submit revised Schedule of Values at earliest possible date, but no later than minimum of 20 days before scheduled date of Initial Application 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 one line item for each Specification Section.
   1. Arrange Schedule of Values on 8-1/2 inches by 11 inches (213 mm by 283 mm) tabular form on white paper in format acceptable to Architect.
   2. Use bar chart or CPM chart as guide to establish format; compile information based on completed tasks.
   3. Project Identification:
      a. Project name and location.
      b. Name of Architect.
      c. Project number.
      d. Contractor's name and address.
      e. Date of submittal.
      f. Owner's contract designation.

4. Provide columns to indicate following for each item listed:
   a. Generic name.
   b. Specific task description.
   c. Change Orders numbers that have affected value.
   d. Dollar value.
   e. Percentage of Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
5. Follow table of contents of Project Manual as format for listing component items; identify each line item with number and title of respective specification section.
6. Provide breakdown of Contract Sum in sufficient detail to facilitate continued evaluation of Applications for Payment and progress reports.
7. Break principal subcontract amounts down into multiple line items by completed task in various locations.
8. For each major line item, list subvalues of major products or operations under item.
9. Round amounts off to nearest whole dollar, total of listed values shall equal total Contract Sum.
10. For each part of work where Application for Payment includes materials or equipment purchased, fabricated, and stored, but not yet installed, include separate line items on Schedule of Values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of work.

C. Margins of Cost:
1. Indicate line items for indirect costs, and margins on actual costs, to the extent that each item is listed individually in Applications for Payment.
2. Each item in Schedule of Values and Application for Payment shall be complete, including its total cost and proportionate share of general overhead and profit margin.
3. At Contractor's option, temporary facilities and other major cost items that are not direct costs of actual work in place may be shown as separate line items in Schedule of Values.
4. Furnish line item cost for each of following general cost items:
   a. Bonds.
   b. Insurance.
   c. Field supervision and layout.
   d. Temporary facilities and controls.
   e. Testing.

D. Resubmittal:
1. After review by Architect, revise and resubmit schedule as necessary.
2. Resubmit revised schedule monthly in same manner.

E. Subschedule of Unit Material Values:
1. Submit subschedule of unit costs and quantities for following:
   a. Submit subschedule for each separate stage of work specified in Section 01 10 00 "Summary."
   b. Products specified under unit cost allowance specified in Section 01 21 00 "Allowances."
   c. Products on which progress payments will be requested for stored products.

2. Form and Content:
   a. Form of submittal shall parallel that of Schedule of Values, with each item identified same as line item in Schedule of Values.
   b. Unit quantity for bulk materials shall include an allowance for normal waste.
3. Unit values for materials shall be broken down as follows:
   a. Cost of material, delivered and unloaded at Project Site, with taxes paid.
   b. Installation costs, including overhead and profit.
4. Installed unit value multiplied by quantity listed shall equal cost of that item in Schedule of Values.
5. After review by Architect, revise and resubmit subschedules as necessary.
6. Resubmit revised subschedules monthly in same manner.

F. Upon request of Architect, provide support values with data which substantiate correctness.

1.4 APPLICATIONS FOR PAYMENT

A. Progress payments shall be made as work proceeds at intervals stated in the Agreement.

B. Work covered by Progress Payments shall, at time of payment, become property of Owner.

C. Form of Application for Payment will be notarized AIA Document G702 Application and Certification for Payment, supported by AIA Document G703 Continuation Sheet, submitted in quadruplicate.

D. Within 15 days of execution of Owner -Contractor Agreement, submit proposed sample of Lien Waiver and Bills Paid Affidavit forms for review and acceptance by Architect.

E. Conditions governing regular schedule for applications, payment, and retainage are stated in Contract.

F. Monthly Applications for Payment include Waivers of Liens for work included in previous months' Application for Payment. Waiver of Liens for subcontractors and materialmen shall be total amount paid prior to previous month's Application for Payment.

G. With each Application for Payment, certify that Application for Payment represents just estimate of cost reimbursable to Contractor under terms of Contract, and shall certify that there are no Mechanics' or Materialmens' Liens outstanding at date of Application for Payment, that due and payable bills with respect to work have been paid to date or shall be paid from proceeds of Application for Payment, and that there is no known basis for filing of Mechanics' or Materialmens' Liens against surety in connection with work, and that Waivers and Bills Paid Affidavit forms from subcontractors and materialmen have been, or will be, obtained in form specified in Contract.

H. Transmittal: Submit notarized 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.

I. Preparation of Application:
   1. Format and Data Required:
      a. Submit itemized applications on AIA Document G702 - Application and Certification for Payment Form, with AIA Document G703 Continuation Forms.
      b. Provide itemized data on continuation sheets with format, schedules, line items, and values stipulated in Schedule of Values and acceptable to Architect.
   2. Application Form:
      a. Fill in required information, including Change Orders executed prior to date of submittal of applications.
      b. Fill in summary of dollar values to agree with respective totals indicated on continuation sheets.
      c. Execute certification with signature of responsible officer of Contract firm.
   3. Continuation Sheets:
      a. Fill in total list of scheduled component items of work with item number and scheduled dollar value for each item.
      b. Fill in dollar value in each column for each scheduled line item when work has been performed or products stored.
      c. Round off values to nearest dollar or as specified for Schedule of Values.
      d. List each Change Order executed prior to date of submission at end of continuation sheets.
      e. List by Change Order number and description as for original component item of work.]
   4. Initial (First) Application for Payment:
      a. Within 15 days of execution of Owner-Contractor Agreement. submit proposed sample of Lien Waiver and Bills Paid Affidavit forms for review and acceptance by Owner for use.
      b. Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include, but are not limited to, the following:
         1) List of subcontractors, with indications of MBE or WBE Owner firms.
         2) List of principal suppliers and fabricators.
         3) Schedule of Values.
         4) Contractor's Construction Schedule (preliminary if not final).
         5) Submittal Schedule (preliminary if not final).
         6) Copies of building permits.
         7) Copies of authorizations and licenses from governing authorities for performance of Work.
         8) Initial progress report.
         9) Report of Preconstruction meeting.
         10) Certificates of Insurance and insurance policies.
         11) Additional items as required in General Conditions.

J. Typical Monthly Application for Payment:
   1. Each Application for Payment shall be consistent with previous Applications for Payments reviewed by Architect and paid by Owner.
   2. Review pencil copy of Application for Payment with Architect at last scheduled job meeting each month, or at other agreeable time as can be scheduled.

3. Submit monthly Application for Payment on 15th day of each month.
4. Period of construction work covered by each Application for Payment is period ending 15 days prior to date for each progress payment and starting day following end of proceeding period.
5. Work covered by Progress Payments shall, at time of payment, become property of Owner.
6. Form of Application for Payment will be on specified forms, submitted in quadruplicate.
7. Complete each entry on forms, including notarization and execution by person authorized to sign legal documents on behalf of Contractor.
8. Incomplete Applications for Payment will be returned without action.
9. Entries shall match data of Schedule of Values and Contractor's Construction Schedule.
10. Use updated schedules if revisions have been made.
11. Include amounts of Change Orders and Construction Change Directives issued prior to last day of construction period covered by application.
12. Transmit executed copies of each Application for Payment to Architect by means ensuring receipt within 24 hours.
13. Transmit each copy with complete transmittal form listing attachments, and recording appropriate information related to Application in acceptable manner.
14. Stored Materials: Include 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.
    a. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment for stored materials.
    b. Provide supporting documentation that verifies amount requested, including paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
    c. Provide summary documentation for stored materials indicating the following:
        1) Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
        2) 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.
        3) Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.
15. Waiver of Liens:
    a. With each Application for Payment, submit waivers of mechanics liens from each contractor, subcontractor and materialman who may be lawfully entitled to file mechanics lien arising out of Contract, and related to Work covered by payment application.
    b. Submit waivers of lien on forms acceptable to Architect.
    c. Waiver of liens shall be total paid prior to previous month's Application for Payment.

16. With each Application for Payment, Contractor certifies the following:
    a. Application for Payment represents just estimate of cost reimbursable to Contractor under terms of Contract.
    b. That there are no Mechanics' or Materialmens' Liens outstanding at date of this Application for Payment.
    c. That due and payable bills with respect to the Work have been paid to date or shall be paid from proceeds of that Application for Payment.
    d. That there is no known basis for filing of Mechanics' or Materialmens' Liens against surety in connection with Work, and that Waivers and Bills Paid Affidavit forms from subcontractors and materialmen have been, or will be, obtained in form specified in Contract.
17. Progress payments will be made in accordance with General Conditions.

K. Application for Payment at Substantial Completion:
1. Following issuance of Certificate of Substantial Completion, submit Application for Payment with following administrative actions and submittals that must precede or coincide with application:
2. Training of Owner's personnel.
3. Occupancy permits and similar required approvals.
4. Warranties and maintenance agreements.
5. Test, adjust, and balance records.
6. Maintenance instructions.
7. Start-up performance reports.
8. Change-over information related to Owner's occupancy, use, operation, and maintenance.
9. Final cleaning.
10. Application for reduction of retainage, and Consent of Surety.
11. Advise on shifting insurance coverage.
12. Final progress photographs.
13. List of incomplete Work, recognized as exceptions to Architect's Certificate of Substantial Completion.
14. Transmittal of required Project construction records to Owner.
15. Removal of temporary facilities and services.
16. Removal of surplus materials, rubbish, and similar elements.
17. Additional items as required by General Conditions.

PART 2 - PRODUCTS
Not used.

PART 3 - EXECUTION
Not used.

END OF SECTION

SECTION 01 30 00

CIVIL ADMINISTRATIVE REQUIREMENTS

PART 1 - - GENERAL

1.1 SECTION INCLUDES

A. Coordination and Project conditions.

B. Preconstruction meeting.

C. Site mobilization meeting.

D. Progress meetings.

E. Preinstallation meetings.

F. Closeout meeting.

G. Alteration procedures.

1.2 COORDINATION AND PROJECT CONDITIONS

A. Coordinate scheduling, submittals, and Work of various Sections of Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements.

B. Verify that utility requirements and characteristics of operating equipment are compatible with building utilities. Coordinate Work of various Sections having interdependent responsibilities for installing, connecting to, and placing operating equipment in service.

C. Coordinate space requirements, supports, and installation of mechanical and electrical Work indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit as closely as practical; place runs parallel with lines of building. Use spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

1. Coordination Drawings: Prepare as required to coordinate all portions of Work. Show relationship and integration of different construction elements that require coordination during fabrication or installation to fit in space provided or to function as intended. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are important.

D. Coordination Meetings: In addition to other meetings specified in this Section, hold coordination meetings with personnel and Subcontractors to ensure coordination of Work.

E. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within construction. Coordinate locations of fixtures and outlets with finish elements.

F. Coordinate completion and clean-up of Work of separate Sections in preparation for Substantial Completion and for portions of Work designated for Owner's occupancy.

G. After Owner's occupancy of premises, coordinate access to Site for correction of defective Work and Work not complying with Contract Documents, to minimize disruption of Owner's activities.

1.3 PRECONSTRUCTION MEETING

A. Architect/Engineer will schedule and preside over meeting after Notice of Award.

B. Attendance Required: Architect/Engineer, Owner, Construction Manager, major Subcontractors, and Contractor.

C. Minimum Agenda:
1. Execution of Owner-Contractor Agreement.
2. Submission of executed bonds and insurance certificates.
3. Distribution of Contract Documents.
4. Submission of list of Subcontractors, list of products, schedule of values, and Progress Schedule.
5. Designation of personnel representing parties in Contract, and Engineer.
6. Communication procedures.
7. Procedures and processing of requests for interpretations, field decisions, field orders, submittals, substitutions, Applications for Payments, proposal request, Change Orders, and Contract closeout procedures.
8. Scheduling.
9. Critical Work sequencing.
10. Scheduling activities of Geotechnical Engineer.

D. Contractor: Record minutes and distribute copies to participants within two days after meeting, with two copies each to Engineer, Owner, and those affected by decisions made.

1.4 SITE MOBILIZATION MEETING

A. Architect/Engineer will schedule and preside over meeting at Project Site prior to Contractor occupancy. Contractor presides over meeting.

B. Attendance Required: Architect/Engineer, Owner, Contractor, Contractor's superintendent, major Subcontractors.

C. Minimum Agenda:
1. Use of premises by Owner and Contractor.
2. Owner's requirements and occupancy.
3. Construction facilities and controls.

4. Temporary utilities.
5. Survey and project layout.
6. Security and housekeeping procedures.
7. Schedules.
8. Procedures for testing.
9. Procedures for maintaining record documents.
10. Requirements for startup of equipment.
11. Inspection and acceptance of equipment put into service during construction period.

D. Contractor: Record minutes and distribute copies to participants within two days after meeting, with two copies each to Engineer, Owner, and those affected by decisions made.

1.5 PROGRESS MEETINGS

A. Schedule and administer meetings throughout progress of the Work at maximum bi-monthly intervals.

B. Make arrangements for meetings, prepare agenda with copies for participants, and preside over meetings.

C. Attendance Required: Job superintendent, major Subcontractors and suppliers, and Architect/Engineer, Owner, as appropriate to agenda topics for each meeting.

D. Minimum Agenda:
1. Review minutes of previous meetings.
2. Review of Work progress.
3. Field observations, problems, and decisions.
4. Identification of problems impeding planned progress.
5. Review of submittal schedule and status of submittals.
6. Review of off-Site fabrication and delivery schedules.
7. Maintenance of Progress Schedule.
8. Corrective measures to regain projected schedules.
9. Planned progress during succeeding work period.
10. Coordination of projected progress.
11. Maintenance of quality and work standards.
12. Effect of proposed changes on Progress Schedule and coordination.
13. Other business relating to Work.

E. Contractor: Record minutes and distribute copies to participants within two days after meeting, with two copies each to Architect/Engineer, Owner, and those affected by decisions made.

1.6 PREINSTALLATION MEETINGS

A. When required in individual Specification Sections, convene preinstallation meetings at Project Site five days before starting Work of specific Section.

B. Require attendance of parties directly affecting, or affected by, Work of specific Section.

C. Notify Engineer five days in advance of meeting date.

D. Prepare agenda and preside over meeting:
   1. Review conditions of installation, preparation, and installation procedures.
   2. Review coordination with related Work.

E. Record minutes and distribute copies to participants within two days after meeting, with two copies each to Engineer, Owner, and those affected by decisions made.

1.7 CLOSEOUT MEETING

A. Schedule Project closeout meeting with sufficient time to prepare for requesting Substantial Completion. Preside over meeting and be responsible for minutes.

B. Attendance Required: Contractor, major Subcontractors, Engineer, Owner, and others appropriate to agenda.

C. Notify Engineer five days in advance of meeting date.

D. Minimum Agenda:
   1. Start-up of facilities and systems.
   2. Operations and maintenance manuals.
   3. Testing, adjusting, and balancing.
   4. System demonstration and observation.
   5. Operation and maintenance instructions for Owner's personnel.
   6. Contractor's inspection of Work.
   7. Contractor's preparation of an initial "punch list."
   8. Procedure to request Architect/Engineer inspection to determine date of Substantial Completion.
   9. Completion time for correcting deficiencies.
   10. Inspections by authorities having jurisdiction.
   11. Certificate of Occupancy and transfer of insurance responsibilities.
   12. Partial release of retainage.
   13. Final cleaning.
   14. Preparation for final inspection.
   15. Closeout Submittals:
      a. Project record documents.
      b. Operating and maintenance documents.
      c. Operating and maintenance materials.

d. Affidavits.

16. Final Application for Payment.
17. Contractor's demobilization of Site.
18. Maintenance.

E. Record minutes and distribute copies to participants within two days after meeting, with two copies each to Engineer, Owner, and those affected by decisions made.

PART 2 - - PRODUCTS
Not used.

PART 3 - - EXECUTION

3.1 ALTERATION PROCEDURES

A. Entire facility will be occupied for normal operations during progress of construction. Cooperate with Owner in scheduling operations to minimize conflict and to permit continuous usage.
   1. Perform Work not to interfere with operations of occupied areas.
   2. Keep utility and service outages to a minimum and perform only after written approval of Owner.
   3. Clean Owner-occupied areas daily. Clean spillage, overspray, and heavy collection of dust in Owner-occupied areas immediately.

B. Materials: As specified in product Sections; match existing products with new and salvaged (if allowed by contract) products for patching and extending Work.

C. Employ original or skilled and experienced installer to perform alteration and renovation Work.

D. Cut, move, or remove items as necessary for access to alterations and renovation Work. Replace and restore at completion. Comply with Section 01 70 00 - Execution and Closeout Requirements

E. Remove unsuitable material not marked for salvage, including rotted wood, corroded metals, and deteriorated masonry and concrete. Replace materials as specified for finished Work.

F. Remove debris and abandoned items from area and from concealed spaces.

G. Prepare surface and remove surface finishes to permit installation of new Work and finishes.

H. Close openings in exterior surfaces to protect existing Work from weather and extremes of temperature and humidity.

I. Remove, cut, and patch Work to minimize damage and to permit restoring products and finishes to original or specified condition.

J. Refinish existing visible surfaces to remain in renovated rooms and spaces, to specified condition for each material, with neat transition to adjacent finishes.

K. Where new Work abuts or aligns with existing Work, provide smooth and even transition. Patch Work to match existing adjacent Work in texture and appearance.

L. When finished surfaces are cut so that smooth transition with new Work is not possible, terminate existing surface along straight line at natural line of division and submit recommendation to Architect/Engineer for review.

M. Where change of plane of 1/4 inch or more occurs, submit recommendation for providing smooth transition to Architect/Engineer for review or request instructions from Engineer.

N. Patch or replace portions of existing surfaces that are damaged, lifted, discolored, or showing other imperfections.

O. Finish surfaces as specified in individual product Sections.

END OF SECTION

SECTION 01 31 00

PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
   1. General coordination procedures.
   2. Coordination drawings.
   3. Request for Information (RFI).
   4. Digital project management procedures.
   5. Project meetings.

B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.

1.2 DEFINITIONS

A. BIM: Building Information Modeling.

B. RFI: Request for Information. Request from Owner, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.
   1. Typically, a Contractor initiated written instrument relating to the execute of the work for additional information or clarification of the contract documents.

1.3 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. Include the following information in tabular form:
   1. Name, address, telephone number, and email address of entity performing subcontract or supplying products.
   2. Number and title of related Specification Section(s) covered by subcontract.
   3. Drawing number and detail references, as appropriate, covered by subcontract.

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 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, in web based Project software directory, and in prominent location in each built facility. Keep list current.

1.4 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 items as required notices, reports, and list of attendees at meetings.
   1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
   1. Preparation of Contractor's construction schedule.
   2. Preparation of the schedule of values.
   3. Installation and removal of temporary facilities and controls.
   4. Delivery and processing of submittals.
   5. Progress meetings.
   6. Preinstallation conferences.
   7. Project closeout activities.
   8. Startup and adjustment of systems.

1.5 COORDINATION DRAWINGS

A. Coordination Drawings: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely indicated 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. Coordinate the addition of trade specific information to coordination drawings in a sequence that best provides for coordination of the information and

resolution of conflicts between installed components before submitting for review.

c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
f. Indicate required installation sequences.
g. Indicate dimensions shown on Drawings. Specifically note dimensions that conflict with submitted equipment and minimum clearance requirements. Provide alternative 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, wall systems, mechanical and electrical equipment, and related Work. Locate components within plenums to accommodate layout of light fixtures and other components 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, including 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 1-1/4 inches (32 mm) 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 locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.
9. Review: Architect will review coordination drawings to confirm that in general 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 prepared in sufficient scope or detail, or are deficient, Architect will inform Contractor, who shall make suitable modifications and resubmit.
10. Coordination Drawing Prints: Prepare coordination drawing prints according to requirements in Section 01 33 00 "Submittal Procedures."

C. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:

1. File Preparation Format: Same digital data software program, version, and operating system as original Drawings.
2. BIM File Incorporation: Develop and incorporate coordination drawing files into BIM established for Project.
   a. Perform three dimensional component conflict analysis as part of preparation of coordination drawings. Resolve component conflicts prior to submittal. Indicate where conflict resolution requires modification of design requirements by Architect.
3. 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. Contractor shall execute a data licensing agreement in the form of AIA Document C106.

1.6 REQUEST FOR INFORMATION (RFI)

A. Upon discovery of the need for additional information, clarification, or interpretation of the Contract Documents, prepare and submit an RFI using the attached form.

1. Architect will return without response those RFIs submitted to Architect by other entities controlled by Contractor.
2. Coordinate and submit RFIs promptly to avoid delays in Contractor's work or work of subcontractors.
3. Submission of an RFI constitutes representation that the Contractor requires additional information regarding the Contract Documents after having made careful study and comparison of the Contract Documents, field conditions, Owner provided information, Contractor prepared coordination drawings, and prior project correspondence or documentation.
   a. No response will be made to requests where the information is conveyed or contained in the Contract Documents or the Contractor’s own documents.

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: AIA Document G716.
   1. Attachments shall be electronic files in PDF format.

D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven workdays for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following workday.
   1. The following Contractor generated RFIs 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 RFIs or inaccurately prepared RFIs.
   2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt by Architect of additional information.
   3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 01 26 00 "Contract Modification Procedures."
      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: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Use software log that is part of web based Project software. Include the following:
   1. Project name.
   2. Name and address of Contractor.
   3. Name and address of Architect.
   4. RFI number including RFIs that were returned without action or withdrawn.
   5. RFI description.
   6. Date the RFI was submitted.
   7. Date Architect's response was received.
   8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.

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 seven days if Contractor disagrees with response.

1.7 DIGITAL PROJECT MANAGEMENT PROCEDURES

A. Use of Architect's Digital Data Files: Digital data files of Architect's BIM model will be provided by Architect for Contractor's use during construction.
   1. Digital data files may be used by Contractor in preparing coordination drawings, Shop Drawings, and Project record Drawings.
   2. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Contract Drawings.
   3. Digital Drawing Software Program: Contract Drawings are available in Autodesk Revit.
   4. Contractor shall execute a data licensing agreement in the form of AIA Document C106 Digital Data Licensing Agreement.
      a. Subcontractors, and other parties granted access by Contractor to Architect's digital data files shall execute a data licensing agreement in the form of AIA Document C106.
   5. The following digital data files will be furnished for each appropriate discipline:
      a. Floor plans.
      b. Reflected ceiling plans.

B. Web Based Project Software: Use Architect's web based Project software site for purposes of hosting and managing Project communication and documentation until Final Completion.

C. PDF Document Preparation: Where PDFs are required to be submitted to Architect, prepare 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 unique identifier, including revision identifier.

3. Certifications: Where digitally submitted certificates and certifications are required, provide a digital signature with digital certificate on where indicated.

1.8 PROJECT MEETINGS

A. Schedule and conduct meetings and conferences at Project site unless otherwise indicated.
   1. Attendees: Inform participants and parties involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times a minimum of 10 workdays prior to meeting.
   2. Agenda: Prepare the meeting agenda. Distribute the agenda to 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: Schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.
   1. Attendees: Authorized representatives of Owner, Architect, and their 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.
   2. Agenda: Discuss items of significance that could affect progress, including the following:
      a. Responsibilities and personnel assignments.
      b. Tentative construction schedule.
      c. Phasing.
      d. Critical work sequencing and long lead items.
      e. Designation of key personnel and their duties.
      f. Lines of communications.
      g. Use of web based Project software.
      h. Procedures for processing field decisions and Change Orders.
      i. Procedures for RFIs.
      j. Procedures for testing and inspecting.
      k. Procedures for processing Applications for Payment.
      l. Distribution of the Contract Documents.
      m. Submittal procedures.
      n. Sustainable design requirements.
      o. Preparation of Record Documents.
      p. Use of the premises and existing building.
      q. Work restrictions.
      r. Working hours.
      s. Owner's occupancy requirements.
      t. Responsibility for temporary facilities and controls.
      u. Procedures for moisture and mold control.
      v. Procedures for disruptions and shutdowns.
      w. Construction waste management and recycling.
      x. Parking availability.
      y. Office, work, and storage areas.
      z. Equipment deliveries and priorities.

aa. First aid.
bb. Security.
cc. Progress cleaning.

3. 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 when required by other sections and when required for 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 of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the activity under consideration, including requirements for the following:
   a. Contract Documents.
   b. Options.
   c. Related RFIs.
   d. Related Change Orders.
   e. Purchases.
   f. Deliveries.
   g. Submittals.
   h. Sustainable design requirements.
   i. Review of mockups.
   j. Possible conflicts.
   k. Compatibility requirements.
   l. Time schedules.
   m. Weather limitations.
   n. Manufacturer's written instructions.
   o. Warranty requirements.
   p. Compatibility of materials.
   q. Acceptability of substrates.
   r. Temporary facilities and controls.
   s. Space and access limitations.
   t. Regulations of authorities having jurisdiction.
   u. Testing and inspecting requirements.
   v. Installation procedures.
   w. Coordination with other work.
   x. Required performance results.
   y. Protection of adjacent work.
   z. 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, 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. Procedures for completing and archiving web based Project software site data files.
      d. Submittal of written warranties.
      e. Requirements for completing sustainable design documentation.
      f. Requirements for preparing operations and maintenance data.
      g. Requirements for delivery of material samples, attic stock, and spare parts.
      h. Requirements for demonstration and training.
      i. Preparation of Contractor's punch list.
      j. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
      k. Submittal procedures.
      l. Coordination of separate contracts.
      m. Owner's partial occupancy requirements.
      n. Installation of Owner's furniture, fixtures, and equipment.
      o. 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 regular intervals.
   1. Coordinate dates of meetings with preparation of payment requests.
   2. Attendees: In addition to representatives of Owner and Architect, 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.
   3. 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) Status of sustainable design documentation.
5) Deliveries.
6) Off-site fabrication.
7) Access.
8) Site use.
9) Temporary facilities and controls.
10) Progress cleaning.
11) Quality and work standards.
12) Status of correction of deficient items.
13) Field observations.
14) Status of RFIs.
15) Status of Proposal Requests.
16) Pending changes.
17) Status of Change Orders.
18) Pending claims and disputes.
19) Documentation of information for payment requests.

4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

F. Coordination Meetings: Conduct Project coordination meetings at regular intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.

1. Attendees: In addition to representatives of Owner 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 meetings shall be familiar with Project and authorized to conclude matters relating to the work.

2. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
a. Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contract is on time, ahead of schedule, or behind schedule, in relation to combined 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.
b. Schedule Updating: Revise combined Contractor's construction schedule after each coordination meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.

c. Review present and future needs of each contractor 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 use.
   8) Temporary facilities and controls.
   9) Work hours.
   10) Hazards and risks.
   11) Progress cleaning.
   12) Quality and work standards.
   13) Status of RFIs.
   14) Proposal Requests.
   15) Change Orders.
   16) Pending changes.

3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

G. Preapplication Roofing Conference: Not less than seven days or more than 21 days prior to scheduled commencement of roofing application, convene a preapplication roofing conference at project site.

1. Attendance is required by Architect, Contractor, roofing installer, roof consultant, and each entity required to coordinate with or to protect work.

2. Minimum Agenda:
   a. Review accepted Submittals.
   b. Review outstanding material problems.
   c. Review minutes of Preliminary Roofing Conference.
   d. Discuss installation schedules and sequence, and revisions that have occurred.
   e. Review equipment set up and on site storage.
   f. Review readiness of deck for application:
      1) Certification in place.
      2) Examination of substrate by those in attendance.
      3) Drains installed.
      4) Curbs, nailers, penetrations, perimeter, equipment.
   g. Review the installation of the roofing system; review requirements.
   h. Review weather and working conditions, and procedures for daily or inclement weather cut-offs.
   i. Review protection requirements after installation.
   j. Review testing requirements and procedures involved.
   k. Discuss requirements for warranties and bonds.
   l. Conduct tour of roof deck to review potential issues and to verify readiness.

PART 2 - PRODUCTS
Not used.

PART 3 - EXECUTION
Not used.

END OF SECTION

SECTION 01 32 00

CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Administrative and procedural requirements for schedules and reports required for proper performance of the work.

1.2 REFERENCES

A. The Associated General Contractors of America (AGC): The Use of CPM in Construction - A Manual for General Contractors and the Construction Industry.

1.3 QUALITY ASSURANCE

A. Scheduler: Submit documentation of Contractor's personnel specializing in CPM scheduling with five years minimum experience in scheduling construction work of complexity comparable to Project and having use of computer facilities capable of delivering readout within 24 hours.

B. Contractor's Administrative Personnel: Submit documentation of five years minimum experience in using and monitoring CPM schedules on comparable projects.

1.4 DESCRIPTION

A. Provide information and input required for development of Project Schedule in accordance with requirements of this Section. Purpose of schedule is:
   1. Assure adequate planning, scheduling, and reporting during execution of work by Contractor.
   2. Assure coordination of work of Contractor and various subcontractors and subsubcontractors.
   3. Assist Contractor and Owner in monitoring progress of work and evaluating proposed changes to Contract and Project Schedule.
   4. Assist Owner and Contractor in preparation and evaluation of Contractor's monthly progress payments.

B. Use Critical Path Method (CPM) for planning, scheduling, and reporting work performed under Contract. Display graphic portions of Project Schedule by Activity-on-Arrow Diagramming Method (ADM).
   1. Include Preliminary Network, Detailed Network, and computer produced Schedule and Cost Reports.

C. Provide Preliminary Network to monitor progress of work during development and acceptance of Detailed Network.

D. Contractor and major subcontractors shall meet with Owner within seven calendar days after date of Notice-to-Proceed to conduct joint review of Project Schedule requirements to assure mutual understanding by parties involved.

1.5 INITIAL SCHEDULE DEVELOPMENT (FORMAT)

A. Propose Critical Path Method arrow diagram format consisting of project activities, sequences and duration, submittals, procurement, and completion of work.

B. Submit to Architect from each major subcontractor letter confirming work schedule for their individual trade.

C. Submit initial network analysis schedule development within seven days of Notice to Proceed, or at Preconstruction Scheduling Meeting, to Architect for review.

D. Incorporate revisions deemed necessary by Architect and resubmit within additional 7 days.

E. Upon acceptance of network analysis format, begin data input and development of Preliminary Network.

1.6 PRELIMINARY NETWORK DEVELOPMENT

A. After acceptance of initial schedule format by Architect, Contractor to submit to Architect Preliminary Network within 14 calendar days of acceptance of schedule format, but not more than 21 days after Notice-to-Proceed. Submit four copies of Preliminary Network neatly organized and drawn non-time scaled from left to right on either 24 inches by 36 inches (610 mm by 915 mm) or 30 inches by 42 inches (563 mm by 1065 mm) standard size sheets with suitable notation relating interface points among sheets. Cover following project phases and activities:

1. Proposed procurement activities, including shop drawings, product data and sample submittals, and fabrication and delivery of critical and long lead time procurements.
    a. Indicate intended submittal dates and realistic delivery dates for fabrication and delivery items.
    b. Incorporated into Detailed Network (described below), including requested revisions.
2. Proposed construction activities to be accomplished during first 90 calendar days of Contract.
    a. Activity durations shall be in units of whole workdays and shall be limited to maximum 15 workdays for each activity.
    b. Incorporate proposed 90 calendar day construction activities into Detailed Network, including requested revisions.
3. Include in proposed procurement and construction activities same information required for Detailed Network described below.
4. Summary activities not included above which are necessary to properly indicate following:
    a. Approach to scheduling remaining work areas or phases of work. Represent work for each phase or area by at least one summary activity such that they cumulatively indicate entire Project Schedule.

b. Show approximate cost and duration for each summary activity on Preliminary Network and include best estimate of work.

B. Show sequence and interdependence of activities subject to requirements of other provisions of this Section.

C. Preliminary Network shall be basis for progress payments during first 90 calendar days of Contract while Detailed Network (described below) is being developed and accepted.

D. Updated on monthly basis while Detailed Network is being developed. Monthly updating of Preliminary Network shall be consistent with procedures and requirements for Schedule Updating, except computer produced Schedule and Cost Reports shall not become part of Project Schedule until after acceptance of Detailed Network.

E. Use as follows for time extension analysis during first 90 calendar days of Contract:

1. When Change Orders (and Proposed Changes) are initiated, delays are experienced, or Contractor desires to revise Preliminary Network, submit to Architect written Time Impact Analysis as required below, except included activities and event times in Analysis from current Preliminary Network update.
2. Determine final determination with regard to extent of time extension allowed in accordance with requirements for Time Impact Analysis, subsequent to development, review and acceptance of Detailed Network.

F. Within seven calendar days of Architect's receipt of Preliminary Network, Architect shall notify Contractor of concerns in regard to Preliminary Network. Furnish written response to Architect's comments prior to or concurrent with submittal of Detailed Network. Resolve comments and concerns before consideration of Detailed Network can commence.

1.7 DETAILED NETWORK DEVELOPMENT

A. Schedule development by Contractor: Within 28 days after Notice-to-Proceed, submit proposed Detailed Network to Architect. Cover entire Contract Time period and incorporate in detail first 90 calendar days of Preliminary Network, including requested revisions. Organize and drawn non-time scaled from left to right on either 24 inches by 36 inches (610 mm by 915 mm) or 30 inches by 42 inches (563 mm by 1065 mm) standard size sheets with suitable notation relating interface points among sheets. Detailed Network shall include, but not be limited by, following as minimum:

1. Proposed procurement activities, including activities and information used in Preliminary Network. Recommended sequence would be as follows:

Duration	Description
---- --00	0 (restraint from NTP)
--00	--02-SUB
--02	--04-APP
--04	--06-F/D
--06	--081ARR
--08	----0 (restraint to installation)

   a. In above sequence, activity --00 --02 is submittal activity which precedes --02 --04, "approval." Activity --04 --06 is fabrication and delivery time which precedes --06 --08, "arrival." Begin each activity description with three character verb abbreviation standard in procurement item scheduling for purposes of computer report selection. Arrival activity, "ARR," is included for purpose of pinpointing cashflow. Load arrival activity with amount due contractor upon delivery of line item in question. Each activity of this type shall have "duration" of one day.

2. Proposed construction activities, including activities and information used in Preliminary Network. Develop construction sequencing separately from procurement. Construction activity sequence shall appear as though it were developed under assumption that materials are immediately available to Project. Link procurement activities grouped together on network diagram (preferably above construction logic), to various installation activities by restraints (dummies) from "J" nodes of "arrival" activities.
3. Proposed durations for construction activities.
4. Proposed sequencing of construction activities.
5. Proposed activity manpower, cost and equipment loading.

B. Depict following for each activity:

1. "I" and "J" (beginning and ending) event nodes and numbers, respectively. Utilize numerical designations to identify each and every event node. Do not utilize alpha-numeric event node numbering. Each "J" node number shall be larger than preceding "I" node numbers.
2. Concise description of Work represented by activity. As requested by Architect, either prior or subsequent to acceptance of Detailed Network, provide graphic explanation of relationship of activities in comparison with work areas identified on prints of Contract Documents, at no additional cost to Owner.

3. Activity duration in whole workdays, with maximum 15 workdays each, unless otherwise directed by Architect, except for nonconstruction activities such as procurement and fabrication of materials, delivery of materials, and curing of concrete. When single activity requires more than 15 days, subdivided into identifiable elements of less than 15 workdays each.
4. Performance responsibility by discipline code: MECH, ELEC, or acceptable abbreviations accepted by Architect.
5. Assigned dollar value (cost loading) of each activity of Detailed Network, which cumulatively equal total Contract Sum. Mobilization, bond and insurance costs may be shown separately. Prorate other General Requirement costs, overhead, and profit throughout activities. For this purpose, assume rate of activity value installation into work as linear with time.
6. Manpower loading of each activity. Prepare and submit (separate) manpower summary analysis in graphic format depicting manpower by principle trades and aggregate. Graph(s) shall show number of man days of effort, by month, over duration of Project Schedule.
7. Assignment to applicable activities of Detailed Network of major construction equipment to be utilized by Contractor, subcontractors, and sub-subcontractors in executing work.

C. Computer Printout:
1. Early Start and Early Finish dates.
2. Late Start and Late Finish dates.
3. Activity Float Time.
4. Actual Start and Finish dates.

D. Clearly identify activities illustrating accomplishment of time(s) for completion of project set forth in Contract. If schedule indicated earlier completion time(s) than that set forth in Contract, show float (or slack) between schedule and Contract dates on computer printout shall be part of total float available.

E. Produce computer printouts sorts and summaries, providing sorts and breakdowns as follows:
1. I-J.
2. Total float.
3. Performing organization.
4. Early start date.
5. Schedule of Values.
6. Monthly cash flow.

F. Develop network diagram logic so that no activity having duration greater than zero shall share I-node or J-node designation with other activities having duration greater than zero. There shall be no converging or diverging logic patterns involving more than one activity of duration greater than zero.
1. Include contractor and subcontractor work at tiers.

G. Show sequence and interdependence of activities required for complete performance of Work in logical sequence and coordinated plan of work.

H. Estimate proposed durations assigned to each activity of time required to complete activity considering scope and resources planned for activity. Upon request by Architect, furnish written description of determination of each duration of critical activities. Include in request:

1. Explain number of crews, crew composition, number of shifts per day, number of hours in shift, and number of workdays per week.
2. Provide major item list of construction equipment for activity, including types, number of units, unit capacities, and proposed time each piece of equipment will be on job keyed to activities on which equipment will be used.
3. Other pertinent data affecting specific activity duration.

I. Failure by Contractor to include elements of work required for performance of Contract shall not excuse Contractor form completing work within Contract Time, regardless of acceptance of Detailed Network.

J. Consider seasonal weather conditions and included in planning and scheduling of work influenced by high or low ambient temperatures or precipitation to ensure completion of Work within Contract Time. Determine Seasonal weather conditions by assessment of average historical climatic conditions based upon preceding 10 year records published for locality by U.S. Weather Bureau Service. Following number of workdays (Mon.-Fri.) is to be minimum allowed in schedule for time lost due to bad weather in form of precipitation, muddy conditions, extreme temperatures, or high winds.

Month	Workdays
January	6
February	6
March	7
April	6
May	6
June	4
July	5
August	5
September	4
October	8
November	5
December	8
Total.	70

1. Show that critical activity path has been delayed by loss of days in excess of number indicated above before consideration of extension will be given.
2. In execution of interior work, show to satisfaction of Architect that interior work has been delayed by adverse weather in excess of number of allowable days above.

K. Indicate holidays, vacations, and non-workdays applicable to schedule.

L. If Architect questions Contractor's proposed logic, durations, manpower, cost or equipment loading, within seven calendar days of receipt of written request, furnish satisfactory revision or adequate justification.

M. Joint Review, Revision, and Approval of Detailed Network:

1. Within 14 calendar days of receipt of Contractor's proposed Detailed Network, and within seven calendar days of receipt by Architect of Contractor's response, Architect, Contractor, and Owner shall meet for joint review, correction, or adjustment of proposed Detailed Network. Areas which, in opinion of Architect, conflict with timely completion of Project shall be subject to revision by Contractor.
2. If Contractor fails to define element of work, activity or logic, and Architects review does not detect this error or omission, update error or omission, current at next monthly update without change to Contract Time.
3. Within 7 calendar days after joint review, revise Network in accordance with agreements reached during review and submit one reproducible mylar sepia and three prints of revised Network.
4. Within 7 calendar days of receipt by Architect of revised Detailed Network, three copies of each revised Network and computer produced Schedule and furnish Cost Reports to Architect by Contractor. Include computer produced cashflow analysis generated by both early start and late start activity dates.
5. Upon establishment of agreed upon Project Schedule, sign on face of documents (Detailed Network and Schedule and Cost Report), indicating acceptance of Schedule.
6. Upon acceptance of Detailed Network by Owner, cost-loaded values of Network shall become basis for determining progress payments.
7. Acceptance of Project Schedule by Owner does not relieve Contractor of responsibilities for accuracy or feasibility of schedule, or Contractor's ability to meet Contract Completion date, nor does acceptance warrant, acknowledge or admit reasonableness of logic, durations, manpower or equipment loading of Project Schedule.

1.8 PROJECT SCHEDULE UPDATING

A. Updated on monthly basis throughout Contract Time and until Substantial Completion. Meet with Owner and Architect each month at Schedule Update meeting to review actual progress made through date of schedule update, including following:

1. Progress made to date, activities started and completed to date, and percentage of Work complete to date on each activity started but not complete.
2. Evaluate percentage of completed work with Contractor prepared estimates and supporting data.
3. Submit contractor prepared estimates of percentage completion of each activity and supporting data on or before 14th day preceding progress payment submittal deadline, including following information:
    a. One marked up copy of previous months Schedule Update Network indicating progress on schedule activities and revised (current) remaining durations. Legibly markup copy with felt-tip markers and red ink.
    b. One original and three reproduced marked up copies of previous months Schedule Update reports coordinated with other requirements above and indicating actual activity start or completion dates, revised current) remaining durations, and percent complete regarding activity cost.

c. Indicate in writing those activities Contractor plans to work on during following update month and current or anticipated conditions which may delay work.

B. In case of disagreements at Schedule Update meeting concerning actual progress to date, Architect's determination shall govern.

C. Upon completion of Schedule Update meeting, which occurs on or before 7th day preceding progress payment submittal deadline, use input from meeting to revise Network to reflect progress as of date of Schedule Update and agreed revisions. Execute computer produced calculation to determine status of Project Schedule. Use percentage completions as required for preparation of monthly request for progress payment.

D. Forward two copies of each updated Project Schedule to Architect including:
1. Description of activities completed during preceding month.
2. Description of progress made on activities listed as started but not completed.
3. Description of revisions to schedule logic, initial activity durations, or activity costs.
4. Prints of updated Network indicating progress made up to date of Schedule Update and indicating revisions to Network.
5. Following computer produced reports:
   a. I-J.
   b. Total float.
   c. 60-day Early Start by I-J.
   d. 60-day Early Start by Responsibility Code.
   e. Cost report.
6. Include I-J, Total Float, and 60-day Early Start Schedule Reports listed for reach activity listed on Network:
   a. I-J Event Node Number(s).
   b. Activity Description.
   c. Original Destination.
   d. Remaining Duration.
   e. Activity Responsibility Code.
   f. Activity Early Start Date.
   g. Activity Early Finish Date.
   h. Activity Late Start Date.
   i. Activity Late Finish Date.
   j. Total Float.

E. If Contractor does not record exceptions to published Project Schedule Update within 14 calendar days after its issuance, Contract shall be deemed to have accepted revisions.

F. Monthly updating of Project Schedule shall be integral part and basic element of estimate upon which progress payments will be made. If, in opinion of Architect, Contractor fails or refuses to provide information required to accomplish complete Update, Contractor shall be deemed to have not provided required estimate upon which progress payments are based and shall not be entitled to progress payment until completed Update has been provided in accordance with requirements of this Section to satisfaction of Architect.

1.9 PROJECT SCHEDULE REVISIONS

A. Updating Project Schedule to reflect actual progress made up to date of Update shall not be considered revisions to Project Schedule.

B. If Project Schedule no longer represents actual progress of work, submit revision to Schedule.

C. If Contractor desires to make changes in Project Schedule to reflect revisions in method of operating and scheduling of work, notify Architect in writing, stating reason for proposed revision.

D. If revision to Schedule is contemplated, Contractor or Owner shall so advise other in writing at least 14 calendar days in advance of next Schedule Update meeting, describing revision and describing reasons for revision.

E. Reasonable requests by Contractor for revisions will be implemented by Owner.

F. Owner directed revisions to Project Schedule will not be incorporated into Schedule without written response from Contractor within 14 calendar days. Contractor's failure to respond within 14 days will be considered acceptance of Owner requested revisions, and such revisions will be incorporated into Schedule.

G. Make requests for revisions of activity manpower, activity costs, or redistribution of activity costs in accordance with requirements.

1.10 ADJUSTMENT OF TIME FOR COMPLETION

A. Time for Completion will be adjusted in accordance with requirements.

B. Accompany request for adjustment of time for completion because of changes or alleged delays with complete Time Impact Analysis submitted for within 30 calendar days after initial notice of delay.

C. Furnish information justifying request and stating extent of adjustment requested for each specific change or alleged delay. Each Analysis shall be on form and content acceptable to Architect. Include but do not limit to, general information set forth in this Clause appropriate to type of request (change or alleged delay) plus following:
   1. Fragmentary CPM network illustrating how Contractor proposes to have change or alleged delay incorporated into current Update Schedule.
   2. Identification of activities in current updated Project Schedule which are proposed to be amended due to change or alleged delay, together with engineering estimates and other appropriate data justifying proposal.
   3. Take into account total allowable time of activity float time available for work involved in request.

1.11 TIME IMPACT ANALYSIS

A. When change Orders (including Proposed Change Orders) are initiated, delays are experienced, or Contractor desires to revise Project Schedule, submit to Architect written

Time Impact Analysis illustrating influence of each Change Order, delay, or Contractor request on current Contract Completion date.

B. Base Time Impact Analysis on dates when change or changes were issued, or dates when alleged delay or delays began, status of work at that time, and include time computations for affected activities.

C. Activity delays shall not automatically mean that extension of Contract Time is warranted or due Contractor.

D. Float is not for exclusive use or benefit of either Owner or Contractor. Contract Time extensions will be granted only to extent equitable time adjustments to activity or activities affected by Change Order or delay exceeds total (positive or zero) float of critical activity (or path) and extends Contract Date.

E. Submit three copies of each Time Impact Analysis within 14 calendar days after commencement of delay or notice of direction for Change Order is given to Contractor.

F. Upon Architects review of Time Impact Analysis, to extension of time for completion of immediate contract milestone, time(s) for completion of milestone(s) will be adjusted by Architect, whether or not time for completion of overall Project Schedule is changed accordingly.

G. If Architect finds, after review of Time Impact Analysis that Contractor is entitled to extension of time for completion, time for completion will be adjusted by Architect and Owner will allow revision to Project Schedule.

H. Upon failure to submit Time Impact Analysis for change or alleged delay within 14 calendar days, or provide additional information as Architect may require, Architect will determine time impact of change or alleged delay. If this results in determination that adjustments should be made, Architect will issue direction at next Update meeting.

I. Incorporate Time Impact Analysis related to Change Order work or Contract Time extensions, into and attached to applicable Change Order.

1.12 RESPONSIBILITY FOR COMPLETION

A. Furnish sufficient forces. Include offices, facilities and equipment works hours, night shifts and overtime operations, as necessary to ensure execution of Work in accordance with monthly Project Schedule Update.

PART 2 - PRODUCTS
Not used.

PART 3 - EXECUTION
Not used.

END OF SECTION

SECTION 01 32 33

PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Administrative and procedural requirements for the following:
   1. Preconstruction photographs.
   2. Periodic construction photographs.
   3. Final completion construction photographs.

1.2 INFORMATIONAL SUBMITTALS

A. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.

B. Digital Photographs: Submit image files within three days of taking photographs.
   1. Submit photos on CD-ROM or thumb drive. Include copy of key plan indicating each photograph's location and direction.
   2. Identification: Provide the following information with each image description in file metadata tag:
      a. Name of Project.
      b. Name and contact information for photographer.
      c. Name of Architect.
      d. Name of Contractor.
      e. Date photograph was taken.
      f. Description of location, vantage point, and direction.
      g. Unique sequential identifier keyed to accompanying key plan.

1.3 FORMATS AND MEDIA

A. Digital Photographs: Provide color images in JPG format, produced by a digital camera with minimum sensor size of 12 megapixels, and at an image resolution of not less than 3200 by 2400 pixels, and with vibration reduction technology. Use flash in low light levels or backlit conditions.

B. Digital Images: Submit digital media as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image editing software.

C. Metadata: Record accurate date and time and GPS location data from camera.

D. File Names: Name media files with date and sequential numbering suffix.

1.4 CONSTRUCTION PHOTOGRAPHS

A. Take photographs with maximum depth of field and in focus.
   1. Maintain key plan with each set of construction photographs that identifies each photographic location.

B. Preconstruction Photographs: Before commencement of demolition, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Architect.
   1. Take 100 photographs of existing buildings either on or adjoining property to accurately record physical conditions at start of construction.
   2. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.

C. Periodic Construction Photographs: Take 20 photographs coinciding with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.

D. Final Completion Construction Photographs: Take 100 photographs after date of Substantial Completion for submission as Project Record Documents. Architect will inform photographer of desired vantage points.

E. Additional Photographs: Architect may request photographs in addition to periodic photographs specified. Additional photographs will be paid for by Change Order and are not included in the Contract Sum.
   1. Three days' notice will be given, where feasible.
   2. In emergency situations, take additional photographs within 24 hours of request.
   3. Circumstances that could require additional photographs include, but are not limited to, the following:
      a. Special events planned at Project site.
      b. Immediate follow up when on site events result in construction damage or losses.
      c. Photographs to be taken at fabrication locations away from Project site. These photographs are not subject to unit prices or unit-cost allowances.
      d. Substantial Completion of a major phase or component of the Work.
      e. Extra record photographs at time of final acceptance.
      f. Owner's request for special publicity photographs.

1.5 USAGE RIGHTS

A. Obtain and transfer copyright usage rights from photographer to Owner for unlimited reproduction of photographic documentation.

PART 2 - PRODUCTS
Not used.

PART 3 - EXECUTION
Not used.

END OF SECTION

SECTION 01 33 00

SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Administrative and procedural requirements including:
   1. Submittal schedule.
   2. Shop Drawings, Coordination Drawings, Product Data, and Samples.
   3. Verification submittals.

1.2 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.

1.3 SUBMITTAL SCHEDULE

A. Submittal Schedule: Submit, as an action submittal, a list 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. Initial Submittal: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List submittals required to maintain orderly progress of the work and those required early due to long lead time for manufacture or fabrication.
   3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.
      a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.
   4. Format: Arrange the following information in a tabular format:
      a. Scheduled date for first submittal.
      b. Specification Section number and title.
      c. Submittal Category: Action; informational.
      d. Name of subcontractor.
      e. Description of the Work covered.

f. Scheduled date for Architect's final release or approval.
g. Scheduled dates for purchasing.
h. Scheduled date of fabrication.
i. Scheduled dates for installation.
j. Activity or event number.

1.4 SUBMITTAL FORMATS

A. Submittal Information: Include the following information in each submittal:
1. Project name.
2. Date.
3. Name of Architect.
4. Name of Construction Manager, if applicable.
5. Name of Contractor.
6. Name of firm or entity that prepared submittal.
7. Names of subcontractor, manufacturer, and supplier.
8. Unique submittal number, including revision identifier. Include Specification Section number with sequential alphanumeric identifier; and alphanumeric suffix for resubmittals.
9. Category and type of submittal.
10. Submittal purpose and description.
11. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
12. Drawing number and detail references, as appropriate.
13. Indication of full or partial submittal.
14. Location(s) where product is to be installed, as appropriate.
15. Other necessary identification.
16. Remarks.
17. Signature of transmitter.

B. Options: Identify options requiring selection by Architect.

C. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Architect on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.

D. Paper Submittals:
1. Action Submittals: Number of Paper Submittals Required:
a. Shop Drawings: Submit six opaque reproductions (prints); submit one additional opaque reproduction for civil, structural, mechanical, electrical or landscaping work.
b. Product Data: Submit number required by Contractor plus two copies that will be retained by Architect.
c. Physical Samples: Submit number of samples of items requested in each specification section; submit minimum of three samples for each item.

2. Informational Submittals: Submit two paper copies of each submittal unless otherwise indicated. Architect will not return copies.
3. Contractor's responsibility for deviations in submittals from requirements of Contract Documents is not relieved by Architect's review of submittals unless Architect gives specific written acceptance of specific deviations.

E. Transmittals:
1. Identification and Information: Identify and incorporate information in each electronic submittal file:
   a. Assemble complete submittal package into a single indexed file with links enabling navigation to each item.
   b. Name file with submittal number or other unique identifier, including revision identifier.
      1) File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., LNHS-061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., LNHS-061000.01. A).
   c. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.
2. Electronic Submittals: Prepare submittals as PDF package, incorporating complete information into each PDF file. Name PDF file with submittal number and date.
   a. Format: Use software generated form from electronic project management software acceptable to Project team, containing the following information:
      1) Project name.
      2) Date.
      3) File name and submittal number.
      4) Name and address of Architect.
      5) Name of Construction Manager. If applicable.
      6) Name of Contractor.
      7) Name of firm or entity that prepared submittal.
      8) Names of subcontractor, manufacturer, and supplier.
      9) Type of submittal.
      10) Specification Section number and title.
      11) Specification paragraph number or drawing designation and generic name for each of multiple items.
      12) Drawing number and detail references, as appropriate.
      13) Location(s) where product is to be installed, as appropriate.
      14) Related physical samples submitted directly.
      15) Indication of full or partial submittal.
      16) Transmittal number, numbered consecutively.
      17) Submittal and transmittal distribution record.
      18) Remarks.
   b. Metadata: Include the following information as keywords in the electronic submittal file metadata:
      1) Project name.
      2) Number and title of appropriate Specification Section.
      3) Manufacturer name.
      4) Product name.

1.5 SUBMITTAL PROCEDURES

A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
   1. Web Based Project Software: Prepare submittals in PDF form, and upload to web based Project software website. Enter required data in web based software site to fully identify submittal.

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 submittal items required for each Specification Section concurrently unless partial submittals for portions of the work are indicated on approved submittal schedule.
   3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
   4. Coordinate transmittal of submittals for related parts of the work specified in different Sections so processing will not be delayed because of need to review submittals concurrently for coordination.
      a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

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 due to failure to transmit submittals enough in advance of the work to permit processing, including resubmittals.
   1. Initial Review: Allow 15 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. Consulting Engineers: Submit submittals for structural, mechanical, and electrical items directly to consulting engineer with copy of transmittal sent to Architect. Upon completion of review, consulting engineer will send its reviewed submittal to Architect.
   3. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
   4. Resubmittal Review: Allow 10 days for review of each resubmittal.
   5. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 15 days for initial review of each submittal.

D. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
   1. Note date and content of previous submittal.
   2. Note date and content of revision in label or title block and clearly indicate extent of revision.
   3. Make revisions in submittals required by Architect, mark number of submission, and resubmit as required until accepted.

4. Shop Drawings and Product Data:
   a. Revise initial drawings or data, and resubmit as specified for initial submittal.
   b. Indicate changes been made other than those requested by Architect.
   c. Mark number of submission and resubmit until accepted.
5. Samples: Submit new samples as required for initial submittal. Remove samples which are rejected or designated as resubmit.
6. Resubmit submittals until marked with approval notation from Architect's action stamp.

E. 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.
1. Distribute reproductions of reviewed Shop Drawings and Product Data that do not require revisions to the following:
   a. Job site file.
   b. Project Record Documents file.
   c. Other affected contractors.
   d. Subcontractors.
   e. Supplier or Fabricator.
2. Distribute accepted samples as directed by Architect.

F. Use for Construction: Retain complete copies of submittals on Project site. Use final action submittals marked with approval notation from Architect's action stamp.

1.6 SUBMITTAL REQUIREMENTS

A. Make submittals promptly in accordance with approved schedule and in sequence that does not delay the work. Submittals shall be made to Architect by Contractor. Submittals from other entities will be returned unreviewed.

B. Paper Submittal Requirements: Place a permanent label or title block on each submittal item for identification.
1. Place a permanent label or title block on each submittal item for identification; include name of firm or entity that prepared submittal.
2. Provide a space approximately 6 inches by 8 inches (150 mm by 200 mm) on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
3. Include the following information for processing and recording action taken:
   a. Project name.
   b. Date.
   c. Name of Architect.
   d. Name of Construction Manager.
   e. Name of Contractor.
   f. Name of subcontractor.
   g. Name of supplier.
   h. Name of manufacturer.

i. Submittal number, including revision identifier, and unique identifiers at Contractor's discretion.
   1) Submittal shall use the Specification Section number, with spaces, followed by a dash and then a sequential 3 digit submittal number (e.g., 061053 – 001). Submittal shall include a 2 digit revision identifier suffix after another dash, starting with "00" on the initial submission (e.g., 061053 – 001 – 00).
j. Number and title of appropriate Specification Section.
k. Drawing number and detail references, as appropriate.
l. Location(s) where product is to be installed, as appropriate.
m. Other necessary identification.

C. Electronic Submittal Requirements:
   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, including revision identifier, and other unique identifiers at Contractor's discretion.
      a. File name and submittal number shall use the Specification Section number, with spaces, followed by a dash and then a sequential 3-digit submittal number (e.g., 061053 – 001). File name and submittal shall also include a 2-digit revision identifier suffix after another dash, starting with "00" on the initial submission (e.g., 061053 – 001 – 00).
   3. Provide electronic stamp to permanently record Contractor's review and approval markings and space for electronic stamp for action taken by Architect and Consultants as needed.
   4. Transmittal Form for Electronic Submittals: Use software generated form from electronic project management software acceptable to Project team, containing the following information:
      a. Project name.
      b. Date.
      c. File name and submittal number.
      d. Name and address of Architect.
      e. Name of Construction Manager.
      f. Name of Contractor.
      g. Name of firm or entity that prepared submittal.
      h. Names of subcontractor, manufacturer, and supplier.
      i. Type of submittal.
      j. Specification Section number and title.
      k. Specification paragraph number or drawing designation and generic name for each of multiple items.
      l. Drawing number and detail references, as appropriate.
      m. Location(s) where product is to be installed, as appropriate.
      n. Related physical samples submitted directly.
      o. Indication of full or partial submittal.
      p. Transmittal number, numbered consecutively.
      q. Submittal and transmittal distribution record.
      r. Remarks.

5. Metadata: Include the following information as keywords in the electronic submittal file metadata:
   a. Project name.
   b. Number and title of appropriate Specification Section.
   c. Manufacturer name.
   d. Product name.
6. Post electronic submittals in Adobe PDF format directly to Newforma Info Exchange at https://projects.corgan.com/.
7. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.

D. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
   1. If information must be specially prepared for submittal because standard published data are unsuitable for use, submit as Shop Drawings, not as Product Data.
   2. Mark each copy of each submittal to show which products and options are applicable.
   3. Include the following information, as applicable:
      a. Manufacturer's catalog cuts.
      b. Show performance characteristics and capacities.
      c. Show dimensions and clearances required.
      d. Manufacturer's technical data.
      e. Color charts.
      f. Statement of compliance with specified referenced standards.
      g. Testing and test results by recognized testing agency.
      h. Application of testing agency labels and seals.
      i. Notation of coordination requirements.
      j. Availability and delivery time information.
   4. For equipment, include the following in addition to the above, as applicable:
      a. Wiring diagrams that show factory installed wiring.
      b. Wiring or piping diagrams and controls.
      c. Printed performance curves.
      d. Operational range diagrams.
      e. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
   5. Manufacturer's Schematic Drawings and Diagrams: Modify drawings and diagrams to delete information that is not applicable.
      a. Supplement standard information to provide information applicable to work.
   6. Submit Product Data before Shop Drawings, and before or concurrent with Samples.

E. Shop Drawings: Prepare Project specific information, drawn accurately to scale, indicating materials (kind, thickness, and finish), dimensions, connections, and details necessary to ensure accurate interpretation of the Contract Documents including attachment to other work, in detail necessary.
   1. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.

2. Identify details by reference to sheet and detail, schedule or room numbers shown on Contract Drawings.
3. Consecutively number shop drawings for each portion of work. Retain numbering system throughout revisions.
4. Show detail, materials, dimensions, thickness, methods of assembly, attachments, relationship to adjoining work and pertinent data and information.
5. Verify dimensions and field conditions. Clearly indicate field dimensions and field conditions.
6. Verify and coordinate shop drawings for each specification section for each trade with requirements of related specifications and trades and as necessary for proper and complete installation of work.
7. Prepare composite shop drawings and installation layouts when necessary or requested to depict proposed solutions for field conditions. Coordinate in field and with affected subcontractors for proper relationship to work of other trades based on field conditions.
8. Preparation: Fully illustrate specified requirements. Include the following information, as applicable:
   a. Identification of products.
   b. Schedules.
   c. Compliance with specified standards.
   d. Notation of coordination requirements.
   e. Notation of dimensions established by field measurement.
   f. Relationship and attachment to adjoining construction clearly indicated.
   g. Seal and signature of professional engineer if specified.
9. Paper Sheet Size: Except for templates, patterns, and similar full size Drawings, submit Shop Drawings on sheets at least 8-1/2 inches by 11 inches (215 mm by 280 mm), but no larger than 30 inches by 42 inches (750 mm by 1067 mm).

F. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other materials.
   1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
   2. Identification: Permanently attach label on unexposed side of Samples that includes the following:
      a. Project name and submittal number.
      b. Generic description of Sample.
      c. Product name and name of manufacturer.
      d. Sample source.
      e. Number and title of applicable Specification Section.
      f. Specification paragraph number and generic name of each item.
   3. Web Based Project Software: Prepare submittals in PDF form, and upload to web based Project software website. Enter required data in web based software site to fully identify submittal.
   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.

5. Samples: Submit full size units or Samples of size indicated, prepared from same material to be used for the work, cured and finished as specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected.
    a. Samples include, but are not limited to, the following:
        1) Partial sections of manufactured or fabricated components.
        2) Small cuts or containers of materials.
        3) Complete units of repetitively used materials.
        4) Color swatches or color range sets showing color, texture, and pattern.
            a) Submit 4 inch by 4 inch (100 mm by 100 mm) sample chip.
        5) Components used for independent testing and inspection.
    b. Number of Samples: Submit four sets of Samples. Architect will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record Sample. Refer to Section 01 78 39 "Project Record Documents" for requirements for record document samples.
        1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and similar characteristics are 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.

G. Coordination Drawings: Comply with requirements specified in Section 01 31 00 "Project Management and Coordination" for preparation.
    1. Conduct coordination meetings with trades attending to coordinate work of trades for each mechanical or electrical area.
    2. Print Coordination Drawings using 1/4 inch (6 mm) minimum scale with congested areas and sections through shafts at 3/8 inch (4.5 mm) minimum scale.
    3. Coordinate with architectural ceiling plans exact location and dimensioning of items which occur within hung ceilings. In event of conflict, request clarification from Architect as to correct locations of items in question.
    4. Submit Coordination Drawings to Architect for review indicate conflicts that could not be resolved in coordination meeting. Submit total sleeving, piping, ductwork, lighting, sprinkler, and HVAC coordination drawings.
    5. After review by Architect, prepare shop drawings for each separate trade.
    6. Coordination drawings are for Architect's and Contractor's use during construction and shall not be construed as replacing shop drawings or Record Documents required by Contract Documents.

H. Product Schedule: Where required by the individual Specification Sections, prepare a written summary indicating types of products required for the work and their intended location. Include the following information in tabular form:
    1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
    2. Manufacturer and product name, and model number if applicable.
    3. Number and name of room or space.
    4. Location within room or space.

I. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

J. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.

K. Certificates:

1. Certificates and Certifications Submittals: Submit 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. Provide a notarized signature where indicated.
2. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
3. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
4. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
5. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
6. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

L. Test and Research Reports:

1. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
2. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
3. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
4. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
5. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by

a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

6. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
   a. Name of evaluation organization.
   b. Date of evaluation.
   c. Time when report is in effect.
   d. Product and manufacturers' names.
   e. Description of product.
   f. Test procedures and results.
   g. Limitations of use.

1.7 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 insufficient 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 digitally signed PDF file and three paper copies 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.

1.8 CONTRACTOR'S REVIEW

A. Review of submittals is for compliance with design concept of Project and compliance with information stated in Contract Documents.

1. Contractor is responsible for verifying and correlating dimensions, information that pertains solely to fabrication process or to techniques of construction, and coordination of work of trades. Architect’s acceptance of a submittal does not relieve the Contractor of its responsibility for deviation from requirements of Contract Documents.

B. Action Submittals and Informational Submittals: Review each submittal and verify 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.

C. Contractor's Action: Indicate Contractor's approval for 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.

1. Architect will not review submittals received from Contractor that do not have Contractor's review and approval or submittals rejected by Contractor.

1.9 ARCHITECT'S REVIEW

A. Architect's review of Submittals is for general design conformance and compliance with information provided in Contract Documents. Contractor is responsible for complying with requirements and characteristics of products and systems specified; dimensions and quantities to be confirmed and correlated at the Project site; and information that pertains solely to fabrication processes, installation techniques, and coordination of work required by other trades. Architect's review and indication of action to be taken shall not relieve Contractor of responsibility for deviation from requirements of Contract Documents.

B. Action Submittals: Architect will review each submittal, indicate corrections or revisions required, and return it. Architect will indicate, via markup on each submittal, the appropriate action as follows:

1. Final Unrestricted Release: When submittal is marked "No Exception Taken," that part of the work covered by the submittal may proceed provided it complies with requirements of the Contract Documents; final acceptance will depend upon that compliance.
2. Final But Restricted Release: When submittal is marked "Comments Included," that part of the Work covered by the submittal may proceed provided it complies with both the Architect's notations and comments on the submittal and requirements of the Contract Documents; final acceptance will depend upon that compliance.
3. Returned for Resubmittal: When submittal is marked "Revise and Submit," do not proceed with that part of the Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal in accordance with the Architects notations or corrections; resubmit without delay.
   a. Do not permit submittals marked "Revise and Submit" to be used at the Project site or elsewhere where construction is in progress.
4. Rejected: When submittal is marked "Rejected" do not proceed with that part of the work as submission is either incomplete, not coordinated, or does not conform to requirements of Contract Documents. Resubmission of the same submittal will not be considered. Prepare and submit new submittal meeting requirements of Contract Documents.
5. Not Reviewed: When submittal is marked "Not Reviewed. Submittal not required by Contract Documents" it has not been reviewed because the submittal was neither requested nor required by Contract Documents.
6. Close Out Submittal: When submittal is marked "Reviewed for Project Close Out Requirements Only" it has been reviewed only for compliance with close out submission requirements. It has not been reviewed for accuracy or completeness. Burden of accuracy and completeness rests with the Contractor.
7. Substitution Request: When a submittal is marked "Proposed Substitution. Resubmit. Comply with Section 01 25 00 "Substitution Procedures," submission does not comply with requirements of Contract Documents. Contractor may elect

to resubmit under the provisions, conditions, and procedures outlined in Section 01 25 00 "Substitution Procedures" or prepare and submit new submittal meeting requirements of Contract Documents.

C. Informational Submittals: Architect will review each submittal and will not return it or will return it if it does not comply with requirements.

D. Partial Submittals prepared for a portion of the Work will be reviewed when use of partial Submittals has received prior approval from Architect.

E. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

F. Architect will return without review submittals received from sources other than Contractor.

G. Submittals not required by the Contract Documents will be returned by Architect without action.

PART 2 - PRODUCTS
Not used.

PART 3 - EXECUTION
Not used.

END OF SECTION

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SECTION 01 35 16

ALTERATION PROJECT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Special procedures for alteration work.

1.2 DEFINITIONS

A. Alteration Work: This term includes remodeling, renovation, repair, and maintenance work performed within existing spaces or on existing surfaces as part of the Project.

B. Consolidate: To strengthen loose or deteriorated materials in place.

C. Design Reference Sample: A sample that represents the Architect's prebid selection of work to be matched; it may be existing work or work specially produced for the Project.

D. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

E. Match: To blend with adjacent construction and manifest no apparent difference in material type, species, cut, form, detail, color, grain, texture, or finish; as approved by Architect.

F. Refinish: To remove existing finishes to base material and apply new finish to match original, or as otherwise indicated.

G. Repair: To correct damage and defects, retaining existing materials, features, and finishes. This includes patching, piecing-in, splicing, consolidating, or otherwise reinforcing or upgrading materials.

H. Replace: To remove, duplicate, and reinstall entire item with new material. The original item is the pattern for creating duplicates unless otherwise indicated.

I. Replicate: To reproduce in exact detail, materials, and finish unless otherwise indicated.

J. Reproduce: To fabricate a new item, accurate in detail to the original, and from either the same or a similar material as the original, unless otherwise indicated.

K. Retain: To keep existing items that are not to be removed or dismantled.

L. Strip: To remove existing finish down to base material unless otherwise indicated.

1.3 COORDINATION

A. Alteration Work Subschedule: A construction schedule coordinating the sequencing and scheduling of alteration work for entire Project, including each activity to be performed, and based on Contractor's Construction Schedule. Secure time commitments for performing critical construction activities from separate entities responsible for alteration work.

1. Schedule construction operations in sequence required to obtain best Work results.
2. Coordinate sequence of alteration work activities to accommodate the following:
   a. Owner's continuing occupancy of portions of existing building.
   b. Owner's partial occupancy of completed work.
   c. Other known work in progress.
   d. Tests and inspections.
3. Detail sequence of alteration work, with start and end dates.
4. Utility Services: Indicate how long utility services will be interrupted. Coordinate shutoff, capping, and continuation of utility services.
5. Use of elevator and stairs.
6. Equipment Data: List gross loaded weight, axle-load distribution, and wheel-base dimension data for mobile and heavy equipment proposed for use in existing structure. Do not use such equipment without certification from Contractor's professional engineer that the structure can support the imposed loadings without damage.

B. Pedestrian and Vehicular Circulation: Coordinate alteration work with circulation patterns within Project building(s) and site. Some work is near circulation patterns. Circulation patterns cannot be closed off entirely and in places can be only temporarily redirected around small areas of work. Plan and execute the work accordingly.

1.4 PROJECT MEETINGS FOR ALTERATION WORK

A. Preliminary Conference for Alteration Work: Before starting alteration work, conduct conference at project site.

1. Attendees: In addition to representatives of Owner, Architect, and Contractor, testing service representative, specialists, and chemical cleaner manufacturer(s) shall be represented at the meeting.
2. Agenda: Discuss items of significance that could affect progress of alteration work, including review of the following:
   a. Alteration Work Subschedule: Discuss and finalize; verify availability of materials, specialists' personnel, equipment, and facilities needed to make progress and avoid delays.
   b. Fire prevention plan.
   c. Governing regulations.
   d. Areas where existing construction is to remain and the required protection.
   e. Hauling routes.
   f. Sequence of alteration work operations.
   g. Storage, protection, and accounting for salvaged and specially fabricated items.

h. Existing conditions, staging, and structural loading limitations of areas where materials are stored.
i. Qualifications of personnel assigned to alteration work and assigned duties.
j. Requirements for extent and quality of work, tolerances, and required clearances.
k. Embedded work such as flashings and lintels, special details, collection of waste, protection of occupants and the public, and condition of other construction that affects the Work or will affect the work.

3. Reporting: Record conference results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from conference.

B. Coordination Meetings: Conduct coordination meetings specifically for alteration work at monthly intervals. Coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.

1. Attendees: In addition to representatives of Owner, Architect, and Contractor, each specialist, supplier, installer, and other entity concerned with progress or involved in planning, coordination, or performance of alteration work activities shall be represented at these meetings. All participants at conference shall be familiar with Project and authorized to conclude matters relating to alteration work.
2. Agenda: Review and correct or approve minutes of previous coordination meeting. Review other items of significance that could affect progress of alteration work. Include topics for discussion as appropriate to status of Project.
   a. Alteration Work Subschedule: Review progress since last coordination meeting. Determine whether each schedule item is on time, ahead of schedule, or behind schedule. Determine how construction behind schedule will be expedited with retention of quality; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities are completed within the Contract Time.
   b. Schedule Updating: Revise Contractor's Alteration Work Subschedule after each coordination meeting where revisions to schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
   c. Review present and future needs of each entity present, including review items listed in the "Preliminary Conference for Alteration Work" Paragraph in this article and the following:
      1) Interface requirements of alteration work with Project Work.
      2) Status of submittals for alteration work.
      3) Access to alteration work locations.
      4) Effectiveness of fire prevention plan.
      5) Quality and work standards of alteration work.
      6) Change Orders for alteration work.
3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

1.5 INFORMATIONAL SUBMITTALS

A. Alteration Work Subschedule:

1. Submit alteration work subschedule within 30 days of date established for commencement of alteration work.

B. Preconstruction Documentation: Show preexisting conditions of adjoining construction and site improvements that are to remain, including finish surfaces, that might be misconstrued as damage caused by Contractor's alteration work operations.

C. Alteration Work Program: Submit 30 days before work begins.

D. Fire-Prevention Plan: Submit 30 days before work begins.

1.6 QUALITY ASSURANCE

A. Title X Requirement: Each firm conducting activities that disturb painted surfaces shall be a "Lead-Safe Certified Firm" according to 40 CFR 745, Subpart E, and use only workers that are trained in lead safe work practices.

B. Alteration Work Program: Prepare a written plan for alteration work for whole Project, including each phase or process and protection of surrounding materials during operations. Show compliance with indicated methods and procedures specified in this and other Sections. Coordinate whole Project alteration work program with specific requirements of programs required in other alteration work.

1. Dust and Noise Control: Include locations of proposed temporary dust and noise control partitions and means of egress from occupied areas coordinated with continuing on site operations and other known work in progress.
2. Debris Hauling: Include plans clearly marked to show debris hauling routes, turning radii, and locations and details of temporary protective barriers.

C. Fire Prevention Plan: Prepare a written plan for preventing fires during the work, including placement of fire extinguishers, fire blankets, rag buckets, and other fire control devices during each phase or process. Coordinate plan with Owner's fire protection equipment and requirements. Include fire watch personnel's training, duties, and authority to enforce fire safety.

D. Safety and Health Standard: Comply with ANSI/ASSE A10.6.

1.7 STORAGE AND HANDLING OF SALVAGED MATERIALS

A. Salvaged Materials:

1. Clean loose dirt and debris from salvaged items unless more extensive cleaning is indicated.
2. Pack or crate items after cleaning; cushion against damage during handling. Label contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner.
5. Protect items from damage during transport and storage.

B. Salvaged Materials for Reinstallation:

1. Repair and clean items for reuse as indicated.
2. Pack or crate items after cleaning and repairing; cushion against damage during handling. Label contents of containers.
3. Protect items from damage during transport and storage.

4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment unless otherwise indicated. Provide connections, supports, and miscellaneous materials to make items functional for use indicated.

C. Existing Materials to Remain: Protect construction indicated to remain against damage and soiling from construction work. Where permitted by Architect, items may be dismantled and taken to a suitable, protected storage location during construction work and reinstalled in their original locations after alteration and other construction work in the vicinity is complete.

D. Storage: Catalog and store items within a weathertight enclosure where they are protected from moisture, weather, condensation, and freezing temperatures.
1. Identify each item for reinstallation with a nonpermanent mark to document its original location. Indicate original locations on plans, elevations, sections, or photographs by annotating the identifying marks.
2. Secure stored materials to protect from theft.
3. Control humidity so that it does not exceed 85 percent. Maintain temperatures 5 degrees F (3 degrees C) or more above the dew point.

1.8 FIELD CONDITIONS

A. Survey of Existing Conditions: Record existing conditions that affect the work by use of measured drawings and preconstruction photographs.
1. Comply with requirements specified in Section 01 32 33 "Photographic Documentation."

B. Discrepancies: Notify Architect of discrepancies between existing conditions and Drawings before proceeding with removal and dismantling work.

C. Size Limitations in Existing Spaces: Materials, products, and equipment used for performing the Work and for transporting debris, materials, and products shall be of sizes that clear surfaces within existing spaces, areas, rooms, and openings, including temporary protection, by 12 inches (300 mm) or more.

PART 2 - PRODUCTS
Not used.

PART 3 - EXECUTION

3.1 PROTECTION

A. Protect persons, motor vehicles, surrounding surfaces of building, building site, plants, and surrounding buildings from harm resulting from alteration work.
1. Use proven protection methods, appropriate to each area and surface being protected.
2. Provide temporary barricades, barriers, and directional signage to exclude the public from areas where alteration work is being performed.
3. Erect temporary barriers to form and maintain fire egress routes.

4. Erect temporary protective covers over walkways and at points of pedestrian and vehicular entrance and exit that must remain in service during alteration work.
5. Contain dust and debris generated by alteration work and prevent it from reaching the public or adjacent surfaces.
6. Provide shoring, bracing, and supports as necessary. Do not overload structural elements.
7. Protect floors and other surfaces along hauling routes from damage, wear, and staining.
8. Provide supplemental sound-control treatment to isolate demolition work from other areas of the building.

B. Temporary Protection of Materials to Remain:
1. Protect existing materials with temporary protections and construction. Do not remove existing materials unless otherwise indicated.
2. Do not attach temporary protection to existing surfaces except as indicated as part of the alteration work program.

C. Comply with each product manufacturer's written instructions for protections and precautions. Protect against adverse effects of products and procedures on people and adjacent materials, components, and vegetation.

D. Utility and Communications Services:
1. Notify Owner, Architect, authorities having jurisdiction, and entities owning or controlling wires, conduits, pipes, and other services affected by alteration work before commencing operations.
2. Disconnect and cap pipes and services as required by authorities having jurisdiction, as required for alteration work.
3. Maintain existing services unless otherwise indicated; keep in service and protect against damage during operations. Provide temporary services during interruptions to existing utilities.

E. Existing Drains: Prior to the start of work in an area, test drainage system to ensure that it is functioning properly. Notify Architect immediately of inadequate drainage or blockage. Do not begin work in an area until the drainage system is functioning properly.
1. Prevent solids such as adhesive or mortar residue or other debris from entering the drainage system. Clean out drains and drain lines that become sluggish or blocked by sand or other materials resulting from alteration work.
2. Protect drains from pollutants. Block drains or filter out sediments, allowing only clean water to pass.

3.2 PROTECTION FROM FIRE

A. Follow fire prevention plan and the following:
1. Comply with NFPA 241 requirements unless otherwise indicated. Perform duties titled Owner's Responsibility for Fire Protection.

2. Remove and keep area free of combustibles, including rubbish, paper, waste, and chemicals, unless necessary for the immediate work.
    a. If combustible material cannot be removed, provide fire blankets to cover such materials.

B. Heat Generating Equipment and Combustible Materials: Comply with the following procedures while performing work with heat generating equipment or combustible materials, including welding, torch cutting, soldering, brazing, removing paint with heat, or other operations where open flames or implements using high heat or combustible solvents and chemicals are anticipated:
    1. Obtain Owner's approval for operations involving use of welding or other high heat equipment. Use of open flame equipment is not permitted. Notify Owner at least 72 hours before each occurrence, indicating location of such work.
    2. As far as practicable, restrict heat generating equipment to shop areas or outside the building.
    3. Do not perform work with heat generating equipment in or near rooms or in areas where flammable liquids or explosive vapors are present or thought to be present. Use a combustible gas indicator test to ensure that the area is safe.
    4. Use fireproof baffles to prevent flames, sparks, hot gases, or other high-temperature material from reaching surrounding combustible material.
    5. Prevent the spread of sparks and particles of hot metal through open windows, doors, holes, and cracks in floors, walls, ceilings, roofs, and other openings.
    6. Fire Watch: Before working with heat generating equipment or combustible materials, station personnel to serve as a fire watch at each location where such work is performed. Fire-watch personnel shall have the authority to enforce fire safety. Station fire watch according to NFPA 51B, NFPA 241, and as follows:
        a. Train each fire watch in the proper operation of fire control equipment and alarms.
        b. Prohibit fire watch personnel from other work that would be a distraction from fire watch duties.
        c. Cease work with heat generating equipment whenever fire watch personnel are not present.
        d. Have fire watch personnel perform final fire safety inspection each day beginning no sooner than 30 minutes after conclusion of work in each area to detect hidden or smoldering fires and to ensure that proper fire prevention is maintained.

C. Fire Control Devices: Provide and maintain fire extinguishers, fire blankets, and rag buckets for disposal of rags with combustible liquids. Maintain each as suitable for the type of fire risk in each work area. Ensure that nearby personnel and the fire-watch personnel are trained in fire-extinguisher and blanket use.

D. Sprinklers: Where sprinkler protection exists and is functional, maintain it without interruption while operations are being performed. If operations are performed close to sprinklers, shield them temporarily with guards.
    1. Remove temporary guards at the end of work shifts, whenever operations are paused, and when nearby work is complete.

3.3 PROTECTION DURING APPLICATION OF CHEMICALS

A. Protect motor vehicles, surrounding surfaces of building, building site, plants, and surrounding buildings from harm or spillage resulting from applications of chemicals and adhesives.

B. Cover adjacent surfaces with protective materials that are proven to resist chemicals selected for Project unless chemicals being used will not damage adjacent surfaces as indicated in alteration work program. Use covering materials and masking agents that are waterproof and UV resistant and that will not stain or leave residue on surfaces to which they are applied. Apply protective materials according to manufacturer's written instructions. Do not apply liquid masking agents or adhesives to painted or porous surfaces. When no longer needed, promptly remove protective materials.

C. Do not apply chemicals during winds of sufficient force to spread them to unprotected surfaces.

D. Neutralize alkaline and acid wastes and legally dispose of off Owner's property.

E. Collect and dispose of runoff from chemical operations by legal means and in a manner that prevents soil contamination, soil erosion, undermining of paving and foundations, damage to landscaping, or water penetration into building interior.

3.4 GENERAL ALTERATION WORK

A. Have specialty work performed only by qualified specialists.

B. Ensure that supervisory personnel are present when work begins and during its progress.

C. Record existing work before each procedure (preconstruction), and record progress during the work. Use digital preconstruction documentation photographs. Comply with requirements in Section 01 32 33 "Photographic Documentation."

D. Perform surveys of Project site as the work progresses to detect hazards resulting from alterations.

E. Notify Architect of visible changes in the integrity of material or components whether from environmental causes including biological attack, UV degradation, freezing, or thawing or from structural defects including cracks, movement, or distortion.

1. Do not proceed with the work in question until directed by Architect.

END OF SECTION

SECTION 01 40 00

QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspection services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specific quality assurance and quality control requirements for individual work results are specified in their respective Specification Sections. Requirements in individual Sections may also cover production of standard products.
2. Specified tests, inspections, and related actions do not limit Contractor's other quality assurance and quality control procedures that facilitate compliance with the Contract Document requirements.
3. Requirements for Contractor to provide quality assurance and quality control services required by Architect, Owner, or authorities having jurisdiction are not limited by quality provisions.
4. Specific test and inspection requirements are not specified in this Section.

1.2 DEFINITIONS

A. Experienced: When used with an entity or individual, unless otherwise noted, experienced is defined as having a minimum of five years documented experience in work similar in nature, size, and extent to this project; familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

B. Field Quality Control Tests: Tests and inspections that are performed on site for installation of the work and for completed work.

C. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a specialized construction operation, including installation, erection, application, assembly, and similar operations.

1. Use of trade specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).

D. Mockups: Full size physical assemblies that are constructed onsite either as freestanding temporary built elements or as part of permanent construction. Mockups are constructed to verify selections; to demonstrate aesthetic effects and qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation

tolerances. Mockups are not samples. Unless otherwise indicated, approved mockups establish the standard by which the work will be judged.

1. Laboratory Mockups: Full size physical assemblies constructed and tested at testing facility to verify performance characteristics.
2. Room Mockups: Mockups of typical interior spaces complete with wall, floor, and ceiling finishes; doors; windows; millwork; casework; specialties; furnishings and equipment; and lighting.

E. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the work, to verify performance or compliance with specified criteria.

F. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) according to 29 CFR 1910.7, by a testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program (NVLAP), or by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

G. Source Quality Control Tests: Tests and inspections performed at the source; for example, plant, mill, factory, or shop.

H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

I. Quality Assurance Services: Activities, actions, and procedures performed before and during execution of the work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

J. Quality Control Services: Tests, inspections, procedures, and related actions during and after execution of the work to evaluate that actual products incorporated into the work and completed construction comply with requirements. Contractor's quality control services do not include contract administration activities performed by Architect.

1.3 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.

1.4 CONFLICTING REQUIREMENTS

A. Conflicting Standards and Other Requirements: If compliance with two or more standards or requirements are specified and the standards or requirements establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for direction before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.5 ACTION SUBMITTALS

A. Shop Drawings: For laboratory mockups.
   1. Include plans, sections, and elevations, indicating materials and size of mockup construction.
   2. Indicate manufacturer and model number of individual components.
   3. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

B. Delegated Design Services Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit a statement 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, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

1.6 INFORMATIONAL SUBMITTALS

A. Contractor's Quality Control Plan: Submit plan for quality assurance and quality control activities and responsibilities.
   1. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.

B. Qualification Data: Submit data for Contractor's quality control personnel.

C. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility submitted to authorities having jurisdiction before starting work on the following systems:
   1. Seismic force resisting system, designated seismic system, or component listed in the Statement of Special Inspections.
   2. Main wind force resisting system or a wind-resisting component listed in the Statement of Special Inspections.

D. Testing Agency Qualifications: Testing agencies who have demonstrated their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

E. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
   1. Specification Section number and title.
   2. Entity responsible for performing tests and inspections.
   3. Description of test and inspection.
   4. Identification of applicable standards.

5. Identification of test and inspection methods.
6. Number of tests and inspections required.
7. Time schedule or time span for tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

F. Reports: Prepare and submit certified written reports and documents as specified.

G. Permits, Licenses, and Certificates: For Owner's record, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents established for compliance with standards and regulations bearing on performance of the work.

1.7 QUALITY CONTROL PLAN

A. Quality Control Plan: Submit quality control plan within 10 days of Notice to Proceed, and not less than five days prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality assurance and quality control responsibilities. Coordinate with Contractor's Construction Schedule.

B. Quality Control Personnel Qualifications: Engage qualified personnel trained and experienced in managing and executing quality assurance and quality control procedures similar in nature and extent to those required.
1. Project quality control manager may serve as Project superintendent.

C. Testing and Inspection: In quality control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:
1. Contractor performed tests and inspections including Subcontractor performed tests and inspections. Include required tests and inspections and Contractor elected tests and inspections. Distinguish source quality control tests and inspections from field quality control tests and inspections.
2. Special inspections required by authorities having jurisdiction and indicated on the Statement of Special Inspections.
3. Owner performed tests and inspections indicated in the Contract Documents.

D. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring work into compliance with standards of workmanship established by Contract requirements and approved mockups.

E. Monitoring and Documentation: Maintain testing and inspection reports including log of approved and rejected results. Include work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.8 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
   1. Date of issue.
   2. Project title and number.
   3. Name, address, telephone number, and email address of testing agency.
   4. Dates and locations of samples and tests or inspections.
   5. Names of individuals making tests and inspections.
   6. Description of the work and test and inspection method.
   7. Identification of product and Specification Section.
   8. Complete test or inspection data.
   9. Test and inspection results and an interpretation of test results.
   10. Record of temperature and weather conditions at time of sample taking and testing and inspection.
   11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
   12. Name and signature of laboratory inspector.
   13. Recommendations on retesting and reinspecting.

B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
   1. Name, address, telephone number, and email address of technical representative making report.
   2. Statement on condition of substrates and their acceptability for installation of product.
   3. Statement that products at Project site comply with requirements.
   4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
   5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
   6. Statement whether conditions, products, and installation will affect warranty.
   7. Other required items indicated in individual Specification Sections.

C. Factory Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory authorized service representative's tests and inspections specified. Include the following:
   1. Name, address, telephone number, and email address of factory authorized service representative making report.
   2. Statement that equipment complies with requirements.
   3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
   4. Statement whether conditions, products, and installation will affect warranty.
   5. Other required items indicated in individual Specification Sections.

1.9 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm having a minimum of 5 years documented experience in manufacturing products or systems similar to those indicated, as well as sufficient production capacity to produce required units. As applicable, procure products from manufacturers able to meet qualification requirements, warranty requirements, and technical or factory authorized service representative requirements.

B. Fabricator Qualifications: A firm having minimum 5 years documented experience in producing products similar to those indicated, a record of successful in-service performance, as well as sufficient production capacity to produce required units.

C. Installer Qualifications: A firm or individual having minimum 5 years documented experienced in installing, erecting, applying, or assembling work similar in material, design, and extent to that indicated, whose work has resulted in construction with a record of successful in-service performance.

D. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated.

E. Specialists: Certain Specification Sections require that specific construction activities are performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and be engaged for the activities indicated.

1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.

F. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspection indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.

G. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

H. Factory Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

I. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:

1. Contractor responsibilities include the following:
    a. Provide test specimens representative of proposed products and construction.

b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the work.
c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
d. Build site assembled test assemblies and mockups using installers who will perform same tasks for Project.
e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed work.
f. When testing is complete, remove test specimens and test assemblies, and mockups; do not reuse products on Project.

2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality assurance service to Architect, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

J. Mockups: Before installing portions of the work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed work:

1. Build mockups in location and of size indicated or as directed by Architect.
2. Notify Architect a minimum of seven days in advance of dates and times when mockups will be constructed.
3. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed to perform same tasks during the construction at Project.
4. Demonstrate the proposed range of aesthetic effects and workmanship.
5. Obtain Architect's approval of mockups before starting corresponding work, fabrication, or construction.
   a. Allow seven days for initial review and each re-review of each mockup.
6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed work.
7. Demolish and remove mockups when directed unless otherwise indicated.

K. Laboratory Mockups: Comply with requirements of preconstruction testing and those specified in individual Specification Sections.

1.10 QUALITY CONTROL

A. Owner Responsibilities: Where quality control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.

1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspection they are engaged to perform.
2. Payment for these services will be made from testing and inspection allowances, as authorized by Change Orders.
3. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.

B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality control activities, regardless if specified, to verify and document that the complies with requirements.

1. Unless otherwise indicated, provide quality control services specified and those required by authorities having jurisdiction. Perform quality control services required of Contractor by authorities having jurisdiction, regardless if specified.
2. Engage a qualified testing agency to perform quality-control services.
   a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
3. Notify testing agencies at least 24 hours in advance of time when work that requires testing or inspection will be performed.
4. Where quality control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
5. Testing and inspection requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality control services, including retesting and reinspecting, for construction that replaced work that failed to comply with the Contract Documents.

D. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the work during performance of its services.
2. Determine the locations from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality control service through Contractor.
5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the work.
6. Do not perform duties of Contractor.

E. Manufacturer's Field Services: Where indicated, engage a factory authorized service representative to inspect field assembled components and equipment installation, including service connections. Report results in writing as specified in Section 01 33 00 "Submittal Procedures."

F. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of

Installer activities, inspection of completed portions of the work, and submittal of written reports.

G. Associated Contractor Services: Cooperate with agencies and representatives performing required tests, inspections, and similar quality control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
   1. Access to the work.
   2. Incidental labor and facilities necessary to facilitate tests and inspections.
   3. Adequate quantities of representative samples of materials that require testing and inspection. Assist agency in obtaining samples.
   4. Facilities for storage and field curing of test samples.
   5. Delivery of samples to testing agencies.
   6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
   7. Security and protection for samples and for testing and inspection equipment at Project site.

H. Coordination: Coordinate sequence of activities to accommodate required quality assurance and quality control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspection.
   1. Schedule times for tests, inspections, obtaining samples, and similar activities.

I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality control services required by the Contract Documents as a component of Contractor's quality control plan. Coordinate and submit concurrently with Contractor's Construction Schedule. Update as the work progresses.
   1. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.11 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Owner will engage a qualified special inspector to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner and as follows:
   1. Verifying that manufacturer maintains detailed fabrication and quality control procedures and reviewing the completeness and adequacy of those procedures to perform the work.
   2. Notifying Architect, and Contractor promptly of irregularities and deficiencies observed in the work during performance of its services.
   3. Submitting a certified written report of each test, inspection, and similar quality control service to Architect with copy to Contractor and to authorities having jurisdiction.
   4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
   5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.

6. Retesting and reinspecting corrected work.

B. Special Tests and Inspections: Conducted by a qualified special inspector as required by authorities having jurisdiction, as indicated in individual Specification Sections, and as follows:
   1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviewing the completeness and adequacy of those procedures to perform the Work.
   2. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
   3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction.
   4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
   5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
   6. Retesting and reinspecting corrected work.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
   1. Date test or inspection was conducted.
   2. Description of the work tested or inspected.
   3. Date test or inspection results were transmitted to Architect.
   4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.
   1. Submit log at Project closeout as part of Project Record Documents.

3.2 REPAIR AND PROTECTION

A. On completion of testing, inspection, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
   1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 01 73 00 "Execution."

B. Protect construction exposed by or for quality control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality control services.

3.3 SCHEDULE OF SPECIAL INSPECTIONS

A. Testing of Earthwork:
1. Testing Services (As specified or required):
a. References (Applicable for tests required):
1) American Society for Testing and Materials (ASTM)
a) D698, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft3 (600 kN-m/m3)
b) D2922, Standard Test Method for Density of Soil and Soil-Aggregate In Place By Nuclear Methods (Shallow Depth)
c) D4318, Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
2) American Association of State Highway and Transportation Officials (AASHTO)
a) T89, Determining the Liquid Limit of Soils
b) T90, Determining the Plastic Limit and Plasticity Index of Soils
c) T99, Moisture Density Relations of Soils Using a 2.5 kg (5.5 lb) Rammer and a 305-mm (12-in) Drop
d) T238, Density of Soil and Soil Aggregates in Place By Nuclear Methods (Shallow Depth)
b. Perform sieve analysis to develop grain size distribution curves for materials to be used for subgrade, fill under slab on grade, and backfills.
c. Establish the moisture density relation of soils to be used as fill using the method best suited to the type of fill material.
d. Determine moisture content of all fill materials before placement and advise Contractor when it is or is not suitable to achieve required compaction.
e. Determine Liquid Limit in accordance with ASTM D4318 or AASHTO T89, Plastic Limit in accordance with ASTM D4318, and Plasticity Index in accordance with ASTM D4318 of all fill material,
f. Perform one (1) in place density test for each 2,500 square feet (280 square yards) of existing subgrade material.
g. Perform Moisture Density curve in accordance with ASTM D698 or AASHTO T99 for one (1) type of fill material. If the original choice of material does not meet the specifications, the Contractor shall pay for additional testing.
h. Perform in place density tests of each lift of compacted fill at locations adequate to evaluate the degree of compaction of all fill areas. Conduct one (1) test for each 2,500 square feet (280 square yards) of each lift of compacted fill.
i. Perform testing at a frequency of one in-place density and moisture test for each 75 lineal feet or less of utility trench, with a minimum of three tests per lift.
2. Reports: Submit reports with the following information:
a. Type and condition of soil at footing bottoms.
b. Level of water table in the excavated areas.
c. Grain size distribution of fill materials (average of three (3) tests).

d. Moisture density test results.
e. In place density test results with moisture content and relative density of each layer of compacted fill. Include within place density test results, a plan showing location of each test.
f. Notify Architect by telephone within one hour of the discovery of the following conditions and follow up telephone notification with written report.
    1) Materials used, or degree of soil compaction not meeting specified requirements.
    2) Frost and freeze protection requirements for excavation bottoms not being complied with.
        a) Water in excavations which is not being removed prior to work being performed in excavation.

B. Inspection of Piped Site Utilities:
1. Laboratory representative shall observe and report on the following:
    a. Proper alignment and grade of trenches.
    b. Pipe bedding and supports.
    c. Pipe, joints, jointing material, and thrust blocks prior to installation of pipe.
    d. Installation of pipe and joints.
    e. Testing of piped utilities performed by Contractor.

C. Paving:
1. Testing Services: Perform field tests for moisture density properties:
    a. Provide field testing of the subgrade as specified.
    b. Paving Subbase: Provide one field test for every 5,000 square feet of area of crushed limestone or caliche subbase.
    c. Lime Treated Subgrade: Provide one field test for every 5,000 square feet of area of lime treated subgrade for content of lime and subgrade compaction.
    d. Cement Soil Stabilization: Provide one field test for every 5,000 square feet of area of cement stabilized subgrade for content of cement and subgrade compaction.

D. Pier Drilling Operation: Services shall be performed by a representative of a qualified geotechnical laboratory.
1. Laboratory representative shall make continuous inspections to determine that proper bearing stratum is obtained and utilized for bearing and that shafts are properly clean and dry before placing concrete.
2. Laboratory shall furnish complete pier log showing the diameter, top and bottom elevations of each pier, casing required or not required, actual penetration into bearing stratum, elevation of top of bearing stratum, volume of concrete used, and deviations from specified tolerances.
3. Laboratory representative shall make continuous inspections of drilled pier construction to check the following:
    a. Verify soundness of bearing stratum and desired penetration.
    b. Verify pier dimensions and reinforcing used.
    c. Monitor condition of hole and removal of water and loose material from bottom.
    d. Monitor placement of concrete and use of tremie or pumps.
    e. Monitor the extraction of casing, if used.

4. Request probe holes when deemed necessary to confirm safe bearing capacity.

E. Concrete Reinforcing Steel and Embedded Metal Assemblies:
   1. Inspect concrete reinforcing steel prior to placing concrete for compliance with Contract Documents and approved shop drawings. Noncompliance with Contract Documents and approved shop drawings shall be immediately brought to the attention of the Contractor for correction and, if left uncorrected, reported to the Architect.
   2. Laboratory representative shall observe and report on the following:
      a. Number and size of bars.
      b. Bending and lengths of bars.
      c. Splicing.
      d. Clearance to forms, including chair heights.
      e. Clearance to sides and bottom of trench if soil formed.
      f. Clearance between bars or spacing.
      g. Rust, form oil, and other contamination.
      h. Grade of steel.
      i. Securing, tying, and chairing of bars.
      j. Excessive congestion of reinforcing steel.
      k. Installation of anchor bolts and placement of concrete around such bolts.
      l. Fabrication and installation of embedded metal assemblies, including visual inspection of all welds.
      m. Visually inspect studs and deformed bar anchors on embedded assemblies for compliance with Contract Documents. Check number, spacing and weld quality. If, after welding, visual inspection reveals that a sound weld or a full 360 degree fillet has not been obtained for a particular stud or bar, such stud or bar shall be struck with a hammer and bent 15 degrees off perpendicular and then bent back into position. Anchors failing this test shall be replaced.
   3. Provide a qualified, experienced inspector to inspect reinforcing steel. Inspector shall have a minimum of three years' experience inspecting reinforcing steel in projects of similar size.

F. Concrete Inspecting and Testing: Receive and evaluate proposed concrete mix designs submitted by Contractor. If mix designs comply with Drawings and Specifications, the laboratory shall submit a letter to the Architect certifying compliance. Mix designs not complying with Drawings and Specifications shall be returned by the laboratory as being unacceptable. Check the proposed mixes for proportions, water cement ratio and slump in accordance with ACI 613 and 318.
   1. Comply with ACI 311 Guide for Concrete Inspection and ACI Manual of Concrete Inspection (SP-2).
   2. Sample and test concrete placed at the site in accordance with ASTM C172. Each sample shall be obtained from a different batch of concrete on a random basis.
   3. Test concrete:
      a. Mold and cure five specimens from each sample.
         1) For each 50 cubic yards or fraction thereof of structural building concrete; and
         2) For each 100 cubic yards or fraction thereof of nonstructural concrete and site work paving and sidewalks.
         3) Laboratory cure two cylinders in accordance with ASTM C192.

4) Field cure remaining cylinders in accordance with ASTM C31.

b. Two specimens shall be tested at seven days for information, two shall be tested at 28 days for acceptance.

c. Store one cylinder for testing at 56 days in the event the 28 days strength tests do not meet strength requirements.

4. Deviations from the requirements of ASTM Specifications shall be recorded in the test report. Test concrete specimens in accordance with ASTM C39.

5. Specimens for pumped concrete shall be taken at the discharge end of pumping equipment.

6. Supervise curing and protection provided for test specimens in field, and transportation from the field to laboratory. Test cylinders shall be stored in the field 24 hours and then carefully transported to laboratory and cured in accordance with ASTM C31.

7. Make one strength test (four cylinders) of each mix design of concrete placed in any one day.

8. Make one slump test for each set of cylinders following procedural requirements of ASTM C143 and ASTM C172. 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. Determine total air content of air entrained normal weight concrete sample for each strength test in accordance with ASTM C231.

10. Determine air content and unit weight of lightweight concrete sample for each strength test in accordance with ASTM C173 and ASTM C567.

11. Determine temperature of concrete sample for each strength test.

12. Inspect each batch of concrete, monitor addition of mixing water to assure uniform consistency from truck to truck. Check mixing form mixers before mix begins to set and within time limits set forth in ASTM C94.

    a. Monitor addition of water and high range water reducer to concrete at job site and length of time concrete is allowed to remain in truck during placement.

13. Testing agency shall furnish and maintain a competent inspector at the mixing plant at the start of each day’s mixing. Inspector shall examine concrete materials for compliance with Specifications and approved mix design, weighing and measuring devices, proportioning, and mixing of materials, water and cement content of each batch, general operation of the plant, and transportation of concrete to jobsite. Inspector shall verify that amount of free surface moisture contained in fine and course aggregate has been properly accounted for in the concrete mixing to achieve required consistency and water cement ratio.

14. Testing laboratory shall monitor addition of water to concrete at the jobsite and the length of time concrete remains in the truck before placement. Inspector shall compare mixture with criteria on the approved mix design and report any significant deviation to the Architect, Contractor, and concrete supplier. Do not permit addition of water which will exceed maximum water/cement ratio for the mix as given on the approved mix design.

15. Observe placing of concrete, except nonstructural slabs on grade and site work. Observe and report on placing method, consolidation, cold joints, length of drop, and displacement of reinforcement. Report deficiencies to Contractor immediately

for corrective action. Inspections may be reduced to a periodic basis when all procedures have been deemed satisfactory by the laboratory.

16. Test reports shall include but no be limited to the following information: date of concrete placement, concrete mix identification number or proportion of ingredients, truck ticket number, time test was made, time of batching, location of each placement, slump, unit weight, water content (microwave test) and air content of concrete sampled and date and results of strength test.
17. Report promptly to Architect all details of reasons for rejection of any and all quantities of concrete. Give all information concerning locations of the concrete pours, quantities, date of pours, and other pertinent facts concerning concrete represented by the specimens.
18. Testing laboratory shall certify each delivery ticket indicating class of concrete delivered (or placed), amount of water added and time at which cement and aggregate were dispensed into the truck, and time at which concrete was discharged from the truck.
19. Evaluation and Acceptance:
    a. If measured slump, or air content of air entrained concrete, falls outside specified limits, a check test shall be made immediately on another portion of the same sample. In the event of a second failure, concrete shall be considered to have failed to meet the requirements of the specifications and shall not be used in the structure.
    b. Strength level of concrete will be considered satisfactory if the averages of sets of three consecutive strength tests results are equal to, or exceed, specified strength and no individual test result (average of two cylinders) is below specified strength by more than 500 psi.
    c. Completed concrete work will be accepted when requirements of ACI 301 Chapter 18 Specifications for Structural Concrete for Buildings have been met.
20. Concrete Test Reports: Reports shall be made and distributed immediately after respective tests or inspections are made.
    a. Where reports indicate deviations from Contract Documents, they shall also include a determination of the probable cause of deviation and where applicable, a recommendation for corrective action.
21. Furnish a statistical analysis for each class of concrete placed on the project in accordance with ACI 214 and ACI 318. Information shall be updated and distributed once a month as directed by the Architect. Information shall include, but not be limited to, the following:
    a. Strength tests at seven days.
    b. Strength tests at 28 days of two cylinder averages.
    c. 28 day moving average strength tests of last three test groups.
    d. Standard deviation and coefficient of variation based on 28 day strength tests.
    e. Average strength and number of 28 days tests for most recent month.
    f. Strength test one cylinder at 56 days in the event the 28 days strength tests do not meet strength requirements.
22. 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.

23. 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.
24. 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.

G. Testing of Nonshrink Grout:
1. Make one strength test for all plates grouted and for all grout used in joints between members.
2. Each test shall consist of four cubes, two tested at 7 days and two at 28 days, made and tested in accordance with ASTM C109, with the exception that grout shall be restrained from expansion by a top plate.

H. Structural Steel: Inspect structural steel during and after erection for compliance with Contract Documents and shop drawings. Review and report on fabricator's quality control procedures and capabilities.
1. Field Inspection:
a. Proper erection of pieces.
b. Proper touch up painting of shop primed structural steel exposed to view or in crawl space.
c. Proper installation of bolts.
d. Plumbness of structure and proper bracing.
e. Proper field painting.
f. Initial inspection of welding process and periodically thereafter as necessary.
g. Visual examination of completed welds.
h. Ultrasonic testing of penetration field welds.
i. Installation of field welded shear studs.
j. Inspect shop fabricated members, upon arrival at the site, for defects incurred during transit and handling.
k. Measure and record camber of beams upon arrival and before erection for compliance with specified camber. Measure lying flat with web horizontal. Return members outside specified camber tolerance to shop for correction.
2. Qualifications of Welders: Fabricator and erector shall provide the testing laboratory with names of welders employed on work, along with certification that each welder has passed qualification tests within the past 12 months, using procedures covered in AWS D1.1 Structural Welding Code - Steel. Verify welder qualifications.
3. Inspection of field welding shall include:
a. Visually inspect fillet welds for size, soundness, and proper return around ends. Inspect seams, folds, and delaminations.
b. Visually inspect welds for proper repair of painting.
c. Ultrasonically test penetration welds in accordance with ASTM E164.
d. Inspect surfaces to be welded. Note surface preparations, fit up, and cleanliness of surface. Verify electrodes for size, type, and condition.
e. Welding inspector shall be present during alignment and fit up of members being welded and verify 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 (50 mm) beyond each end of crack.

f. 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.

g. 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.

h. 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.

i. Weld quality to comply with the American Institute of Steel Construction (AISC) Manual of Steel Construction.

j. Determine percentage of weld tested by the number of welds that fail the initial testing.

k. Reweld and retest welds that fail until the welds pass. Test two additional welds for every weld failure.

4. Inspect bolted construction in accordance with AISC Specification for Structural Steel Buildings:
   a. Visually inspect bolts ensuring that plies have been brought into snug contact.
   b. Inspect high strength bolt in accordance with Section 9 of the Specifications for Structural Joints Using ASTM A325 or A490 Bolts.

5. Inspect stud welding in accordance with Section 7.8, of AWS D1.1 Structural Welding Code:
   a. Weld at least two shear studs at the start of each production period to determine correct generator, control unit, and stud welder setting. The studs shall be capable of being bent 45 degrees from vertical without weld failure.
   b. When the temperature is below 32 degrees F (0 degrees C), test one stud in each 100 after cooling. Do not weld studs at temperatures below 0 degrees F or when surface is wet with rain or snow. If stud fails in the weld, two new studs shall pass the test before resumption of welding.
   c. Visually inspect studs for compliance with the requirements of the Contract Documents. Verify number, spacing, and weld quality. If, after welding, visual inspection reveals that a sound weld or a full 360 degree fillet has not been obtained for a particular stud, that stud shall be struck with a hammer and bent 15 degrees off perpendicular in the direction away from the missing weld. Studs failing test shall be replaced.

I. 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.

J. Open Web Joists and Joist Girders: Inspect joists at jobsite for compliance with specified fabrication requirements. Verify welded connections between web and chord, splices, and straightness of members.
   1. Check connections to supporting members, chord extensions, number of rows of bridging, and bridging connections for compliance with Contract Documents and referenced standards.
   2. Verify welder qualification certificates for both shop and field welding operators.

K. 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.

L. 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.

M. Sprayed Fire Resistant Materials:
   1. Verify applied thickness, density, and bond strength of sprayed fireproofing meets fire rating requirements of approved design.
   2. Verify installation complies with fire rating requirements of approved design.
   3. Inspect and test for thickness:
      a. Test 25 percent of structural frame columns and beams in each building level.
      b. Test 10 percent of beams other than structural frame in each building level.
      c. Test one slab per 5,000 square feet of building area.

4. Inspect and test in accordance procedures of ASTM E605 and ASTM E736.

N. Mastic and Intumescent Fire Resistive Materials:
   1. Verify applied fire resistant coatings complies with fire rating requirements of approved design.

O. Fire Resistive Joint System:
   1. Verify fire resistant joint systems are tested and listed in accordance with IBC Section 715.3 and Section 715.4 and inspected in accordance with ASTM E2393.

P. Exterior Insulation and Finish System (EIFS).

Q. Smoke Control: Test smoke control system.

R. Water Resistive Barrier Coating: When applied to building sheathing, verify water resistive barrier coating complies with ASTM E2570.

S. Expansion Bolt Installation: Inspect drilling of each hole and installation of each expansion bolt for compliance with Contract Documents and shop drawings.
   1. Verify installation torque for each expansion bolt for compliance with manufacturer's installation instructions.

T. 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 b y 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) Mix design compressive strength.
         2) Mix design wet and dry density range.
         3) Number of Tests:
            a) One per 5,000 square feet
            b) Not less than one for each day's work
      d. Test EPS insulation board for density in accordance with ASTM C578.

3.4 TESTING OF 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.

B. Masonry:

1. Inspection and Observation Services:
   a. Inspection of placement of reinforcement including condition, grade, size, location, spacing, and lap splices.
   b. Review mortar design mixes.
   c. Inspection of laying, mortaring, and grouting of concrete masonry units and elements.
2. Testing Services:
   a. References (As applicable for tests required):
      1) ASTM International (ASTM)
         a) C140, Standard Test Methods of Sampling and Testing Concrete Masonry Units
         b) C780, Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
         c) C1019, Standard Test Method for Sampling and Testing Grout
         d) E447-97, Standard Test Methods for Compressive Strength of Laboratory Constructed Masonry Prisms
   b. Testing of Concrete Masonry Units (CMU):
      1) Preconstruction: Perform the following tests in accordance with ASTM C140.
         a) Compressive Strength
         b) Absorption
         c) Weight
         d) Moisture Content
         e) Dimensions
   c. Mortar Tests:
      1) Preconstruction: Perform the following tests in accordance with ASTM C780 on each type of mortar mix used on the Project.
      2) 28 Day Compressive Strength
      3) Water Retention
      4) Construction: Perform 28 day compressive strength test in accordance with ASTM C780 on each type of mortar mix used on the Project at the rate of one test per 2,000 square feet of masonry.
   d. Refer to and include work for reinforcing steel specified.

e. Grout Tests:
   1) Preconstruction: Perform the following tests in accordance with ASTM C1019 on each type of grout mix used on the Project.
      a) Slump Test
      b) 28 Day Compressive Strength
      c) Construction: Perform 28 day compressive strength test in accordance with ASTM C1019 on each type of grout mix used on the Project at the rate of one (1) test per 2,000 square feet of masonry.
      d) Prism Test: Perform preconstruction 28 day compressive strength test on concrete masonry walls in accordance with ASTM E447-97, Method B.

C. Seismic Resistance Testing and Inspections: In Seismic Design Categories D, E, or F:
   1. Structural Observation.
   2. Periodic Special Inspection for Architectural Components:
      a. Erection and fastening of exterior cladding.
      b. Exterior and interior nonloadbearing walls.
      c. Exterior and interior veneer.
      d. Anchorage of access floors.
   3. Plumbing, mechanical, and electrical components:
      a. Anchorage of electrical equipment for emergency and standby power systems.
      b. Anchorage of electrical equipment.
      c. Installation and anchorage of piping systems design to carry hazardous materials.
      d. Installation and anchorage of vibration isolation system where there is nominal clearance of 1/4 inch (6 mm) of less between equipment support frame and restraint.
   4. Anchorage of storage racks 8 feet (2438 mm0 or greater in height.
   5. Seismic isolation systems.

D. Structural inspection for wind requirements.

E. Special inspections and tests for proposed work required by the Building Official, including but not limited to:
   1. Construction materials and systems that are alternative to materials and systems prescribed by the Code.
   2. Unusual design applications of materials.
   3. Materials and systems required to be installed in accordance with additional manufacturer instructions that prescribe requirements not address by code or referenced standards.

END OF SECTION

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SECTION 01 40 00.10

CIVIL QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Quality control.

B. Tolerances.

C. References.

D. Labeling.

E. Mockup requirements.

F. Testing and inspection services.

G. Manufacturers' field services.

1.2 QUALITY CONTROL

A. Monitor quality control over suppliers, manufacturers, products, services, Site conditions, and workmanship, to produce Work of specified quality.

B. Comply with specified standards as the minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

C. Perform Work using persons qualified to produce required and specified quality.

D. Products, materials, and equipment may be subject to inspection by Architect/Engineer at place of manufacture or fabrication. Such inspections shall not relieve Contractor of complying with requirements of Contract Documents.

E. Supervise performance of Work in such manner and by such means to ensure that Work, whether completed or in progress, will not be subjected to harmful, dangerous, damaging, or otherwise deleterious exposure during construction period.

1.3 TOLERANCES

A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with manufacturers' recommended tolerances and tolerance requirements in reference standards. When such tolerances conflict with Contract Documents, request clarification from Architect/Engineer before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.

1.4 REFERENCES

A. For products or workmanship specified by association, trade, or other consensus standards, comply with requirements of standard except when more rigid requirements are specified or are required by applicable codes.

B. Conform to reference standard by date of issue current as of date for receiving Bids or date of Owner-Contractor Agreement when there are no Bids except where specific date is established by code.

C. Obtain copies of standards and maintain on Site when required by product Specification Sections.

D. When requirements of indicated reference standards conflict with Contract Documents, request clarification from Architect/Engineer before proceeding.

E. Neither contractual relationships, duties, or responsibilities of parties in Contract nor those of Architect/Engineer shall be altered from Contract Documents by mention or inference in reference documents.

1.5 LABELING

A. Attach label from agency approved by authorities having jurisdiction for products, assemblies, and systems required to be labeled by applicable code.

B. Label Information: Include manufacturer's or fabricator's identification, approved agency identification, and the following information, as applicable, on each label:
   1. Model number.
   2. Serial number.
   3. Performance characteristics.

C. Manufacturer's Nameplates, Trademarks, Logos, and Other Identifying Marks on Products: Not allowed on surfaces exposed to view in public areas, interior or exterior.

1.6 MOCK-UP REQUIREMENTS

A. Tests will be performed under provisions identified in this Section and identified in individual product Specification Sections.

B. Assemble and erect specified or indicated items with specified or indicated attachment and anchorage devices, flashings, seals, and finishes.

C. Accepted mockups shall be comparison standard for remaining Work.

D. Where mockup has been accepted by Architect/Engineer and is specified in product Specification Sections to be removed, remove mockup and clear area when directed to do so by Architect/Engineer.

1.7 TESTING AND INSPECTION SERVICES

A. Owner will employ and pay for specified services of an independent firm to perform testing and inspection.

B. Independent firm will perform tests, inspections, and other services specified in individual Specification Sections and as required by Architect/Engineer or Owner.
   1. Laboratory: Authorized to operate at Project location.
   2. Laboratory Staff: Maintain full-time Professional Engineer on staff to review services.
   3. Testing Equipment: Calibrated at reasonable intervals with devices of an accuracy traceable to National Bureau of Standards or accepted values of natural physical constants.

C. Testing, inspections, and source quality control may occur on or off Project Site. Perform off-Site testing as required by Architect/Engineer or Owner.

D. Reports shall be submitted by independent firm to Architect/Engineer, Contractor, and authorities having jurisdiction, in duplicate or email, indicating observations and results of tests and compliance or noncompliance with Contract Documents.
   1. Submit final report indicating correction of Work previously reported as noncompliant.

E. Cooperate with independent firm; furnish samples of materials, design mix, equipment, tools, storage, safe access, and assistance by incidental labor as requested.
   1. Notify Architect/Engineer and independent firm 24 hours before expected time for operations requiring services.
   2. Make arrangements with independent firm and pay for additional Samples and tests required for Contractor's use.

F. Employment of testing agency or laboratory shall not relieve Contractor of obligation to perform Work according to requirements of Contract Documents.

G. Retesting or re-inspection required because of nonconformance with specified or indicated requirements shall be performed by same independent firm on instructions from Architect/Engineer. Payment for retesting or re-inspection will be charged to Contractor by deducting testing charges from Contract Sum/Price.

H. Agency Responsibilities:
   1. Test Samples of mixes submitted by Contractor.
   2. Provide qualified personnel at Site. Cooperate with Architect/Engineer and Contractor in performance of services.
   3. Perform indicated sampling and testing of products according to specified standards.
   4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
   5. Promptly notify Architect/Engineer and Contractor of observed irregularities or nonconformance of Work or products.

6. Perform additional tests required by Architect/Engineer.
7. Attend preconstruction meetings and progress meetings.

I. Agency Reports: After each test, promptly submit two or email copies of report to Architect/Engineer, Contractor, and authorities having jurisdiction. When requested by Architect/Engineer, provide interpretation of test results. Include the following:
1. Date issued.
2. Project title and number.
3. Name of inspector.
4. Date and time of sampling or inspection.
5. Identification of product and Specification Section.
6. Location in Project.
7. Type of inspection or test.
8. Date of test.
9. Results of tests.
10. Conformance with Contract Documents.

J. Limits on Testing Authority:
1. Agency or laboratory may not release, revoke, alter, or enlarge on requirements of Contract Documents.
2. Agency or laboratory may not approve or accept any portion of the Work.
3. Agency or laboratory may not assume duties of Contractor.
4. Agency or laboratory has no authority to stop the Work.

1.8 MANUFACTURER'S FIELD SERVICES

A. When specified in individual Specification Sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe Site conditions, conditions of surfaces and installation, quality of workmanship, as applicable, and to initiate instructions when necessary.

B. Submit qualifications of observer to Architect/Engineer seven days in advance of required observations. Observer is subject to approval of Owner.

C. Report observations and Site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturer's written instructions.

D. Refer to Section 01 33 00 - Submittal Procedures, "Manufacturer's Field Reports" Article.

PART 2 - PRODUCTS (Not used)

PART 3 - EXECUTION (Not used)

END OF SECTION

SECTION 01 41 00

REGULATORY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Regulatory requirements.

1.2 GOVERNING REQUIREMENTS

A. Governing Law: Applicable governing laws, codes, and regulations of the jurisdiction of the location of the project are found in the Contract Documents.

B. Codes, Regulations, and Standards:
   1. Where references are made on Drawings or Specifications to codes, they shall be considered an integral part of the Contract Documents as minimum standards. Nothing contained in Contract Documents shall be construed to conflict with law, bylaws, or regulation of municipal, State, Federal, or authorities having jurisdiction.
   2. Perform work in compliance with:
      a. The Building Codes listed on Drawings.
      b. National, state, and local barrier free regulations, laws, and ordinances.

1.3 FIRE RESISTANCE REQUIREMENTS

A. Fire Resistance Ratings and Fire Tests: Determine fire resistance ratings of building elements, components, and assemblies in accordance with the test procedures set forth in ASTM E 119 or UL 263, or by alternative methods approved by applicable authorities having jurisdiction.
   1. Determine fire resistance ratings or listing based on fire tests performed by one of the following testing agencies, or an agency acceptable to governing authorities having jurisdiction.
      a. Factory Mutual Laboratories.
      b. Intertek.
      c. Southwest Research Institute.
      d. Underwriters Laboratories, Inc.
   2. Where reference is made to one testing authority, equivalent fire ratings determined or listed by another testing agency are acceptable if approved by applicable authorities having jurisdiction.

B. Marking and Identification: Permanently identify fire walls, fire barriers, fire partitions, smoke barriers, and smoke partitions, and other walls or partitions required to have protected openings or penetrations with signage or stenciling. Identification shall be:
   1. Located in accessible floor plenums, ceiling plenums, or attic spaces as applicable.
   2. Repeated at intervals not exceeding 30 feet (10 m) o.c., measured horizontally along the partition or wall.

3. Of lettering not less than 1/2 inch (13 mm) in height, worded as follows: "FIRE AND/OR SMOKE BARRIER - PROTECT OPENINGS AND PENETRATIONS."

PART 2 - PRODUCTS
Not used.

PART 3 - EXECUTION
Not used.

END OF SECTION

SECTION 01 42 00

REFERENCES

PART 1 - GENERAL

1.1 DEFINITIONS

A. Basic Contract definitions are included in the Conditions of the Contract.

B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."

D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": Supply and deliver to project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.

H. "Provide": Furnish and install, complete and ready for the intended use.

I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.2 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are necessary to perform a required construction activity, obtain copies directly from publication source.

1.3 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."

B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities

C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities.

D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations.

E. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities.

PART 2 - PRODUCTS
Not used.

PART 3 - EXECUTION
Not used.

END OF SECTION

SECTION 01 45 36

CONCRETE IMAGING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Procedural requirements for the nondestructive examination (NDE) of concrete, three dimensionally locating, mapping, and identifying embedments in concrete prior to drilling, coring, cutting or breaking activities.

1. NDE services include inspections, tests, and related actions, including reports performed by an approved, independent testing agency.
2. NDE services are required to verify compliance with requirements specified or indicated in the contract documents. These services do not relieve Contractor of responsibility for compliance with Contract Document requirements.

B. Requirements to provide quality control services required by Architect, Owner, or authorities having jurisdiction are not limited by these requirements.

1.2 RESPONSIBILITIES

A. Contractor Responsibilities: Unless otherwise indicated as the responsibility of another identified entity, provide NDE inspections, tests, and quality control services specified in the Contract Documents and required by authorities having jurisdiction. Costs for these services are included in the Contract Sum.

B. Retesting: Retesting is the Contractor’s responsibility where results of NDE inspections, tests, or quality control services prove unsatisfactory and indicate noncompliance with Contract Document requirements, regardless who was responsible for the original test.

C. Associated Services: Cooperate with agencies performing required inspections, tests, and similar services, and provide reasonable auxiliary services as requested. Notify the NDE agency sufficiently in advance of operations to permit assignment of personnel. Auxiliary services required include, but are not limited to, the following:

1. Provide access to the work.
2. Furnish incidental labor and facilities necessary to facilitate inspections and tests.
3. Provide the NDE agency with available as-built drawings and project design documentation as requested by the agency.

D. Duties of the NDE Testing Agency: The independent agency engaged to perform concrete NDE inspections and surveys shall cooperate with the Architect and the Contractor in performance of the agency's duties. The testing agency shall provide qualified personnel to perform required inspections and tests.

1. The agency shall notify the Architect and the Contractor promptly of potential clashes between proposed penetrations of the subject concrete and embedments observed in the Work during performance of its services.

2. The agency is not authorized to release, revoke, alter, or enlarge requirements of the Contract Documents or approve or accept any portion of the work.
3. The agency shall not perform the duties of the Contractor.

E. Coordination: Coordinate the sequence of activities to accommodate required NDE services with a minimum of delay. Coordinate activities to avoid the necessity of removing and replacing construction to accommodate inspections and tests.

F. Schedule date and time for inspections, tests, taking samples, and similar activities.

1.3 SUBMITTALS

A. The independent NDE testing agency shall submit a written report, in duplicate, of each inspection, test, survey, or similar service to the Architect. If the Contractor is responsible for the service, submit a certified written report, in duplicate, of each inspection, test, or similar service through the Contractor.
1. Submit additional copies of each written report directly to the governing authority, when the authority so directs.
2. Report Data: Written reports of each inspection, test, or similar service include, but are not limited to, the following:
a. Date of issue.
b. Project title and number.
c. Name, address, and telephone number of testing agency.
d. Dates and locations of tests or inspection
e. Names of individuals making the inspection or test.
f. Designation of the Work and test method(s).
g. Complete NDE test data with annotations.
h. Survey results and an interpretation of the results.
i. Site conditions at the time of NDE testing.
j. Comments or professional opinions on whether proposed concrete penetrations clash or interfere with observed embedments in the concrete.
k. Name and signature of NDE report preparer.
l. Recommendations on retesting.

1.4 QUALITY ASSURANCE

A. Qualifications for NDE Service Agencies:
1. NDE Agency: Entity having a minimum of 10 years documented experience in the use of ground penetrating radar (GPR) for the three dimensional locating, mapping and identification of concrete embedments for similar, mission critical, facilities.
a. Ability to archive project reports, collected data, and related documents for a period of not less than 5 years from completion of the NDE Work.
2. GPR Field Technicians and Analysts: Individuals having minimum 5 years documented experience in the use of ground penetrating radar (GPR) for the three dimensional locating, mapping, and identification of concrete embedments for similar, mission critical, facilities.
a. Demonstrated ability to accurately, dimensionally locate concrete survey and data collection areas.
3. Professional Liability Insurance ("Errors and Omissions") with minimum limits of $2 million per occurrence / $2 million annual aggregate.

4. NDE Work shall be performed in accordance with the applicable sections of ASTM D6432, CSDA Best Practice BP-007.
5. Acceptable NDE Service Agencies:
   a. Dearborn Companies - Bridgeview, IL (708-430-7600)
   b. CTLGroup - Skokie, IL (847-965-7500)

PART 2 - PRODUCTS
Not used.

PART 3 - EXECUTION

3.1 NONDESTRUCTIVE EXAMINATION (NDE) OF CONCRETE

A. Utilize ground penetrating radar (GPR) as the primary NDE investigative tool deployed for the three dimensional (3D) imaging of concrete.

B. Prior to drilling, coring, cutting, or breaking of concrete, image the area utilizing GPR by an approved NDE agency and evaluated by the agency for potential clashes with embedded elements in the concrete (conduit, piping, reinforcing bar, post tensioning tendons, etc.).

3.2 GROUND PENETRATING RADAR (GPR)

A. GPR system shall utilize a ground coupled antenna system with minimum center frequency of 1000 MHz.

B. Collect data utilizing defined, bi-directional grids with supplemental line scans being performed deemed necessary by the operator. Collect data on a grid basis, unless physical constraints restrict the data collection process to only line scans.

C. Grid locations shall be dimensionally located relative to fixed building or site elements. Identify the grid origin position and grid axis orientation and recorded.

D. Data shall be initially processed on-site, with observed embedments "real-time" marked on the concrete surface. Marking methods and materials shall be approved by the Owner in advance of the NDE services commencing. Marks shall be documented using digital photography.

E. Digitally record and post-process data utilizing the system manufacturer's analytical software. Line scan images and GPR plan map images shall be annotated to convey the nature and three dimensional location of observed embedments. Annotated images shall be included as part of each written report.

3.3 RESTRICTION ON LOCATION OF PROPOSED CONCRETE PENETRATIONS

A. Concrete penetrations shall not be made within 4 inches (100 mm) of any fixed obstruction (wall, etc.) due to the physical limitation presented by the typical GPR antenna dimensions.

END OF SECTION

SECTION 01 50 00

TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Requirements for temporary utilities, support facilities, and security and protection facilities.

1.2 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 engaged in the Project to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, occupants of Project, testing agencies, and authorities having jurisdiction.

B. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

C. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

1.3 INFORMATIONAL SUBMITTALS

A. Site Utilization Plan: Show temporary facilities, temporary utility lines and connections, staging areas, construction site entrances, vehicle circulation, and parking areas for construction personnel.

B. Implementation and Termination Schedule: Within 15 days of date established for commencement of the work, submit schedule indicating implementation and termination dates of each temporary utility.

C. Project Identification and Temporary Signs: Show fabrication and installation details, including plans, elevations, details, layouts, typestyles, graphic elements, and message content.

D. Erosion and Sedimentation Control Plan: Show compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

E. Fire Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.

F. Moisture and Mold Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage and mold.

G. Dust and HVAC Control Plan: Submit coordination drawing and narrative that indicates the dust and HVAC control measures proposed for use, proposed locations, and proposed time frame for their operation. Include the following:
   1. Locations of dust control partitions at each phase of work.
   2. HVAC system isolation schematic drawing.
   3. Location of proposed air filtration system discharge.
   4. Waste handling procedures.
   5. Other dust control measures.

1.4 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.

C. Accessible Temporary Egress: Comply with applicable provisions in the United States Access Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1 and Texas Accessibility Standards (TAS).

1.5 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Portable Chain Link Fencing: Minimum 2-inch (50-mm), 0.148 inch (3.8 mm) thick, galvanized steel, chain link fabric fencing; minimum 6 feet (1.8 m) high with galvanized steel pipe posts; minimum 2-3/8 inch (60 mm) OD line posts and 2-7/8 inch (73 mm) OD corner and pull posts, with 1-5/8 inch (42 mm) OD top and bottom rails. Provide galvanized steel bases for supporting posts.

B. Fencing Windscreen Privacy Screen: Polyester fabric scrim with grommets for attachment to chain link fence, sized to height of fence, in color selected by Architect from manufacturer's standard colors.

C. Polyethylene Sheet: Reinforced, fire resistive sheet, 10 mil (0.25 mm) minimum thickness, with flame spread rating of 15 or less per ASTM E 84 and passing NFPA 701 Test Method 2.

D. Dust Control Adhesive Surface Walk Off Mats: Provide mats minimum 36 inches by 60 inches (914 mm by 1524 mm).

E. Insulation: Unfaced mineral fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame spread and smoke developed indexes of 25 and 50, respectively.

2.2 TEMPORARY FACILITIES

A. Field Offices: 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 1 Sections. Keep office clean and orderly. Furnish and equip offices as follows:

1. Furniture required for Project site documents including file cabinets, plan tables, plan racks, and bookcases.
2. Conference room of sufficient size to accommodate meetings of 10 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 (1.2 m) square tack and marker boards.
3. Drinking water and private toilet.
4. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 degrees F to 72 degrees F (20 degrees C to 22 degrees C).
5. Lighting fixtures capable of maintaining average illumination of 20 fc (215 lx) 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: Use of Owner’s existing permanent HVAC system is permitted to the extent it is available during the work.

1. Use of gasoline burning space heaters, open flame heaters, or salamander type heating units is prohibited.
2. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction and marked for intended location and application.
3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with minimum MERV of 8 at each return air grille in system, remove at end of construction, and clean HVAC system as required in Section 01 77 00 "Closeout Procedures."

C. HVAC Equipment: Provide vented, self-contained, liquid propane gas or fuel oil heaters with individual space thermostatic control.
   1. Use of gasoline burning space heaters, open flame heaters, or salamander type heating units is prohibited.
   2. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction and marked for intended location and application.
   3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return-air grille in system and remove at end of construction and clean HVAC system as required in Section 01 77 00 "Closeout Procedures."

D. Air Filtration Units: Primary and secondary HEPA filter equipped portable units with four stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

PART 3 - EXECUTION

3.1 TEMPORARY FACILITIES

A. Conservation: Coordinate construction and use of temporary facilities 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. Refer to other Sections for disposition of salvaged materials that are designated as Owner's property.

3.2 INSTALLATION

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
   1. Locate facilities to limit site disturbance as specified in Section 01 10 00 "Summary."

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.3 TEMPORARY UTILITY INSTALLATION

A. Install temporary service or connect to existing service.
   1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
   2. When tapping into Owner’s existing services, coordinate with Owner’s Representative before tapping into existing utility services available in the facility.

B. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.

1. Install electric power service overhead unless otherwise indicated.
2. Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
3. Connect temporary service to Owner's existing power source as directed by Owner.

C. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.
1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.

D. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.

E. 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.
1. Toilets: Use of Owner's existing toilet facilities will be permitted, provided facilities are cleaned and maintained in a sanitary condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.
   a. Provide toilet paper, paper towels, and related accessories and maintenance items.
   b. Thoroughly clean and disinfect toilet rooms daily.
   c. At the end of the work, thoroughly clean and sanitize, disinfect, and restore toilet rooms to like new condition. Replace plumbing fixtures and toilet accessories broken, damaged, or removed by construction personnel. If necessary, repaint paintable surfaces.

F. Temporary 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.
1. Provide temporary dehumidification systems when required to reduce ambient and substrate moisture levels to level required to allow installation or application of finishes and their proper curing or drying.

G. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.
1. Prior to commencing work, isolate the HVAC system in area where work is to be performed.
   a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
   b. Maintain negative air pressure within work area using HEPA equipped air filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.

2. Maintain dust partitions during the work. Use vacuum collection attachments on dust producing equipment. Isolate limited work within occupied areas using portable dust containment devices.
3. Perform daily construction cleanup and final cleanup using approved, HEPA filter equipped vacuum equipment.

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 WiFi cell phone access equipment and at least one land based telephone line(s) for each field office.
1. Provide additional telephone lines as determined by useage.
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 afterhours telephone number.
   e. Architect's office.
   f. Engineers' offices.
   g. Owner's office.
   h. Principal subcontractors' field and home offices.
3. Include costs for installation, maintenance and removal, and service charges for local calls. Toll charges shall be paid by party who places call.

J. Electronic Communication Service: Provide a desktop computer in the primary field office adequate for use by Architect and Owner to access Project electronic documents and maintain electronic communications. Equip computer with not less than the following:
1. Processor: Intel Core i5 or i7.
2. Memory: 4 gigabyte.
3. Disk Storage: 500 gigabyte hard disk drive and combination DVD-RW/CD-RW drive.
4. Display: 24 inch (610 mm) LCD monitor with 256-Mb dedicated video RAM.
5. Full size keyboard and mouse.
6. Network Connectivity: 10/100BaseT Ethernet or Gigabit.
7. Operating System: Microsoft Windows 10 Professional.
8. Productivity Software:
   a. Microsoft Office Professional, 2013 or higher, including Word, Excel, and Outlook.
   b. Adobe Reader 11.0 or higher.
   c. WinZip 7.0 or higher.
9. Printer: All in one unit equipped with printer server, combining color printing, photocopying, scanning, and faxing, or separate units for each of these three functions.

10. Internet Service: Broadband modem, router, and ISP, equipped with hardware firewall, providing minimum 1.0 Mbps upload and 15 Mbps download speeds at each computer.
11. Internet Security: Integrated software, providing software firewall, virus, spyware, phishing, and spam protection in a combined application.
12. Backup: External hard drive, minimum 2 terabyte, with automated backup software providing daily backups.

3.4 SUPPORT FACILITIES INSTALLATION

A. Install and maintain support facilities until Substantial Completion inspection. Remove prior to Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Temporary Facilities and Services:
1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet (9 m) of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

C. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas as indicated on Drawings.
1. Provide dust control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.

D. Temporary Use of Planned Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.
1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
2. Prepare subgrade and install subbase and base for temporary roads and paved areas according to Section 31 20 00 "Earth Moving."
3. Recondition base after temporary use, including removing contaminated material, regrading, proofrolling, compacting, and testing.
4. Delay installation of final course of permanent hot mix asphalt pavement until immediately before Substantial Completion. Repair hot mix asphalt base course pavement before installation of final course according to Section 32 12 16 "Asphalt Paving."

E. 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 firefighting equipment and access to fire hydrants.

F. Parking: Provide temporary parking areas for construction personnel.
1. Parking is limited. Provide temporary parking unless Owner designates parking areas for construction personnel.

G. 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.

H. 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 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 touch up signs so they are legible at all times.

I. 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."

3.5 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.
1. Where access to adjacent properties is required in order to affect protection of existing facilities, obtain written permission from adjacent property owner to access property for that purpose.

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 specified work restrictions.

C. Temporary Erosion and Sedimentation Control: Comply with requirements specified in Section 31 00 00 "Earthwork."

D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

E. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.

F. 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 materials approved by authorities having jurisdiction.

G. Site Enclosure Fence: Prior to commencing earthwork, furnish and install site enclosure fence in a manner that will prevent people from easily entering site except by entrance gates.

1. Extent of Fence: Required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish one set of keys to Owner.

H. 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 workday.

I. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

J. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.

K. 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.

L. Temporary Partitions: Provide floor to ceiling dustproof partitions to limit dust and dirt migration and to separate areas occupied by Owner from fumes and noise.

1. Construct dustproof partitions with gypsum wallboard with joints taped on occupied side, and fire retardant treated plywood on construction operations side.
2. Construct dustproof partitions with two layers of 6 mil (0.14 mm) polyethylene sheet on each side. Cover floor with two layers of 6 mil (0.14 mm) polyethylene sheet, extending sheets 18 inches (460 mm) up the sidewalls. Overlap and tape full length of joints. Cover floor with fire retardant treated plywood.
    a. Construct vestibule and airlock at each entrance through temporary partition with not less than 48 inches (1219 mm) between doors. Maintain water dampened foot mats in vestibule.
3. Where fire resistance rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies.
4. Insulate partitions to control noise transmission to occupied areas.
5. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.

6. Protect air handling equipment.
7. Provide walk off mats at each entrance through temporary partition.

M. 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. Comply with additional limits on smoking specified in other Sections.
2. Supervise welding operations, combustion type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
3. Develop and supervise an overall fire prevention and protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.6 MOISTURE AND MOLD CONTROL

A. Contractor's Moisture Protection Plan: Describe delivery, handling, storage, installation, and protection provisions for materials subject to water absorption or water damage.
1. Indicate procedures for discarding water damaged materials, protocols for mitigating water intrusion into completed work, and replacing water damaged Work.
2. Indicate sequencing of work that requires water, such as sprayed fire resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.
3. Indicate methods to be used to avoid trapping water in finished work.

B. Exposed Construction Period: 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 Period: 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 and replace stored or installed material that begins to grow mold.
7. Perform work in a sequence that allows wet materials adequate time to dry before enclosing the material in gypsum board or other interior finishes.

D. Controlled Construction Period: 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 temporary or permanent HVAC system to control humidity within ranges specified for installed and stored materials.
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 and require replacing.
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 and replace materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.7 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 in Section 01 77 00 "Closeout Procedures."

END OF SECTION

SECTION 01 60 00

PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

1.2 DEFINITIONS

A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
3. Comparable Product: Product that is demonstrated and approved by Architect through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Basis of Design Product Specification: A specification in which a single manufacturer's product is named and accompanied by the words "basis of design product," including make or model number or other designation. In addition to the basis of design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification.

C. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products qualified under the specified product procedure. Should a named product or product by a named manufacturer does not meet the other requirements of the specifications, select another named product or product from another named manufacturer that does meet the requirements of the specifications. Submit a comparable product request, if applicable.

1.3 ACTION SUBMITTALS

A. Comparable Product Request Submittal: Submit request for consideration of each comparable product. Identify basis of design product or fabrication or installation method

to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Include data to indicate compliance with specified requirements.
2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
    a. Form of Architect's Approval of Submittal: Specified in Section 01 33 00 "Submittal Procedures."
    b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

B. Basis of Design Product Specification Submittal: Comply with requirements in Section 01 33 00 "Submittal Procedures." Show compliance with requirements.

1.4 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

B. Identification of Products: Except for required labels and operating data, do not attach or imprint manufacturer or product names or trademarks on exposed surfaces of products or equipment that will be exposed to view in occupied spaces or on the exterior.

1. Labels: Locate required product labels and stamps on a concealed surface, or, where required for observation following installation, on a visually accessible surface that is not conspicuous.
2. Equipment Nameplates: Provide a permanent nameplate on each item of service connected or power operated equipment. Locate on a visually accessible but inconspicuous surface. Include information essential for operation, including the following:
    a. Name of product and manufacturer.
    b. Model and serial number.
    c. Capacity.
    d. Speed.
    e. Ratings.
3. Refer to individual identification sections in Divisions 21, 22, 23, and 26 for additional identification requirements.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:
   1. Schedule delivery to minimize long term storage at site.
   2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and losses.
   3. Deliver products to site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
   4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

C. Storage:
   1. Store products to allow for inspection and measurement of quantity or counting of units.
   2. Store materials to avoid endangering Project structure and building elements.
   3. Store products subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
   4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
   5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
   6. Protect stored products from damage and liquids from freezing.
   7. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.6 PRODUCT WARRANTIES

A. Warranties specified in the specification sections are in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
   1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a product and specifically endorsed by manufacturer to Owner.
   2. Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.

B. Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
   1. Manufacturer's Standard Form: Modified and coordinated to include Project specific information and properly executed.
   2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
   3. Refer to the individual specification sections for specific content requirements and requirements for submitting warranties.

C. Submittal Time: Comply with requirements in Section 01 77 00 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. Product Requirements: Provide products complying with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
   1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
   2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
   3. Owner reserves the right to limit selection to products with warranties meeting requirements of the Contract Documents.
   4. Where products are accompanied by the term "as selected," Architect will make selection.
   5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
   6. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.
      a. Submit additional documentation required by Architect in order to establish equivalency of proposed products. Evaluation of "or equal" product status is by the Architect, whose determination is final.

B. Product Selection Procedures:
   1. Sole Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
      a. Sole product may be indicated by the phrase: "Subject to compliance with requirements, provide the following: …"
   2. Sole Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
      a. Sole manufacturer/source may be indicated by the phrase: "Subject to compliance with requirements, provide products by the following: …"
   3. Limited List of Products: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.
      a. Limited list of products may be indicated by the phrase: "Subject to compliance with requirements, provide one of the following: …"
   4. Limited List of Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.
   5. Basis of Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the

specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

a. For approval of products by unnamed manufacturers, comply with requirements in Section 01 25 00 "Substitution Procedures" for substitutions for convenience.

C. Visual Matching Specification: Where Specifications require "match Architect's sample," provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.

1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 01 25 00 "Substitution Procedures" for proposal of product.

D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 SUSTAINABLE PRODUCTS

A. Where the Specifications include products with sustainable attributes, select products that comply with sustainability requirements.

1. Where there is an option to provide one of the listed products, give preference to products with minimal packaging and easily recyclable packaging.
2. Maximize use of source reduction and recycling procedures.
3. Provide environmentally preferable products (EPP) to the extent possible.
   a. Environmentally Preferable Products: Products and materials that have a lesser or reduced effect on the environment considering raw materials acquisition, production, manufacturing, packaging, distribution, reuse, operation, maintenance, or disposal of the product.

2.3 COMPARABLE PRODUCTS

A. Conditions for Consideration of Comparable Products: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:

1. Evidence that proposed product does not require revisions to the Contract Documents, is consistent with the Contract Documents, will produce the indicated results, and is compatible with other portions of the work. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant product qualities include attributes such as type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other specific features and requirements.
2. Evidence that proposed product provides specified warranty.

3. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
4. Samples, if requested.

B. Submittal Requirements: Approval by the Architect of Contractor's request for use of comparable product is not intended to satisfy other submittal requirements. Comply with specified submittal requirements.

PART 3 - EXECUTION
Not used.

END OF SECTION

SECTION 01 70 00

CIVIL EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Field engineering.

B. Closeout procedures.

C. Starting of systems.

D. Demonstration and instructions.

E. Testing, adjusting, and balancing.

F. Project record documents.

G. Operation and maintenance data.

H. Manual for materials and finishes.

I. Manual for equipment and systems.

J. Spare parts and maintenance products.

K. Product warranties and product bonds.

L. Maintenance service.

M. Examination.

N. Preparation.

O. Execution.

P. Cutting and patching.

Q. Protecting installed construction.

R. Final cleaning.

1.2 FIELD ENGINEERING

A. Employ land surveyor registered at Project location in State of Texas and acceptable to Architect/Engineer.

B. Owner will locate and Contractor shall Locate and protect survey control and reference points. Promptly notify Architect/Engineer of discrepancies discovered.

C. Control datum for survey is indicated on Drawings.

D. Prior to beginning Work, verify and establish connection elevations of existing facilities to ensure that new Work will meet existing elevations in smooth and level alignment except where specifically detailed or indicated otherwise.

E. Verify setbacks and easements; confirm Drawing dimensions and elevations.

F. Provide field engineering services. Establish elevations, lines, and levels using recognized engineering survey practices.

G. Submit copy of Site drawing signed by land surveyor certifying elevations and locations of the Work are in conformance with Contract Documents.

H. Maintain complete and accurate log of control and survey Work as Work progresses.

I. On completion of foundation walls and major Site improvements, prepare certified survey illustrating dimensions, locations, angles, and elevations of construction and Site Work.

J. Protect survey control points prior to starting Site Work; preserve permanent reference points during construction.

K. Promptly report to Architect/Engineer loss or destruction of reference point or relocation required because of changes in grades or other reasons.

L. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect/Engineer.

1.3 CLOSEOUT PROCEDURES

A. Prerequisites to Substantial Completion: Complete following items before requesting Certification of Substantial Completion, either for entire Work or for portions of Work:

1. Submit maintenance manuals, Project record documents, digital images of construction photographs and other similar final record data in compliance with this Section.
2. Complete facility startup, testing, adjusting, balancing of systems and equipment, demonstrations, and instructions to Owner's operating and maintenance personnel as specified in compliance with this Section.
3. Conduct inspection to establish basis for request that Work is substantially complete. Create comprehensive list (initial punch list) indicating items to be completed or corrected, value of incomplete or nonconforming Work, reason for being incomplete, and date of anticipated completion for each item. Include copy of list with request for Certificate of Substantial Completion.
4. Obtain and submit releases enabling Owner's full, unrestricted use of Project and access to services and utilities. Include certificate of occupancy, operating

certificates, and similar releases from authorities having jurisdiction and utility companies.

5. Deliver tools, spare parts, extra stocks of material, and similar physical items to Owner.
6. Make final change-over of locks eliminating construction master-key system and transmit keys directly to Owner. Advise Owner's personnel of change-over in security provisions.
7. Discontinue or change over and remove temporary facilities and services from Project Site, along with construction tools, mockups, and similar elements.
8. Perform final cleaning according to this Section.

B. Substantial Completion Inspection:
1. When Contractor considers Work to be substantially complete, submit to Architect/Engineer:
   a. Written certificate that Work, or designated portion, is substantially complete.
   b. List of items to be completed or corrected (initial punch list).
2. Within seven days after receipt of request for Substantial Completion, Architect/Engineer will make inspection to determine whether Work or designated portion is substantially complete.
3. Should Architect/Engineer determine that Work is not substantially complete:
   a. Architect/Engineer will promptly notify Contractor in writing, stating reasons for its opinion.
   b. Contractor shall remedy deficiencies in Work and send second written request for Substantial Completion to Architect/Engineer.
   c. Architect/Engineer will reinspect Work.
   d. Redo and Inspection of Deficient Work: Repeated until Work passes Architect/Engineer's inspection.
4. When Architect/Engineer finds that Work is substantially complete, Architect/Engineer will:
   a. Prepare Certificate of Substantial Completion on AIA G704 - Certificate of Substantial Completion, accompanied by Contractor's list of items to be completed or corrected as verified and amended by Architect/Engineer and Owner (final punch list).
   b. Submit Certificate to Owner and Contractor for their written acceptance of responsibilities assigned to them in Certificate.
5. After Work is substantially complete, Contractor shall:
   a. Allow Owner occupancy of Project under provisions stated in Certificate of Substantial Completion.
   b. Complete Work listed for completion or correction within time period stipulated.
6. Owner will occupy portions of project as specified in Section 01 10 00 - Summary.

C. Prerequisites for Final Completion: Complete following items before requesting final acceptance and final payment.
   1. When Contractor considers Work to be complete, submit written certification that:
      a. Contract Documents have been reviewed.
      b. Work has been examined for compliance with Contract Documents.
      c. Work has been completed according to Contract Documents.
      d. Work is completed and ready for final inspection.
   2. Submittals: Submit following:
      a. Final punch list indicating all items have been completed or corrected.
      b. Final payment request with final releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.
      c. Specified warranties, workmanship/maintenance bonds, maintenance agreements, and other similar documents.
      d. Accounting statement for final changes to Contract Sum.
      e. Contractor's affidavit of payment of debts and claims on AIA G706 - Contractor's Affidavit of Payment of Debts and Claims.
      f. Contractor affidavit of release of liens on AIA G706A - Contractor's Affidavit of Release of Liens.
      g. Consent of surety to final payment on AIA G707 - Consent of Surety to Final Payment Form.
   3. Perform final cleaning for Contractor-soiled areas according to this Section.

D. Final Completion Inspection:
   1. Within seven days after receipt of request for final inspection, Architect/Engineer will make inspection to determine whether Work or designated portion is complete.
   2. Should Architect/Engineer consider Work to be incomplete or defective:
      a. Architect/Engineer will promptly notify Contractor in writing, listing incomplete or defective Work.
      b. Contractor shall remedy stated deficiencies and send second written request to Architect/Engineer that Work is complete.
      c. Architect/Engineer will reinspect Work.
      d. Redo and Inspection of Deficient Work: Repeated until Work passes Architect/Engineer's inspection.

1.4 STARTING OF SYSTEMS

A. Coordinate schedule for startup of various equipment and systems.

B. Notify Architect/Engineer seven days prior to startup of each item.

C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions which may cause damage.

D. Verify that tests, meter readings, and electrical characteristics agree with those required by equipment or system manufacturer.

E. Verify that wiring and support components for equipment are complete and tested.

F. Execute startup under supervision of manufacturer's representative or Contractors' personnel according to manufacturer's instructions.

G. When specified in individual Specification Sections, require manufacturer to provide authorized representative who will be present at Site to inspect, check, and approve equipment or system installation prior to startup and will supervise placing equipment or system in operation.

H. Submit a written report according to Section 01 33 00 - Submittal Procedures that equipment or system has been properly installed and is functioning correctly.

1.5 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate operation and maintenance of products to Owner's personnel two weeks prior to date of Substantial Completion and/or final inspection.

B. Demonstrate Project equipment and instructed by qualified manufacturer's representative who is knowledgeable about the Project.

C. Video Recordings: Provide high-quality color video recordings of demonstration and instructional sessions. Engage commercial videographer to record sessions. Include classroom instructions, demonstrations, board diagrams, and other visual aids. Include menu navigation.

D. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

E. Use operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.

F. Demonstrate startup, operation, control, adjustment, troubleshooting, servicing, maintenance, and shutdown of each item of equipment at scheduled time, at equipment location.

G. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

H. Required instruction time for each item of equipment and system is specified in individual Specification Sections.

1.6 TESTING, ADJUSTING, AND BALANCING

A. Owner will appoint, employ, and pay for services of independent firm to perform testing, adjusting, and balancing.

B. Independent firm will perform services as required.

C. Reports will be submitted by independent firm to Architect/Engineer indicating observations and results of tests and indicating compliance or noncompliance with requirements of Contract Documents.

1.7 PROJECT RECORD DOCUMENTS

A. Maintain on Site one set of the following record documents; record actual revisions to the Work:
   1. Drawings.
   2. Specifications.
   3. Addenda.
   4. Change Orders and other modifications to the Contract.
   5. Reviewed Shop Drawings, product data, and Samples.
   6. Manufacturer's instruction for assembly, installation, and adjusting.

B. Ensure entries are complete and accurate, enabling future reference by Owner.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress, not less than weekly.

E. Specifications: Legibly mark and record, at each product Section, description of actual products installed, including the following:
   1. Manufacturer's name and product model and number.
   2. Product substitutions or alternates used.
   3. Changes made by Addenda and modifications.

F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction as follows:
   1. Include Contract modifications such as Addenda, supplementary instructions, change directives, field orders, minor changes in the Work, and change orders.
   2. Include locations of concealed elements of the Work.
   3. Identify depth of buried utility lines and provide dimensions showing distances from permanent facility components that are parallel to utilities.
   4. Dimension ends, corners, and junctions of buried utilities to permanent facility components using triangulation.
   5. Identify and locate existing buried or concealed items encountered during Project.
   6. Measured depths of foundations in relation to finish main floor datum.
   7. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
   8. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
   9. Field changes of dimension and detail.
   10. Details not on original Drawings.

G. Submit marked-up paper copy documents to Architect/Engineer before Substantial Completion with claim for final Application for Payment.

H. Submit PDF electronic files of marked-up documents to Architect/Engineer before Substantial Completion with claim for final Application for Payment.

1.8 OPERATION AND MAINTENANCE DATA

A. Submit in PDF composite electronic indexed file.

B. Submit data bound in 8-1/2 x 11-inch text pages, three D side ring binders with durable plastic covers.

C. Prepare binder cover with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS," title of Project, and subject matter of binder when multiple binders are required.

D. Internally subdivide binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.

E. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

F. Contents: Prepare table of contents for each volume, with each product or system description identified, typed on white paper, in three parts as follows:

1. Part 1: Directory, listing names, addresses, and telephone numbers of Architect/Engineer, Contractor, Subcontractors, and major equipment suppliers.
2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by Specification Section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Include the following:
    a. Significant design criteria.
    b. List of equipment.
    c. Parts list for each component.
    d. Operating instructions.
    e. Maintenance instructions for equipment and systems.
    f. Maintenance instructions for special finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
    g. Safety precautions to be taken when operating and maintaining or working near equipment.
3. Part 3: Project documents and certificates, including the following:
    a. Shop Drawings and product data.
    b. Air and water balance reports.
    c. Certificates.
    d. Originals of warranties and bonds.

1.9 MANUAL FOR MATERIALS AND FINISHES

A. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect/Engineer will review draft and return one copy with comments.

B. For equipment or component parts of equipment put into service during construction and operated by Owner, submit documents within ten days after acceptance.

C. Instructions for Care and Maintenance: Include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

D. Moisture Protection and Weather Exposed Products: Include product data listing applicable reference standards, chemical composition, and details of installation. Include recommendations for inspections, maintenance, and repair.

E. Additional Requirements: As specified in individual product Specification Sections.

F. Include listing in table of contents for design data, with tabbed fly sheet and space for insertion of data.

1.10 MANUAL FOR EQUIPMENT AND SYSTEMS

A. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect/Engineer will review draft and return one copy with comments.

B. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit documents within ten days after acceptance.

C. Each Item of Equipment and Each System: Include description of unit or system and component parts. Identify function, normal operating characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and model number of replaceable parts.

D. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; by label machine.

E. Include color-coded wiring diagrams as installed.

F. Operating Procedures: Include startup, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shutdown, and emergency instructions. Include summer, winter, and special operating instructions.

G. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and troubleshooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

H. Include servicing and lubrication schedule and list of lubricants required.

I. Include manufacturer's printed operation and maintenance instructions.

J. Include sequence of operation by controls manufacturer.

K. Include original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

L. Include control diagrams by controls manufacturer as installed.

M. Include Contractor's coordination drawings with color-coded piping diagrams as installed.

N. Include charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

O. Include list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

P. Include test and balancing reports as specified in Section 01 40 00.10 - Civil Quality Requirements.

Q. Additional Requirements: As specified in individual product Specification Sections.

R. Include listing in table of contents for design data with tabbed dividers and space for insertion of data.

1.11 SPARE PARTS AND MAINTENANCE PRODUCTS

A. Furnish spare parts, maintenance, and extra products in quantities specified in individual Specification Sections.

B. Deliver to Project Site and place in location as directed by Owner; obtain receipt prior to final payment.

1.12 PRODUCT WARRANTIES AND PRODUCT BONDS

A. Obtain warranties and bonds executed in duplicate by responsible Subcontractors, suppliers, and manufacturers within ten days after completion of applicable item of Work.

B. Execute and assemble transferable warranty documents and bonds from Subcontractors, suppliers, and manufacturers.

C. Verify documents are in proper form, contain full information, and are notarized.

D. Co-execute submittals when required.

E. Include table of contents and assemble in three D side ring binder with durable plastic cover.

F. Submit prior to final Application for Payment.

1.13 MAINTENANCE SERVICE

A. Furnish service and maintenance of components indicated in Specification Sections during warranty period.

B. Examine system components at frequency consistent with reliable operation. Clean, adjust, and lubricate as required.

C. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by manufacturer of original component.

D. Do not assign or transfer maintenance service to agent or Subcontractor without prior written consent of Owner.

PART 2 - PRODUCTS
Not used.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that existing Site conditions and substrate surfaces are acceptable for subsequent Work. Beginning new Work means acceptance of existing conditions.

B. Verify that existing substrate is capable of structural support or attachment of new Work being applied or attached.

C. Examine and verify specific conditions described in individual Specification Sections.

D. Verify that utility services are available with correct characteristics and in correct locations.

3.2 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance according to manufacturer's instructions.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer-required or -recommended substrate primer, sealer, or conditioner prior to applying new material or substance in contact or bond.

3.3 EXECUTION

A. Comply with manufacturer's installation instructions, performing each step in sequence. Maintain one set of manufacturer's installation instructions at Project Site during installation and until completion of construction.

B. When manufacturer's installation instructions conflict with Contract Documents, request clarification from Architect/Engineer before proceeding.

C. Verify that field measurements are as indicated on approved Shop Drawings or as instructed by manufacturer.

D. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.
   1. Secure Work true to line and level and within specified tolerances, or if not specified, industry-recognized tolerances.
   2. Physically separate products in place, provide electrical insulation, or provide protective coatings to prevent galvanic action or corrosion between dissimilar metals.
   3. Exposed Joints: Provide uniform joint width and arrange to obtain best visual effect. Refer questionable visual-effect choices to Architect/Engineer for final decision.

E. Allow for expansion of materials and building movement.

F. Climatic Conditions and Project Status: Install each unit of Work under conditions to ensure best possible results in coordination with entire Project.
   1. Isolate each unit of Work from incompatible Work as necessary to prevent deterioration.
   2. Coordinate enclosure of Work with required inspections and tests to minimize necessity of uncovering Work for those purposes.

G. Mounting Heights: Where not indicated, mount individual units of Work at industry recognized standard mounting heights for particular application indicated.
   1. Refer questionable mounting heights choices to Architect/Engineer for final decision.
   2. Elements Identified as Accessible to Handicapped: Comply with applicable codes and regulations.

H. Adjust operating products and equipment to ensure smooth and unhindered operation.

I. Clean and perform maintenance on installed Work as frequently as necessary through remainder of construction period. Lubricate operable components as recommended by manufacturer.

3.4 CUTTING AND PATCHING

A. Employ original installers to perform cutting and patching.

B. Submit written request in advance of cutting or altering elements affecting:
   1. Structural integrity of element.
   2. Integrity of weather-exposed or moisture-resistant elements.
   3. Efficiency, maintenance, or safety of element.
   4. Visual qualities of sight-exposed elements.
   5. Work of Owner or separate contractor.

C. Execute cutting, fitting, and patching including excavation and fill to complete Work and to:
   1. Fit the several parts together, to integrate with other Work.
   2. Uncover Work to install or correct ill-timed Work.

3. Remove and replace defective and nonconforming Work.
4. Remove samples of installed Work for testing.
5. Provide openings in elements of Work for penetrations of mechanical and electrical Work.

D. Execute Work by methods to avoid damage to other Work and to provide proper surfaces to receive patching and finishing.

E. Cut masonry and concrete materials using masonry saw or core drill.

F. Restore Work with new products according to requirements of Contract Documents.

G. Fit Work tight to pipes, sleeves, ducts, conduits, and other penetrations through surfaces.

H. Refinish surfaces to match adjacent finishes. For continuous surfaces, refinish to nearest intersection; for assembly, refinish entire unit.

I. Identify hazardous substances or conditions exposed during the Work to Architect/Engineer for decision or remedy.

3.5 PROTECTING INSTALLED CONSTRUCTION

A. Protect installed Work and provide special protection where specified in individual Specification Sections.

B. Provide temporary and removable protection for installed products. Control activity in immediate Work area to prevent damage.

C. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

D. Use durable sheet materials to protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects.

E. Prohibit traffic or storage upon waterproofed or roofed surfaces. When traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

F. Prohibit traffic from landscaped areas.

3.6 FINAL CLEANING

A. Execute final cleaning prior to final Project assessment.
1. Employ experienced personnel.

B. Clean interior and exterior glass and surfaces exposed to view; remove temporary labels, stains, and foreign substances; polish transparent and glossy surfaces.

C. Clean equipment and fixtures to sanitary condition with appropriate cleaning materials.

D. Replace filters of operating equipment.

E. Clean debris from roofs, gutters, downspouts, and drainage systems.

F. Clean Site; sweep paved areas, rake clean landscaped surfaces.

G. Remove waste and surplus materials, rubbish, and construction facilities from Site.

END OF SECTION

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SECTION 01 73 00

EXECUTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: General administrative and procedural requirements governing execution of the work including, but not limited to, the following:
   1. Construction layout.
   2. Installation of the work.
   3. Coordination of Owner installed products.
   4. Progress cleaning.
   5. Starting and adjusting.
   6. Protection of installed construction.

1.2 INFORMATIONAL SUBMITTALS

A. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

B. Final Property Survey: Submit copy showing the work performed and record survey data.

1.3 QUALITY ASSURANCE

A. Manufacturer's Installation Instructions: Obtain and maintain on site manufacturer's written recommendations and instructions for installation of products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Comply with requirements specified in other Sections.
   1. For projects requiring compliance with sustainable design and construction practices and procedures, use products for patching that comply with sustainable design requirements.

B. Existing Materials: Use materials for patching identical to existing 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 existing materials.

C. Progress Cleaning:
   1. Provide covered containers for deposit of waste materials, debris and rubbish.
   2. Use cleaning materials that do not create hazards to health and property and do not damage surfaces.
   3. Use cleaning materials recommended by manufacturer of surface to be cleaned.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examination and Acceptance of Conditions: Before proceeding with each component of the work, examine substrates, areas, and conditions for compliance with requirements for installation tolerances and conditions affecting performance. Record observations.
   1. Written Report: Where a written report listing conditions detrimental to performance of the work is required, include the following:
      a. Description of the work.
      b. List of detrimental conditions, including substrates.
      c. List of unacceptable installation tolerances.
      d. Recommended corrections.
   2. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
   3. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
   4. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

B. Proceed with installation after correcting unsatisfactory conditions. Proceeding with the work constitutes acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to 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. Engage a land surveyor 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. Identification: Owner will identify existing benchmarks, control points, and property corners.

B. 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.

C. 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.

D. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

E. Final Property Survey: Engage a land surveyor to prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.
   1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.
   2. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

3.5 INSTALLATION

A. 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 (2440 mm) in occupied spaces and 90 inches (2300 mm) 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. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

F. Sequence the work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.

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 portions of the 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.

K. Repair or remove and replace damaged, defective, or nonconforming work.

1. Comply with Section 01 77 00 "Closeout Procedures" for repairing or removing and replacing defective work.

3.6 OWNER INSTALLED PRODUCTS

A. Site Access: Provide access to the 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.

3.7 PROGRESS CLEANING

A. 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 degrees F (27 degrees C).
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 contractors are working concurrently.
5. Broom and vacuum clean interior areas prior to start of surface finishing and continue cleaning to eliminate conditions that could affect final finishing.

B. Site: Maintain Project 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 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:
1. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 degrees F (27 degrees C).
2. Provide onsite dumpsters and containers for collection of waste materials, rubbish, and debris.
3. Do not allow waste materials, rubbish, and debris to accumulate and become an unsightly and hazardous condition. Provide additional collection and dispose of debris when scheduled removal is inadequate to prevent accumulation.
4. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to EPA and local regulations.
   a. Utilize containers intended for holding hazardous waste to be stored.
5. Terminate closed chutes into appropriate containers with lids. Open free fall chutes are not permitted.
6. Do not overload trucks to prevent spillage on access and haul routes. Examine traffic areas and maintain clear routes.

7. Clean site and work areas daily, including common areas. Enforce requirements strictly. Legally dispose of waste materials, rubbish, and debris away from site.
   a. Do not bury or burn waste materials onsite. Do not wash waste materials down sewers or into waterways.
   b. Legally dispose of waste materials and comply with 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 ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.8 STARTING AND ADJUSTING

A. Coordinate startup and adjusting of equipment and operating components with 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.

E. Manufacturer's Field Service: Comply with qualification requirements in Section 01 40 00 "Quality Requirements."

3.9 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed work is without damage or deterioration at time of Substantial Completion.

B. Protection of Existing Items: Provide protection and ensure that existing items to remain undisturbed by construction are maintained in condition that existed at commencement of the work.

C. Comply with manufacturer's written instructions for temperature and relative humidity.

3.10 CORRECTION OF THE WORK

A. Repair or remove and replace defective construction. Restore damaged substrates and finishes.

1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

B. Restore permanent facilities used during construction to their specified condition.

C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION

SECTION 01 73 29

CUTTING AND PATCHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Requirements and limitations of cutting and patching of work.
   1. Execute cutting, fitting, and patching, including attendant excavation and backfill, required to complete work or to:
      a. Cutting, fitting, and patching necessary to complete the work.
      b. Cutting, fitting, and patching necessary to repair existing work or work damaged by construction activities.
      c. Uncover and replacement for work performed out of sequence.
      d. Removal and replacement of defective work and work deemed as not in compliance with the Contract Documents.
      e. Uncovering and replacement of work that had been covered prior to required observations.
      f. Fit parts of the work.
      g. Uncover work covered prior to Architect's required observation.
      h. Removal or field samples and mockups.
      i. Removal of testing samples.
      j. Repair of penetrations for mechanical, electrical, and plumbing work.

1.2 DEFINITIONS

A. Cutting: Removal of construction necessary to permit installation or performance of other work.

B. Patching: Fitting and repair work required to restore surfaces to original condition or like new after installation of other work.

1.3 SUBMITTALS

A. Cutting and Patching Plan: Submit plan describing procedures at least 10 days prior to the time cutting and patching will be performed. Include the following information:
   1. Extent: Describe reason for and extent of each occurrence of cutting and patching.
   2. Changes to In Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and significant visual elements.
   3. Products: List products used for patching and entities that will perform patching work.
      a. Indicate products necessary to comply with sustainable design.
   4. Dates: Indicate when cutting and patching will be performed.
   5. Structural Integrity: Identify if the structural integrity of the building or a member will be penetrated and indicate how the overall structural integrity will be maintained.

6. Utilities, Mechanical, and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted.
    a. Include description of provisions for temporary services and systems during interruption of permanent services and systems.

B. Submit written request to Architect in advance of executing cutting or alteration which affects:
1. Work of Owner or separate contractor.
2. Structural value or integrity of any element of project.
3. Integrity or effectiveness of weather exposed or moisture resistant elements or systems.
4. Efficiency, operational life, maintenance, or safety of operational elements.
5. Visual qualities of sight exposed elements.

C. Request Include:
1. Identification of Project.
2. Date and time of the work.
3. Location and description of affected work.
4. Necessity for cutting, alteration, or excavation.
5. Effect on work of Owner or separate contractor, or on structural or weatherproof integrity of Project.
6. Description of proposed work:
    a. Scope of cutting, patching, alteration, or excavation.
    b. Trades who will execute work.
    c. Products proposed to be used.
    d. Extent of refinishing to be done.
    e. Cost proposal when applicable.
7. Alternatives to cutting and patching.
8. Written permission of separate contractor whose work will be affected.

D. Should conditions of work or schedule indicate change of products from original installation, submit request for substitution as specified in Section 01 25 00 "Substitution Procedures."

E. Submit written notice to Architect designating date and time work will be uncovered or altered.

1.4 QUALITY ASSURANCE

A. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

B. 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.

C. Operational Elements: Do not cut and patch operating elements and related components that results in reducing the capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
   1. Primary operational systems and equipment.
   2. Fire separation assemblies.
   3. Air or smoke barriers.
   4. Fire suppression systems.
   5. Mechanical systems piping and ducts.
   6. Control systems.
   7. Communication systems.
   8. Fire detection and alarm systems.
   9. Conveying systems.
   10. Electrical wiring systems.
   11. Operating systems of special construction.

D. Miscellaneous Elements: Do not cut and patch elements or related components that change the load bearing capacity, resulting in a reduction of capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.
   1. Water, moisture, or vapor barriers.
   2. Membranes and flashings.
   3. Exterior curtain wall construction.
   4. Equipment supports.
   5. Piping, ductwork, vessels, and equipment.
   6. Noise and vibration control elements and systems.
   7. Sprayed fire resistive material.

E. Visual Requirements: Do not cut and patch construction resulting in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces 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.
   1. If possible, retain original Installer or fabricator to cut and patch exposed work. If possible, engage original Installer or fabricator. If original installer is not available, engage recognized, experienced, and specialized firm for the work.
      a. Processed concrete finishes.
      b. Ornamental metal.
      c. Matched veneer woodwork.
      d. Preformed metal panels.
      e. Roofing.
      f. Firestopping.
      g. Window system.
      h. Fluid applied flooring.
      i. Wall covering.

j. HVAC enclosures, cabinets, or covers.

F. Cutting and Patching Conference: Before proceeding, meet at site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.5 COORDINATION

A. Coordinate cutting and patching with selective demolition and deconstruction.

1.6 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials complying with conditions of existing warranties.
1. Notify warrantor before cutting and patching warranted work. If necessary for warranty, engage authorized installer or repair personnel to perform patching and repair work.
2. Notify warrantor on completion of cutting and patching. Obtain documentation verifying that existing work has been inspected and warranty remains in effect. Submit documentation at Project closeout.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Comply with specified requirements, governing codes, and recognized product and material standards for each product and material.
1. Sustainable Design Projects: Provide patching and repair materials complying with sustainable design requirements.

B. Existing Materials: Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
1. If identical materials are unavailable or cannot be used, submit a request for a substitution complying with Section 01 25 00 "Substitution Procedures." In the Substitution Request, recommend materials that, when installed, will match the visual and functional performance of existing materials.

C. Should conditions of work or schedule indicate change of products from original installation, submit request for substitution as specified in Section 01 25 00 "Substitution Procedures."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine existing conditions of Project, including elements subject to damage or to movement during cutting, patching, excavating, and backfilling.

B. After uncovering work, examine conditions affecting installation of Products, or performance of work.

C. Report unsatisfactory or questionable conditions to Architect in writing. Do not proceed with work until Architect has provided further instructions.

3.2 PREPARATION

A. Temporary Support: Provide temporary support of work to insure continued structural integrity of the work.

B. Protection: Protect existing construction during cutting and patching to prevent damage to adjacent work. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

C. Adjoining Occupied Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining 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 50 00 "Temporary Facilities and Controls."

D. Existing Services: Where removal, relocation, or abandonment is necessary, bypass existing services before cutting to avoid interruption of services to occupied areas. Comply with requirements of Section 01 50 00 "Temporary Facilities and Controls" for temporary utilities and services.

E. Provide positive methods of dust control and apply dust control materials to minimize raising dust from cutting and patching operations.

3.3 DUST CONTROL

A. Provide positive methods of dust control and apply dust control materials to minimize raising dust from cutting and patching operations.

3.4 EXECUTION

A. Execute cutting and demolition by methods which will prevent damage to other work and will provide proper surfaces to receive installation of repairs.

B. Execute fitting and adjustment of products to provide finished installation to comply with specified products, functions, tolerances, and finishes.

C. Restore work which has been cut or removed. Install new products to provide Work in accordance with requirements of Contract Documents.

D. Fit work airtight to pipes, sleeves, ducts, conduit, and penetrations through surfaces. Where fire rated separations are penetrated, fill space around pipe or insert with material with physical characteristics equivalent to fire resistance requirement of penetrated surface.

E. Refinish entire surfaces as necessary to provide even finish to match adjacent finishes:
   1. For continuous surfaces, refinish to nearest intersection.
   2. For assembly, refinish entire unit.

F. Employ original installer or fabricator of work performed to perform cutting and patching for:
   1. Weather exposed or moisture resistant elements.
   2. Sight exposed finished surfaces.

3.5 CUTTING AND PATCHING

A. Cutting and Patching: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
   1. Cut existing construction to provide for installation of components or performance of construction, and subsequently patch as necessary to restore surfaces to an original condition.

B. Cutting: Cut existing 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. Use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
   2. Finished Surfaces: Cut or drill from 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 earthwork specifications 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.

C. 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 possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications.
   1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
   2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction to eliminate 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 are removed, extend one finished area into another, patch and repair floor and wall surfaces in new space. Provide even surface of uniform finish, color, texture, and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary to achieve uniform color and appearance.
4. Painted Surfaces: Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
5. Ceilings: Patch, repair, or rehang existing ceilings as necessary to provide an even plane surface of uniform appearance.
6. Mechanical, Electrical, and Plumbing: Fit work airtight to pipes, sleeves, ducts, conduit, and penetrations through surfaces.
7. Fire Resistive Separations and Penetrations: Where fire rated separations are penetrated, fill space around pipe or insert with material complying with fire resistance requirements of penetrated surface. Refer to fireproofing and fire stopping requirements.
8. Exterior Building Enclosure: Patch components and restore enclosure to a weathertight condition.

3.6 CLEANING

A. Restore surfaces to match adjacent surfaces. Clean area dust, dirt, and debris caused by cutting and patching. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

B. Return to condition existing before cutting and patching.

END OF SECTION

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SECTION 01 77 00

CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Administrative and procedural requirements for contract closeout, including, but not limited to, the following:
   1. Substantial Completion procedures.
   2. Final completion procedures.
   3. Closeout submittals and warranties.
   4. Payment and release of liens.
   5. Final cleaning.
   6. Repair of the work.

1.2 ACTION SUBMITTALS

A. Product Data: Technical data for each type of cleaning agent.

B. Contractor's List of Incomplete Items (Punchlist): Initial submittal at Substantial Completion.

C. Certified List of Incomplete Items: Final submittal at final completion.

1.3 CLOSEOUT SUBMITTALS

A. Submit the following:
   1. Final application for payment.
   2. Certificate of Occupancy.
   3. Certificate of inspections for mechanical and electric systems.
   4. Certificates of Release: Certificates from authorities having jurisdiction.
   5. Certificate of Insurance: Certificates for continuing coverage.
   6. Certificate of Insurance for Products and Completed Operations.
   7. Project record documents.
   8. Operation and maintenance data.
   9. Warranties and bonds.
   10. Evidence of payments and release of liens.
   11. Final adjustment of accounts.
   12. Spare parts, maintenance materials, and extra materials.
   13. Field Report: Report of pest control inspection.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Schedule of Maintenance Material Items: Submit extra materials as specified in the individual specification sections.

1.5 SUBSTANTIAL COMPLETION PROCEDURES

A. Upon determination that the work is substantially complete, notify Architect and submit written certification that the Work is complete.

B. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.

1. Contractor’s 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.

C. 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 specified closeout submittals, including project record documents, operation and maintenance manuals, damage or settlement surveys, property surveys, 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 extra materials 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.
    a. Schedule of Maintenance Material Items: Prepare and submit schedule of extra material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Owner's signature for receipt of submittals.
5. Submit testing, adjusting, and balancing records.
6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

D. 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 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.
6. Advise Owner of changeover in utility services.
7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
8. Terminate and remove temporary facilities from site, along with mockups, construction tools, and similar elements.
9. Complete final cleaning requirements.
10. Touch up paint and otherwise repair and restore marred exposed finishes to eliminate visual defects.

E. Substantial Completion 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 inspection and tests accompanied by the list of incomplete items.
1. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements.
2. 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, the Architect will supplement the Contractor’s list with such items.
    a. Architect’s 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.
3. 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.
4. Reinspection: Upon correction of deficiencies, notify Architect requesting a reinspection accompanied by the list of items to be complete or corrected and date of anticipated completion.

F. Substantial Completion: Upon concurrence that the project is substantially complete, the Architect will prepare a Certificate of Substantial Completion on AIA Form G704 accompanied by the Constructor’s List of Incomplete Items that has been verified and amended by Architect.
1. The Architect will submit the Certificate of Substantial Completion to the Owner and Contractor for written acceptance of the responsibilities assigned in the Certificate.

G. Contractor Activities: Upon receipt of the certification of Substantial Completion, perform the following activities:
1. Allow Owner occupancy of the project as stated in the Certification of Substantial Completion provisions.
2. Obtain and submit the Certificate of Occupancy, operating certificates, and similar releases enabling the Owner unrestricted use of the work.
3. Complete work listed for completion or correction within designated form.

4. Advise Owner of pending insurance change over requirements.
5. Perform final cleaning.
6. Make final change over of permanent locks and transmit keys to Owner.

1.6 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:
   1. Submit final Application for Payment in accordance with Section 01 29 00 "Payment Procedures." and the Agreement.
   2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items for completion or correction (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. Equipment Testing: Submit certified list of completed testing of installed equipment and system stating that testing was performed in the presence of the Owner’s representative and are operational.
   4. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
   5. Submit pest control final inspection report.
   6. Submit final completion photographic documentation.

B. Final 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.
   1. Inspection: On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
   2. Reinspection: Request reinspection when the work identified in previous inspections as incomplete is completed or corrected with written certification that:
      a. The Contract Documents have been reviewed and the work has been examined for compliance and completed in accordance with Contract Documents.
      b. Equipment and systems have been tested in presence of Owner's representative and are operational.
      c. The work is completed and ready for final examination.

C. Determination of Final Completion: Architect will inspect the work to verify status of completion within seven calendar days after receipt of certification.
   1. Should Architect deem the work is incomplete or defective, the Architect will notify Contractor in writing, itemizing the work that is incomplete or defective.
   2. Take immediate action to finish incomplete work and remedy deficiencies before requesting a second inspection accompanied by a second written certification that work is complete.
   3. Architect will reinspect the work.
      a. If the work is found complete, Architect will request submission of closeout submittals.

b. If the work is again found incomplete, complete the work and request a reinspection accompanied by a third written certification that work is complete.

1.7 REINSPECTION FEES

A. In the event the Architect is required to perform reinspections due to the failure of the work to comply with claims of completion certified by Contractor:
   1. The Owner will compensate Architect for additional services.
   2. The Owner will deduct amount of compensation from final payment to Contractor.

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. Include the following information at the top of each page:
      a. Project name.
      b. Date.
      c. Name of Architect.
      d. Name of Contractor.
      e. Page number.
   4. Submit list of incomplete items in the following formats:
      a. MS Excel electronic file. Architect will return annotated file.
      b. PDF electronic file. Architect will return annotated file.

1.9 CLOSEOUT SUBMITTALS

A. Upon request of Architect after a successful Final Completion Inspection, submit the following documents for closeout:
   1. Evidence of compliance with requirements of governing authorities:
      a. Certificate of Occupancy.
      b. Certificate of Inspection: Mechanical and electrical systems.
   2. Project Record Documents: Refer to Section 01 78 39 "Project Record Documents."
   3. Operating and Maintenance Data: Refer to Section 01 78 23 "Operation and Maintenance Data."
   4. Warranties and bonds.
   5. Spare Parts and Maintenance Materials: Provide products, spare parts, and maintenance materials in quantities specified in each specification section in addition to that required for completion of work.
      a. Coordinate delivery with Owner; deliver to site, store properly, and obtain receipt prior to final payment.

6. Certificates of Insurance:
   a. Certificates for products and completed operations.
   b. Certificate for continuing coverage.
7. Field Report: Submit report for pest control inspection.

1.10 PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the work where warranties are indicated to commence on dates other than date of Substantial Completion, 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 in an orderly sequence based on the table of contents of Project Manual.

D. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
   1. Submit by uploading to web based project software site.

E. Warranties in Paper Form:
   1. Bind warranties and bonds in heavy duty, three ring, vinyl covered, loose leaf binders, thickness necessary to accommodate contents, and sized to receive 8-1/2 inch by 11 inch (215 mm by 280 mm) 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.

F. Provide additional copies of each warranty to include in operation and maintenance manuals.

1.11 PAYMENT AND RELEASE OF LIENS

A. Evidence of Payment:
   1. Contractor's Affidavit of Payment of Debts and Claims: AIA G706.
   2. Contractor's Affidavit of Release of Liens: AIA G706A.
   3. Attachment to Contractor's Affidavit of Release of Liens:
      a. Consent of Surety to Final Payment: AIA G707.
      b. Contractor's Release or Waiver of Liens.

c. Separate releases of waivers of liens from subcontractors, suppliers, and others with lien rights against property of Owner, together with list of those parties.

4. Submittals shall be duly executed before delivery to Owner.

B. Adjustments of Accounts: Submit final statement of accounting to Architect.

1. Statement shall reflect adjustments to Contract Sum: Include the following data:
   a. Original Contract Sum.
   b. Additions and deductions resulting from:
      1) Previous Change Orders.
      2) Allowances.
      3) Unit Prices.
      4) Deductions for uncorrected work.
      5) Penalties and bonuses.
      6) Deductions for liquidated damages.
      7) Deductions for reinspection payments.
      8) Other adjustments.
   c. Total Contract Sum, as adjusted.
   d. Previous payments.
   e. Sum remaining due.

C. Upon receipt and review, Architect will prepare final Change Order, reflecting approved adjustments to Contract Sum that were not previously made by Change Orders.

D. Final Application for Payment: Refer to Section 01 29 00 "Payment Procedures."

E. Adjustment: No adjustments to Contract requested by Contractor will be allowed if asserted after execution of Final Payment of Contract.

1.12 CONTRACTOR CORRECTION PERIOD

A. Prior to expiration of the Contractor’s Correction Period prior to the one year anniversary of the Date of Substantial Completion, Owner and Contractor will make visual inspection of the project to determine whether further correction of work is required in accordance with provisions of Contract Documents.

B. During the Correction Period, the Owner will promptly notify the Contractor in writing of observed deficiencies. Schedule a time and establish a schedule for correction of deficiencies.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. Perform final cleaning. Conduct cleaning and waste removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete cleaning operations before requesting inspection for certification of Substantial Completion for entire project or for a designated portion of project:
    a. Clean 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 not planted, mulched, or paved to a smooth, even-textured surface.
    d. Remove tools, construction equipment, machinery, and surplus material from site.
    e. Remove snow and ice to provide safe access to building.
    f. 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.
    g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
    h. Sweep concrete floors broom clean in unoccupied spaces.
    i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
    j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and noticeable, vision obscuring materials. Replace chipped or broken glass and damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
    k. Remove labels that are not permanent.
    l. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
    m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
    n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
    o. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
    p. Clean luminaires, lamps, globes, and reflectors to function with full efficiency.
    q. Leave Project clean and ready for occupancy.

C. Pest Control: Comply with pest control requirements in Section 01 50 00 "Temporary Facilities and Controls." Prepare written report.

D. Construction Waste Disposal: Comply with waste disposal requirements in Section 01 50 00 "Temporary Facilities and Controls."

E. Testing and Inspections: Comply with Section 01 40 00 "Quality Requirements" and the individual specification sections for required testing and inspections.
   1. Submit a schedule of tests and inspections and indicate the date results of inspections and testing.

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 repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that 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.

END OF SECTION

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SECTION 01 78 23

OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
   1. Operation and maintenance documentation directory manuals.
   2. Emergency manuals.
   3. Systems and equipment operation manuals.
   4. Systems and equipment maintenance manuals.
   5. Product maintenance manuals.

1.2 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.

1.3 CLOSEOUT SUBMITTALS

A. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
   1. Architect will comment on whether content of operation and maintenance submittals is acceptable.
   2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operation and maintenance manuals in the following format:
   1. Submit by uploading to web-based project software site. Enable reviewer comments on draft submittals.

C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect will comment on whether general scope and content of manual are acceptable.

D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect will return copy with comments.
   1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's comments and prior to commencing demonstration and training.

E. Comply with Section 01 77 00 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

1.4 FORMAT OF OPERATION AND MAINTENANCE MANUALS

A. 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: Bookmark 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.

1.5 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Organization of Manuals: 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. 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."

1.6 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY MANUAL

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals. List items and their location to facilitate ready access to desired information. Include the following:

1. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
2. 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.
3. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

1.7 EMERGENCY MANUALS

A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

B. Content: Organize manual into a separate section for each of the following:

1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

C. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

1. Fire.
2. Flood.
3. Gas leak.

4. Water leak.
5. Power failure.
6. Water outage.
7. System, subsystem, or equipment failure.
8. Chemical release or spill.

D. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

E. Emergency Procedures: Include the following, as applicable:
1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

1.8 SYSTEMS AND EQUIPMENT OPERATION MANUALS

A. Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, and routine and special operating procedures.
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.

B. 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.

C. 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.

D. 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.

E. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

F. Piped Systems: Diagram piping as installed, and identify color coding where required for identification.

1.9 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Systems and Equipment Maintenance Manuals: Assemble a complete set of data indicating maintenance of each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance documentation, preventive maintenance procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information.
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.

B. 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 warranties and bonds as described below.

C. 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.

D. Manufacturers' Maintenance Documentation: Include the following information for each component part or piece of equipment:
   1. Standard maintenance instructions and bulletins; 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.
      a. 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.
   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.

E. 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.

F. 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.

G. 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.

H. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

I. Warranties: Submit copies of warranties and lists of circumstances and conditions that would affect validity of warranties or bonds. Include procedures to follow and required notifications for warranty claims.

J. 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 maintenance manuals.

1.10 PRODUCT MAINTENANCE MANUALS

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. 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.

C. 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.

D. 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.

E. Maintenance Procedures: Submit 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.

F. Repair Materials and Sources: Submit lists of materials and local sources of materials and related services.

G. Warranties: Include copies of warranties and lists of circumstances and conditions that would affect validity of warranties or bonds.
   1. Include procedures to follow and required notifications for warranty claims.

PART 2 - PRODUCTS
Not used.

PART 3 - EXECUTION
Not used.

END OF SECTION

SECTION 01 78 39

PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Administrative and procedural requirements for project record documents, including the following:
   1. Record Drawings.
   2. Record Specifications.
   3. Record Product Data.
   4. Miscellaneous record submittals.

1.2 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:
   1. Number of Copies: Submit clean set(s) of marked up record prints.
      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 one clean paper copy set(s) of marked up record prints.
         2) Submit PDF electronic files of scanned record prints.
         3) Print and PDF each drawing, whether or not changes and additional information were recorded.

B. Record Specifications: Submit one annotated paper copy and an annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.

C. Record Product Data: Submit one paper copy and an annotated PDF electronic files and directories of each submittal.
   1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked up Product Data as a component of manual.

D. Miscellaneous Record Submittals: Refer to the individual Specification Sections for miscellaneous recordkeeping requirements and submittals in connection with various construction activities. Submit one paper copy and an annotated PDF electronic files and directories of each submittal.

E. Reports: Submit written report monthly indicating items incorporated into project record documents concurrent with progress of the work, including revisions, concealed conditions, field changes, product selections, and other notations incorporated.

1.3 BURDEN OF ACCURACY

A. The burden of accuracy is the responsibility of the Contractor who shall bear costs of damages incurred by Owner due to inaccuracies or incompleteness of submitted Record Documents for the period of time following Substantial Completion defined by Agreement and the Conditions of the Contract.

1.4 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 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.
      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. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked up record prints with Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings:
   1. Format: Annotated PDF electronic file with comment function enabled.
   2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
   3. Refer instances of uncertainty to Architect through Construction Manager for resolution.
   4. Architect will furnish Contractor with one set of digital data files of the Contract Drawings for use in recording information.
      a. See Section 01 31 00 "Project Management and Coordination" for requirements related to use of Architect's digital data files.
      b. Architect will provide data file layer information. Record markups in separate layers.

C. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
   1. Record Prints: Organize record prints 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.

1.5 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
   1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
   2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
   3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
   4. Note related Change Orders, record Product Data, and record Drawings where applicable.

B. Format: Submit record Specifications as annotated PDF electronic file and an annotated paper copy of the project manual.

1.6 RECORD PRODUCT DATA

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. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
   1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
   2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
   3. Note related Change Orders, record Specifications, and record Drawings where applicable.

C. Format: Submit record Product Data as annotated PDF electronic file and a paper copy.
   1. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

1.7 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. Miscellaneous record submittals include but are not limited to:
   1. Reviewed shop drawings, product data, and samples.
   2. Field test reports.
   3. Inspection certificates.
   4. Manufacturer's certificates.
   5. Inspections by authorities having jurisdiction.
   6. Documentation of foundation depths.
   7. Special measurements or adjustments.
   8. Tests and inspections.
   9. Surveys.
   10. Design mixes.

B. Format: Submit miscellaneous record submittals as PDF electronic file and a paper copy.
   1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 RECORD DOCUMENTS

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and modifications to the Documents as they occur. Do not wait until the end of the project. Architect will periodically review record documents to assure compliance.

B. Maintenance of Record Documents: Store record documents 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

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SECTION 01 79 00

DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Administrative and procedural requirements for instructing Owner's personnel, including the following:
   1. Instruction in operation and maintenance of systems, subsystems, and equipment.
   2. Demonstration and training video recordings.

B. Unit Price for Instruction Time: Length of instruction time will be measured by actual time spent performing demonstration and training in required location. No payment will be made for time spent assembling educational materials, setting up, or cleaning up. See requirements in Section 01 22 00 "Unit Prices."

1.2 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. Qualification Data: Submit data for instructor videographer.

C. Attendance Record: Submit record for each training module, submit list of participants and length of instruction time.

D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.3 CLOSEOUT SUBMITTALS

A. Demonstration and Training Video Recordings: Submit two copies within 15 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 and address of videographer.
      c. Name of Architect.
      d. Name of Construction Manager.
      e. Name of Contractor.
      f. 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 prepared in same PDF file format required for operation and maintenance manuals specified in Section 01 78 23 "Operation and Maintenance Data."

1.4 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

B. Instructor Qualifications: A factory authorized service representative experienced in operation and maintenance procedures and training.

C. Videographer Qualifications: A professional videographer experienced photographing demonstration and training events similar to those required.

D. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00 "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:
1. Confirm schedule of training days and times with Owner’s designated personnel. Adjust schedule co accommodate Owner’s staff.
2. Inspect and discuss locations and other facilities required for instruction.
3. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
4. Review required content of instruction.
5. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.5 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 have been reviewed and approved by Architect.

1.6 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, required by individual Specification Sections.

B. Training Modules: Develop a learning objective and 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. Systems and equipment operation manuals.
   c. Systems and equipment maintenance manuals.
   d. Product maintenance manuals.
   e. Project Record Documents.
   f. Identification systems.
   g. Warranties and bonds.
   h. 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.

1.7 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.

1.8 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 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. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance based test.

F. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

1.9 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

A. 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. Digital Video Recordings: Provide high resolution, digital video in MPEG format, produced by a digital camera with minimum sensor resolution of 12 megapixels and capable of recording in full HD mode with vibration reduction technology.
   1. Submit video recordings on CD-ROM or thumb drive. Confirm all recordings are viable prior to submittal.
   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 on 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 recording that describes the following for each Contractor involved on the Project, arranged according to Project Manual table of contents:
      a. Name of Contractor/Installer.
      b. Business address.
      c. Business phone number.
      d. Point of contact.
      e. Email 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. Include description of items being viewed. Provide dubbed additional clarifying narration off-site after recording as necessary.

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.

PART 2 - PRODUCTS
Not used.

PART 3 - EXECUTION
Not used.

END OF SECTION

SECTION 01 91 00

BUILDING SYSTEMS COMMISSIONING

PART 1 GENERAL

1.1 DESCRIPTION

A. Commissioning this project shall include MEP systems installation and operations. The commissioning process shall generally follow the ASHRAE Guideline 0 and ASHRAE Std 90.1 I-P. Commissioning for this project shall be as necessary for full compliance with 2015 IECC commissioning requirements.

B. Commissioning Agent (CA): The owner will engage the CA under separate contract.

C. Mechanical and plumbing commissioning shall be done by the registered design professional or approved agency.

D. For electrical commissioning, the registered design professional shall provide evidence that the system is operating in accordance with the construction documents.

E. Commissioning: Commissioning is a systematic process of ensuring that all building systems

F. perform interactively according to the design intent and the owner's operational requirements. Commissioning during the construction phase is intended to achieve the following specific objectives according to the Contract Documents:
   1. Observe and document equipment and systems installations and operations.
   2. Observe and document proper performance of equipment and systems per the construction documents.
   3. Review systems manual and closeout documentation.

G. The commissioning process does not take away from or reduce the responsibility of the

H. system designers or installing contractors to provide a finished and fully functioning product, equipment, or system.

I. Abbreviations: The following are common abbreviations used in the specifications and in the Commissioning Plan.

A/E	Architect & Design Engineers	FT	Functional Performance Test
CA/CxA	Commissioning Agent	GC	General Contractor
CC	Construction Manager	MC	Mechanical Contractor
Cx	Commissioning	PC	Project Checklist
CxP	Commissioning Plan	Subs	Sub Contractors
EC	Electrical Contractor	MC	Mechanical Contractor
PLC	Plumbing Contractor	TAB	Test And Balance Contractor
FC	Fire Alarm Contractor	SC	Security Contractor
CTC	Controls Contractor	TC	Technology Contractor

J. Divisional specifications sections related to commissioning activities are as follows:

1. Division 01 - General Requirements
2. Division 22 - Plumbing
3. Division 23 - HVAC&R
4. Division 26 - Electrical

1.2 COORDINATION

A. Commissioning Team. The members of the commissioning team consist of the Commissioning Agent (CA), the owner's Project Manager (PM), the designated representative of the owner's Construction Management firm (CM), the General Contractor (GC or Contractor), the architect and design engineers (particularly the mechanical engineer), the Mechanical Contractor (MC), the Electrical Contractor (EC), the TAB representative, the Controls Contractor (CC), any other installing subcontractors or suppliers of equipment. If known, the Owner's building or plant operator/engineer is also a member of the commissioning team.

B. Management. The CA will report directly to the Owner for commissioning related functions and copy the Architect and Contractor as required. The CA directs and coordinates the commissioning activities and reports with the CM and PM. All team members work together to fulfill their contracted responsibilities and meet the objectives of the Contract Documents.

C. Scheduling. The CA will work with the CM and GC according to established protocols to schedule the commissioning activities. The CM will notify the CA as to the readiness of systems and equipment for functional testing. The CA will provide sufficient notice to the CM and GC for scheduling commissioning activities for such equipment and systems upon notification from the CM that said systems will be ready for testing and or commissioning. The GC will integrate all commissioning activities into the master project schedule and will provide a copy of the schedule, including all updates, to the CA for his use in commissioning this project. All parties will address scheduling problems and make necessary notifications in a timely manner in order to expedite the commissioning process. It is understood that the progress for commissioning of systems will be dependent upon the progress of the following:
   1. Response Times: Timelines for delivering information requested, required, or providing responses to the CA are essential to providing the construction product to the owner on time as well as facilitating the commissioning process. The contractor shall adhere to the following to meet this objective:
   2. Written response to Issue Log, Punchlist, Site Observation report, or request for information, clarification, or other documentation necessary to facilitate and carry out the commissioning process: 07 Calendar days from the date request was received by contractor in writing.
   3. Discrepancies identified in record drawings during the construction phase: 15 calendar days.

1.3 COMMISSIONING PROCESS

A. Commissioning Plan. The Commissioning Plan provides guidance in the execution of the commissioning process. The CA will update the plan which is then considered the "final" plan, though it will continue to evolve and expand and be updated on a regular basis for content by the CA as the project progresses. The Specifications will take precedence over the Commissioning Plan.

B. Commissioning Process. The following narrative provides a brief overview of the typical commissioning tasks during construction and the general order in which they

occur.

C. Equipment documentation is submitted to the CA during normal submittals and concurrent with the design team submittal submission, including detailed start-up procedures.

D. In general, the check-out and performance verification proceeds from simple to complex; from component level to equipment to systems and intersystem levels with CHECKLISTS being completed before functional testing.

E. The Subs, under their own direction, execute and document the CHECKLISTS and perform start-up and initial check-out.

F. The checklist procedures are executed by the contractor responsible for their respective systems and under their respective scope of work. An example of a coordinated procedure would be an AHU that requires Electrical, FA Duct Smoke Detector, DDC Controls, and a VFD for operation. This would require a signature from the Mechanical, Electrical, Fire Alarm, Controls contractor, and TAB sub.

G. Functional Testing of the MEP SYSTEMS shall be scheduled by the CA and GC and shall be conducted by the appropriate sub-contractor. The CA will direct the testing and sub-contractor will carry out the test.

H. Items of non-compliance in material, installation, or setup are corrected and the system is to be retested at the contractor's expense.

I. The CA reviews the O&M documentation for completeness.

J. Commissioning is completed before Substantial Completion.

K. Deferred or seasonal testing is to be conducted as specified and as required.

1.4 RESPONSIBILITIES

A. Commissioning Team: The responsibilities of various parties in the commissioning process are provided in this section and are typically referenced as follows: Division 01 - General Requirements, Division 22 - Plumbing, Division 23 - HVAC & R, and 26 - Electrical. It is noted that the services for the Owner's Project Manager, Construction Manager, Architect, MEP, Special systems design consultants, and Commissioning Agent are not provided for in this contract. That is, the Contractor is not responsible for providing their services except where stated in other divisional specs sections. Their responsibilities are listed here to clarify the commissioning process.
   1. The commissioning team, at a minimum, shall consist of the following:
      a. Owner
      b. Commissioning Authority
      c. Architect
      d. Design Engineer
      e. Prime Contractor
      f. Divisional Contractors and Subcontractors
      g. Vendors or Factory reps where required by the divisional specs

B. All Parties
   1. Follow the Commissioning Plan and specifications.
   2. Attend commissioning scoping meetings and commissioning meetings as necessary.

3. Assist the CA in carrying out commissioning process activities.

C. Architect (A/E)
   1. Construction and Acceptance Phase
      a. Owner Manages the CA contract.
      b. Attend the commissioning scoping meeting and selected commissioning team meetings.
      c. Perform normal submittal review, construction observation, as-built drawing preparation, O&M manual preparation, etc., as contracted. Provide submittals for MEP the CA concurrent with the design consultant's submittal review.
      d. Provide all design narrative documentation and updates as requested by the CA for systems to be commissioned.
      e. Coordinate resolution of system and component deficiencies identified during commissioning activities.
      f. Copy the CA on all responses to RFI/RFC/Revisions as issued by the design team related to systems being commissioned.
      g. Furnish a copy of all construction documents, addenda, change orders, RFI's, ASI's, and approved submittals and shop drawings related to commissioned equipment to the CA.
      h. Review and approve O&M documentation.
      i. Warranty Period
      j. Coordinate resolution of design non-conformance issues, design deficiencies, and contractor related deficiencies identified during warranty-period commissioning.

D. MEP & Special Systems Designers/Engineers (of the A/E)
   1. Construction and Acceptance Phase
      a. Perform normal submittal review, construction observation, as-built drawing preparation, etc., as contracted. Conduct site observations as contracted and required by the owner and A/E.
      b. Provide an updated design narrative and sequences documentation requested by the CA for functional testing of MEP systems. The designers shall assist (along with the contractors) in clarifying the operation and control of commissioned MEP equipment in areas where the specifications, control drawings or equipment documentation is not sufficient for writing detailed testing procedures.
      c. Attend commissioning scoping meetings and other selected commissioning team meetings.
      d. Participate in the resolution of system deficiencies identified during commissioning, according to the contract documents.
      e. Prepare and submit the final as-built design intent and operating parameters documentation. Review and approve the O&M manuals.
      f. Review, comment and approve the functional test procedures for sufficiency prior to their use.
      g. Utilizing the sampling method, review and provide comments and recommendations for the checklists for major pieces of equipment for sufficiency prior to their use.
      h. Warranty Period
      i. Participate in the resolution of non-compliance, non-conformance, and design deficiencies identified during commissioning warranty-period

commissioning.

E. Commissioning Agent (CA)
   1. Construction and Acceptance Phase
      a. The CA is not responsible for design concepts, design criteria, compliance with codes and industry design standards, design or general construction scheduling, cost estimating, test and balance, or construction management. The CA may assist with issue resolution for non-conformance or deficiencies, but ultimately that responsibility resides with the general contractor and the A/E. The primary function of the CA is to develop and coordinate the execution of a testing plan, observe and document and verify using sampling techniques that systems are functioning in accordance with the documented OPR and the Construction Documents. The Contractors will provide all of their own tools to install, start, check out and functionally test equipment and systems.
      b. Coordinates and directs the commissioning activities in a logical, sequential, and efficient manner using consistent protocols and forms, centralized documentation, clear and regular communications and consultations with all necessary parties, frequently updated timelines and schedules, and technical expertise.
      c. Coordinate the commissioning work and, with the GC and CM, ensure that commissioning activities are being scheduled into the master project schedule.
      d. Revise the Commissioning Plan during the construction phase as necessary.
      e. Request and review information required to perform commissioning tasks, including O&M materials, contractor start-up, and check-out procedures as necessary.
      f. Before start-up, gather and review the current control sequences and interlocks and work with contractors and design engineers until sufficient clarity has been obtained, in writing, to be able to write testing procedures as necessary.
      g. Write and distribute systems functional performance Test requirements.
      h. Attend selected planning and job-site meetings to obtain information on construction progress. Review construction meeting minutes for revisions and substitutions relating to the Commissioning process. Assist in resolving discrepancies.
      i. Perform site observations as necessary to observe component and system installations for testing of systems.
      j. Oversee sufficient functional testing of the control system.
      k. With assistance from installing contractors and A/E, write the functional performance test procedures for equipment and systems. This may include energy management control system trending or manual functional testing.
      l. Analyze any functional performance trend logs and monitoring data as required to verify performance.
      m. Coordinate, witness, and approve manual functional performance tests performed by installing contractors. Coordinate retesting with the GC and A/E as necessary or required.
      n. Maintain a master issue and resolution log and a separate testing record. Provide the owner and CM/GC with periodic written progress reports and test results with recommended actions.

o. Witness performance testing of control systems and document these tests and include this documentation in Commissioning Record in O&M manuals.
p. Compile and maintain a commissioning record and review building systems manual.
q. Review and approve the preparation of the O&M manuals.
r. Provide a final commissioning report.
s. Warranty Period: Coordinate and supervise required seasonal or deferred testing and deficiency corrections.

F. Construction Manager-Owner's Representative (CM) as applicable
1. Construction and Acceptance Phase
a. Facilitate the coordination of the commissioning work by the CA, working with the GC, to ensure that commissioning activities are being scheduled into the master project schedule.
b. Review and be familiar with the commissioning specifications and final Commissioning Plan-Construction Phase.
c. Attend the commissioning scoping meeting and other commissioning team meetings.
d. Perform the normal review of Contractor submittals.
e. Furnish a copy of all construction documents, addenda, change orders, and approved submittals and shop drawings related to commissioned equipment to the CA.
f. Review the functional performance test procedures submitted by the CA, prior to testing.
g. When necessary, observe and witness checklists, start-up, and functional testing of selected equipment.
h. Review commissioning progress and deficiency reports.
i. Coordinate the resolution of non-compliance and design deficiencies identified in all phases of commissioning.
j. Sign-off (final approval) on individual commissioning tests as completed and passing. Recommend completion of the commissioning process to the Project Manager.
k. Assist the GC in coordinating the training of owner personnel.
l. Warranty Period: Assist the CA as necessary in the seasonal or deferred testing and deficiency corrections required by the contract documents.

G. Owner's Project Manager (PM)
1. Construction and Acceptance Phase
2. Assist the CA as necessary to carry out commissioning activities.
3. Manage the contract of the CA, A/E, and GC.
4. Arrange for facility operating and maintenance personnel to attend various field commissioning activities and field training sessions.
5. Provide final approval for the completion of the commissioning work.
6. Warranty Period: Ensure that any seasonal or deferred testing and any deficiency issues are addressed or that a plan is in place to address issues pending resolution

H. General Contractor (GC)
1. Contractor and their subcontractors and vendors shall assign capable, skilled, and knowledgeable representatives with expertise and authority to act on their behalf and schedule them to participate in and perform commissioning process activities.

2. Construction and Acceptance Phase
    a. Facilitate the coordination of the commissioning work by the CA and ensure that commissioning activities are being addressed in the master construction project schedule.
    b. Include the cost of commissioning tasks to be carried out by the contractor and subs, for commissioning of the building systems in the contract price. This will not include the CA's contract. The CA's contract for commissioning services shall be between the owner and CA.
    c. In each purchase order or subcontract written, include requirements for submittal data, O&M data, commissioning tasks, and training.
    d. Ensure that all Subs execute their commissioning responsibilities according to the Contract Documents and schedule.
    e. A representative shall attend a commissioning scoping meeting and other necessary meetings scheduled by the CA to facilitate the Cx process.
    f. Coordinate and conduct owner training on building and systems operation for equipment provided and installed.
    g. Prepare close-out documents including O&M documents, according to the Contract Documents, including clarifying and updating the original control sequences of operation and As-built drawings.
    h. Warranty Period: Ensure that Subs execute seasonal or deferred functional performance testing, to be witnessed by the CA, according to the specifications
    i. Ensure that Subs correct deficiencies and make necessary adjustments to O&M manuals and final as-built drawings and warranty documents for applicable issues identified in any seasonal and deferred testing.

I. Equipment Suppliers
1. Construction and Acceptance Phase
    a. Provide all requested submittal data, including detailed start-up procedures, blank start-up docs and checklists, and specific responsibilities of the Owner to keep warranties in force.
    b. Assist in equipment start-up, energizing, and pre-testing per agreements with Subs.
    c. Include all special tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment according to these Contract Documents in the base bid price to the Contractor, except for stand-alone data logging equipment that may be used by the CA. Such tools not required for routine maintenance, operation, and service and not required to be turned over to the owner under other divisional spec sections, shall be returned to the user providing such tools. Examples of this intent would be a flow hood used by the TAB contractor would be returned and remain the property of the TAB contractor whereas a special key for unlocking the chiller control cabinet would be turned over to the owner.
    d. Provide information requested by CA regarding equipment sequence of operation and testing procedures.
    e. Review system start-up and test procedures for equipment installed by factory representatives.

J. Mechanical Contractor
1. Provide start-up for all HVAC equipment.
2. Assist and cooperate with the TAB contractor and CA by:

a. Putting all HVAC equipment and systems into operation and continuing the operation during each working day of TAB and commissioning, as required.
b. Including cost of sheaves and belts that may be required by TAB.
c. Providing test holes in ducts and plenums where directed by TAB to allow air measurements and air balancing. Provide an approved rubber or steel plug to seal
d. traverse holes.
e. Providing temperature and pressure taps according to the Construction Documents for TAB and commissioning testing.

3. Install a P/T plug at each water sensor which is an input point to the control system and both inlet and discharge side of ALL pumps for TAB.
4. List and clearly identify on the as-built drawings the locations of all air-flow stations.
5. Notify the GC or CA depending on protocol, when pipe and duct system testing, flushing, cleaning, start-up of each piece of equipment, and TAB will occur. Be responsible to notify the GC or CA, ahead of time, when commissioning activities not yet performed or not yet scheduled could delay construction. Be proactive in seeing that commissioning processes are executed and that the CA has the scheduling information needed to efficiently execute the commissioning process.

K. Controls Contractor
1. Sequences of Operation Submittals. The Controls Contractor's submittals of control drawings shall include complete detailed sequences of operation for each piece of equipment, regardless of the completeness and clarity of the sequences in the specifications or drawings. The engineer shall be provided written documentation for any revisions to the HVAC&R design documents including engineered approved control sequences. Upon review of the DDC control submittals, the engineer shall provide his approval or rejection in writing to the controls contractor. The Controls Contractor's submittals of control drawings shall include:
a. An overview narrative of the system (1 or 2 paragraphs) generally describing its purpose, components, and function.
b. All interactions and interlocks with other systems.
c. Detailed delineation of control between any packaged controls and the building automation system, listing what points the BAS monitors only and what BAS points are control points and are adjustable.
d. Written sequences of control for packaged controlled equipment. (Equipment manufacturers' stock sequences may be included but will generally require additional narrative).
e. Start-up sequences.
f. Warm-up mode and Optimum Start sequences.
g. Normal operating mode sequences.
h. Unoccupied mode sequences.
i. Shutdown sequences.
j. Capacity control sequences and equipment staging.
k. Temperature and pressure control: setbacks, setups, resets, etc.
l. Detailed sequences for all control strategies, e.g., economizer control, optimum start/stop, staging, optimization, demand limiting, etc.
m. Effects of power or equipment failure with all standby components including HVAC and Emergency powered systems with VFD's and responses (Restart, Alarm, etc.).

n. Sequences for all alarms and emergency shutdowns.
o. Seasonal operational differences and recommendations.
p. Initial and recommended values for all adjustable settings, set points parameters that are typically set or adjusted by operating staff; and any other control settings or fixed values, delays, etc. that will be useful during testing and operating the equipment.
q. Schedules, if known and provided by owner.
r. All sequences shall be written in small statements, each with a number for reference. For a given system, numbers will not repeat for different sequence sections, unless the sections are numbered.

2. Control Drawings Submittal
   a. The control drawings shall have a key and legend for all abbreviations and symbols.
   b. The control drawings shall contain graphic schematic depictions of the systems and each component.
   c. The schematics will include the system and component layout of any equipment that the control system monitors, enables, or controls, even if the equipment is primarily controlled by packaged or integral controls.
   d. Provide a full points list with at least the following included for each point:
      1) Controlled system Point abbreviation
      2) Point description
      3) Display unit
      4) Control point or set point (Yes / No)
      5) Monitoring point (Yes / No)
      6) Intermediate point (Yes / No)
      7) Calculated point (Yes / No)
         (a) Key:
            (1) Point Description: DB temp, airflow, etc.
            (2) Control or Setpoint: Point that controls equipment and can have its set points changed (OSA, SAT, etc.)
            (3) Intermediate Point: A Point whose value is used to make a calculation which then controls equipment (space temperatures that are averaged to a virtual point to control reset).
            (4) Monitoring Point: A Point that does not control or contribute to the control of equipment; but is used for the operations, maintenance, or performance verification.
            (5) Calculated Point: “Virtual” point generated from calculations of other point values. The Controls Contractor shall keep the CA informed of all changes to this list during programming and setup in all phases of the project.
3. An updated as-built version of the control drawings and sequences of operation shall be included in the final controls O&M manual submittal.
4. Assist, coordinate and cooperate with the TAB contractor in the following manner:
   a. Meet with the TAB contractor prior to beginning TAB work and review the TAB plan to determine the capabilities of the control system toward completing TAB. Provide the TAB any needed unique instruments for setting terminal unit boxes and instruct TAB in their use (handheld control system interface for use around the building during TAB, etc.).

   b. For a given area, have all required checklists, calibrations, start-up, and selected
   c. Pre-commissioning documentation of the system available during TAB activities.
   d. Provide a qualified technician to operate the controls, to assist the TAB contractor in performing TAB work, during scheduled TAB activities. Remote operation of control system, during scheduled TAB and Functional Testing, will not be acceptable. The Controls contractor may provide training to the TAB technician for inputting data into the control software and logic. However, the controls contractor shall be ultimately responsible for entering and saving the data, provided by the TAB contractor, into the control system.
5. Assist and cooperate with the CA in the following manner:
   a. Execute the functional testing of the controls system as specified for the controls contractor in Controls Specification Section.
   b. Assist in the functional testing of all equipment specified.
   c. Execute all control system trend logs specified.
6. Provide a signed and dated certification to the CA and GC upon completion of the check-out of each controlled device, equipment, and system prior to TAB and functional testing. This shall be for each piece of equipment or system, Confirmation that all system programming, installation of control components, debugging, pre-testing, checkout is complete, and the control system is made fully operational as to all respects of the Contract Documents. This shall be completed prior to any TAB work or functional testing of the building systems under DDC control.
7. Beyond the control points necessary to execute all documented control sequences provide monitoring, control, and virtual points.
8. List and clearly identify on the as-built duct and piping drawings the locations of ALL: static and differential pressure sensors (air, water, and building pressure), hydronic control valves/actuators, electrical control relays for lighting, and control boards.
9. The Controls Contractor shall be responsible for Pre-commissioning of all control systems and components provided and installed by the controls contractor. See other sections of this specification and divisional specifications for training requirements. During TAB and functional testing, the controls contractor shall produce, at the request of the engineer or commissioning authority, graphic screenshots of the building systems operation as indicated on the building controls graphics.
10. Test and Balance Contractor (TAB)
11. Prior to starting TAB, submit to the CA and GC, the lead TAB technicians contact information.
12. Submit the outline of the TAB plan, to the CA, GC, and Controls Contractor prior to starting the TAB. The TAB contractor will be provided with a set of final approved mechanical and
13. HVAC&R control submittals by the GC, 60 calendar days prior to beginning TAB activities.
14. The submitted TAB plan may include:
   a. Certification that the TAB contractor has reviewed the construction documents and the systems with the design engineers and contractors to sufficiently understand the design intent for each system.
   b. An explanation of the intended use of the building control system. The controls contractor will comment on feasibility of the plan.

c. All field check-out sheets and logs to be used that list each piece of equipment to be tested, adjusted, and balanced with the data cells to be gathered for each.
d. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
e. Final test report forms to be used.
f. Detailed step-by-step procedures for TAB work for each system and issue.
g. Terminal flow calibration (for each terminal type), diffuser proportioning, branch and submain proportioning, total flow calculations, rechecking, diversity issues, expected problems and solutions, etc. Criteria for using air flow straighteners or relocating flow stations and sensors will be discussed. Provide analogous explanations for the waterside.
h. List of all airflow, water flow, sound level, system capacity, and efficiency measurements to be performed and a description of specific test procedures, parameters, and formulas to be used.
i. Details of how total flow will be determined (Air: sum of terminal flows via BAS calibrated readings or via hood readings of all terminals, supply (SA), and return air (RA) pitot traverse, SA or RA flow stations. Water: pump curves, circuit setter, flow station, ultrasonic, etc.).
j. The identification and types of measurement instruments to be used and their most recent calibration date.
k. Specific procedures that will ensure that both air and water side are operating at the lowest possible pressures and provide methods to verify this.
l. Confirmation that TAB understands the outside air ventilation criteria under all operational conditions.
m. Details of whether and how minimum outside air CFM will be verified and set and for what level (total building, zone, etc.).
n. Details of how building static and exhaust fan/relief damper capacity will be checked.
o. Proposed selection points for sound measurements and sound measurement methods.
p. Details of methods for making any specified coil or other system plant capacity measurements.
q. Details of any TAB work to be done in phases (by floor, etc.), or of areas to be built out later.
r. Details regarding specified deferred or seasonal TAB work.
s. Details of any specified false loading of systems to complete TAB work.
t. Details of all exhaust fan balancing and capacity verifications, including any required room pressure differentials.
u. Details of any required interstitial cavity differential pressure measurements and calculations.
v. Plan for hand-written field technician logs of discrepancies, deficient or uncompleted work by others, contract interpretation requests, and lists of completed tests (scope and frequency).
w. Plan for formal progress reports (scope and frequency).
x. Plan for formal deficiency reports (scope, frequency, and distribution).

15. A running log of events and issues shall be kept by the TAB field technicians. Submit hand-written reports of discrepancies, deficient or uncompleted work by others, contract interpretation requests, and lists of completed TAB work. All issues found during daily TAB activities shall be provided to the GC on-site and

prior to leaving the job site for the day.

16. Communicate in writing to the controls contractor all set point and parameter changes made or problems and discrepancies identified during TAB which affect the control system setup and operation.
17. Provide a draft TAB report within five calendar days of starting Functional Testing of the HVAC & R systems. Field notes that are legible shall be allowed to be submitted in place of a full draft TAB report.
18. Provide the CA with requested system data findings, gathered or collected during TAB work, but not shown on the TAB reports.
19. Provide a final and complete TAB report for the CA and A/E within 15 calendar days from end of TAB work and as requested by the CA. Punch list items or issues discovered during scheduled TAB activities, reported to the GC for correction by the GC's subs or vendors, which cause delay in the TAB contractor's ability to complete his work on time per the project schedule, will have the additional time required to complete the TAB work, charged to the GC who may choose to back charge his/her subs. Charges shall be on a Time and Material basis and shall be documented with a line item breakdown for Manpower, time, systems TAB'd, and date of work. Such documentation shall be made available for review by the GC and A/E, prior to any approval by the GC.
20. Assist the CA as needed and required to carry out all HVAC & R functional testing. Conduct functional performance tests and checks on the original TAB as specified for TAB in Division 23 and controls specification section. Make follow-up visits to the site as necessary and required to correct any work deficiencies or variances to contract documents made by the TAB technician.

L. Electrical Contractor
1. Include the cost of commissioning by the electrical sub in the contract price.
2. Include requirements for submittal data, O&M data, and owner training.
3. Attend a commissioning scoping meeting and other necessary meetings scheduled by the CA to facilitate the Cx process.
4. Contractor shall provide normal cut sheets and shop drawing submittals to the CA of electrical systems to be commissioned.
5. Provide requested electrical systems documentation to the CA when requested by the CA, for development of functional testing procedures.
    a. Typically, this will include detailed manufacturer installation and start-up, operating,
    b. Troubleshooting and maintenance procedures, full details of any owner-contracted tests, fan and pump curves, full factory testing reports, if any, and full warranty information, including all responsibilities of the Owner to keep the warranty in force clearly identified. In addition, the installation and check-out materials that are actually shipped inside the equipment and the actual field check-out sheet forms to be used by the factory or field technicians shall be submitted to the Commissioning Agent.
    c. The Commissioning Agent may request further documentation necessary for the commissioning process.
    d. This data request may be made prior to or post normal submittals.
6. Provide a copy of the electrical systems O&M manuals submittals of commissioned equipment, through normal channels, to the CA.
7. Contractors shall assist (along with the design engineers) in clarifying the operation and control of electrical commissioned equipment in areas where the specifications, control drawings or equipment documentation is not sufficient for writing detailed electrical testing procedures.

8. Provide assistance to the CA in developing and conducting all CA directed electrical testing. Subs shall review all test procedures to ensure feasibility, safety, and equipment protection and provide necessary written alarm limits to be used during the tests.
9. In a clear and legible format, document all completed installation, start-up, and system operational check-out procedures, providing a copy to the A/E and CA.
10. Address current A/E punch list and Cx Issues Log items before final payment is released.
11. Provide skilled technicians to execute energizing and starting of electrical equipment and to execute all required electrical tests. Ensure that they are available and present during the agreed upon schedules and for sufficient duration to complete the necessary tests, adjustments, and issue resolution.
12. Perform functional performance testing under the direction of the CA or A/E for specified electrical equipment tests. Assist the CA in interpreting any monitoring data, as necessary.
13. Correct deficiencies (differences between specified and observed performance) as interpreted by the CA, GC, and A/E and retest the equipment.
14. Prepare O&M manuals and red-line as-built drawings according to the Contract Documents, including updating the electrical as-built conditions.
15. Provide training of the Owner's operating personnel as specified.
16. Coordinate with equipment manufacturers to determine specific requirements to maintain the validity of the warranty.
17. Warranty Period: Execute and assist the CA in carrying out deferred functional performance testing according to the specifications.
18. Correct deficiencies and make necessary adjustments to electrical systems O&M manuals and electrical as-built drawings for applicable issues identified in any seasonal or deferred testing.

M. Plumbing Contractor
1. Provide installation and operation for all plumbing equipment.
2. Assist and cooperate with the CA by putting all plumbing equipment, fixtures, domestic water systems, water heaters, recirc pumps, etc., into operation as requested by the CA for testing and confirming the operation of such equipment and components installed under the plumbing scope of services.
3. List and clearly identify on the as-built drawings the locations of all plumbing valves installed above ceiling, in building walls, and underground.
4. Be responsible to notify the GC and CA, ahead of time, when commissioning
5. Activities related to plumbing systems not scheduled could delay construction.
6. Include the cost of commissioning by the plumbing sub in the contract price.
7. Include requirements for plumbing submittal data, O&M data, and participation in owner training for plumbing systems.
8. Attend a commissioning scoping meeting and other necessary meetings scheduled by the CA to facilitate the Cx process.
9. Contractor shall provide normal cut sheets and shop drawing submittals to the CA for plumbing systems to be commissioned. Submissions shall follow proper protocol for distribution of materials. Typically, from Vendor to Sub to GC to Architect, or CM to CA.
10. Provide requested plumbing systems documentation to the CA when requested by the CA for development of plumbing checklists and testing procedures.
11. Typically, this will include detailed manufacturer installation and start-up, operating, troubleshooting, and maintenance procedures, full details of any owner-contracted tests and pump curves, factory test reports, if any, and full

warranty information, including all responsibilities of the Owner to keep the warranty in force clearly identified. In addition, the installation and check-out materials that are actually shipped inside the plumbing equipment and the actual field check-out sheet forms to be used by the factory or field technicians shall be submitted to the Commissioning Agent.

12. The Commissioning Agent may request further documentation necessary for the commissioning process.
13. This data request may be made prior to or post normal submittals.
14. Provide a copy of the plumbing systems O&M manuals submittals of commissioned equipment, through normal channels, to the CA.
15. Contractors shall assist (along with the design engineers) in clarifying the operation and control of plumbing systems commissioned, in areas where the specifications, control drawings or equipment documentation is not sufficient for writing detailed testing procedures.
16. Provide assistance to the CA for developing and conducting all CA directed plumbing system and equipment testing. Subs shall review all test procedures to ensure feasibility, safety, and equipment protection and provide necessary written alarm limits to be used during the tests.
17. Develop a full installation check-out plan using manufacturer's installation, start-up procedures, and the checklists from the CA and other requested equipment documentation to CA and A/E for review.
18. During the start-up and initial check-out process for Plumbing systems, equipment requiring electrical power will require coordination with the electrical sub to execute and document the electrical-related portions of the plumbing checklists and likewise for HVAC and Electrical devices where plumbing systems and equipment are installed as part of the complete HVAC or electrical system, the plumbing sub must coordinate with those disciplines for sign off of the checklist documents.
19. In a clear and legible format, document all completed installation, start-up, and system operational check-out procedures, providing a copy to the A/E and CA through the GC.
20. Provide skilled technicians to execute energizing and starting of electrical equipment and to execute all required electrical tests. Ensure that they are available and present during the agreed upon schedules and for sufficient duration to complete the necessary tests, adjustments, and issue resolution.
21. Perform functional performance testing under the direction of the CA or A/E for specified plumbing equipment tests.
22. Correct deficiencies (differences between specified and observed performance) as interpreted by the CA, GC, and A/E and retest the equipment.
23. Address current A/E punch list and Cx Issues Log items before final payment is released.
24. Prepare O&M manuals and red-line as-built drawings according to the Contract Documents, including updating the plumbing as-built conditions.
25. Provide training of the Owner's operating personnel for operation and maintenance of plumbing systems.
26. Coordinate with equipment manufacturers to determine specific requirements to maintain the validity of the warranty.
27. Warranty Period: Execute and assist the CA in carrying out deferred testing according to the specifications.
28. Correct deficiencies and make necessary adjustments to plumbing systems O&M manuals and as-built drawings for applicable issues identified in any seasonal or deferred testing.

1.5 DEFINITIONS

A. Acceptance Phase - Phase of construction after start-up and initial check-out when functional performance tests, O&M documentation review, and training occurs.

B. Approval - Acceptance that a piece of equipment or system has been properly installed and is functioning in the tested modes according to the Contract Documents.

C. Architect/Engineer (A/E) - The prime consultant (architect) and sub-consultants who comprise the design team; generally the HVAC mechanical designer/engineer and the electrical designer/engineer.

D. Basis of Design (BOD) - The basis of design is the documentation of the primary thought processes and assumptions behind design decisions that were made to meet the design intent. The basis of design describes the systems, components, conditions, and methods chosen to meet the intent. Some reiterating of the design intent may be included.

E. Checklist (PC) - A list of items to inspect and elementary component tests to conduct to verify proper installation of equipment. Checklists are primarily static inspections and procedures to prepare the equipment or system for initial operation (e.g., belt tension, oil levels OK, labels affixed, gages in place, sensors calibrated, etc.). However, some Checklist items entail simple testing of the function of a component, a piece of equipment, or system (such as measuring the voltage imbalance on a three phase pump motor of a chiller system). The word pre-functional refers to before functional performance testing. Checklists augment and are combined with the manufacturer’s start-up checklist. Even without a commissioning process, contractors typically perform some checklist items. However, few contractors document in writing the execution of these checklist items. Therefore, for most equipment, the contractors execute the checklists on their own.

F. Commissioning Agent (CA) - An independent agent, not otherwise associated with the A/E team members or the Contractor, though CA may be hired as a subcontractor to them. The CA directs and coordinates the day-to-day commissioning activities. The CA does not take an oversight role like the CM. The CA is part of the Construction Manager (CM) team or shall report directly to the CM.

G. Commissioning Plan - An overall plan, developed before or after bidding that provides the structure, schedule, and coordination planning for the commissioning process.

H. Contract Documents - The documents binding on parties involved in the construction of this project (drawings, specifications, change orders, amendments, contracts, Cx Plan, etc.).

I. Contractor - The general contractor or authorized representative.

J. Control system - The central building energy management control system.

K. Construction Manager (CM) - The Owner’s representative in the day-to-day activities of construction. In general, the construction management services contractor (CM) is hired by the owner to assist in the overall management of the project including supervising and on-site managing authority over a project’s construction. The General Contractor reports to the CM. The CM is the owner’s on-site representative.

L. Data logging - Monitoring flows, currents, status, pressures, etc. of equipment using DDC control system.

M. Deferred Functional Tests - FTs that are performed later, after substantial completion, due to partial occupancy, equipment, seasonal requirements, design, or other site conditions that disallow the test from being performed.

N. Deficiency - A condition in the installation or function of a component, piece of equipment, or system that is not in compliance with the Contract Documents (it does not perform properly or is not complying with the design intent).

O. Design Intent - A dynamic document that provides the explanation of the ideas, concepts, and criteria that are considered to be very important to the owner. It is initially the outcome of the programming and conceptual design phases.

P. Design Narrative or Design Documentation - Sections of the Design Intent or BOD.

Q. Factory Testing - Testing of equipment on-site or at the factory by factory personnel with an Owner's representative present.

R. Functional Performance Test (FT) - Test of the dynamic function and operation of equipment and systems using manual (direct observation) or monitoring methods. Functional testing is the dynamic testing of systems (rather than just components) under full operation (e.g., the chiller pump is tested interactively with the chiller functions to see if the pump ramps up and down to maintain the differential pressure set point). Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc. The systems are run through all the control system's sequences of operation and components are verified to be responding as the sequences state. Traditional air or water test and balancing (TAB) is not functional testing, in the commissioning sense of the word. TAB's primary work is setting up the system flows and pressures as specified, while functional testing is verifying that which has already been set up. The commissioning agent develops the functional test procedures in a sequential written form, coordinates, oversees and documents the actual testing, which is usually performed by the installing contractor or vendor. FTs are performed after CHECKLISTS and start-up is complete.

S. General Contractor (GC) - The prime contractor for this project generally refers to all the GC's subcontractors as well. Also is referred to as the Contractor in some contexts.

T. Indirect Indicators - Indicators of a response or condition, such as a reading from a control system screen reporting a damper to be 100% closed.

U. Manual Test - Using hand-held instruments, immediate control system readouts, or direct observation to verify performance (contrasted to analyzing monitored data taken over time to make the "observation").

V. Monitoring - The recording of parameters (flow, current, status, pressure, etc.) of equipment operation using data loggers or the trending capabilities of control systems.

W. Non-Compliance - See the definition of Deficiency.

X. Non-Conformance - See the definition of Deficiency.

Y. Over-written Value - Writing over a sensor value in the control system to see the response of a system (e.g., changing the outside air temperature value from 50°F to 75°F to verify economizer operation). See also “Simulated Signal.”

Z. Owner-Contracted Tests - Tests paid for by the Owner outside the GC’s contract and for which the CA does not oversee. These tests will not be repeated during functional tests if properly documented.

AA. Phased Commissioning - Commissioning that is completed in phases (by floors, for example) due to the size of the structure or other scheduling issues, in order to minimize the total construction time.

BB. Project Manager (PM) - The contracting and managing authority for the owner over the design and/or construction of the project.

CC. Sampling - Functionally testing only a fraction of the total number of identical or near identical pieces of equipment.

DD. Seasonal Performance Tests - FT that are deferred until the system(s) will experience conditions closer to their design conditions.

EE. Simulated Condition - Condition that is created for the purpose of testing the response of a system (e.g., applying heated air to a space sensor using a hair dryer to see the response in the HVAC system).

FF. Simulated Signal - Disconnecting a sensor and using a signal generator to send an amperage, resistance, or pressure to the transducer and DDC system to simulate a sensor value.

GG. Specifications - The construction specifications of the Contract Documents.

HH. Start-up - The initial starting or activating of dynamic equipment, including executing Checklists.

II. Subs - The subcontractors to the GC who provide and install building components and systems.

JJ. Systems/Subsystems/Equipment & Components - Where these terms are used together or separately, they shall mean “As-Built” systems, subsystems, equipment, and component.

KK. Test Procedures - The step-by-step process which must be executed to fulfill the test requirements. The test procedures are developed by the CA.

LL. Test Requirements - Requirements specifying what modes and functions, etc. shall be tested. The test requirements are not detailed test procedures. The test requirements are specified in the Contract Documents.

MM. Trending - Monitoring using the building control system.

NN. Vendor - Supplier of equipment.

OO. Warranty Period - The warranty period for the entire project, including equipment components. Warranty begins at Substantial Completion and extends for at least one

year, unless specifically noted otherwise in the Contract Documents and accepted submittals.

1.6 SYSTEMS TO BE COMMISSIONED

A. The following systems and their sub-components are anticipated to be commissioned on this project. The actual systems commissioned will be based on the systems listed in the commissioning contract with the owner. Systems included for this project will be confirmed during the CA construction phase.

B. These systems and sub-components will be commissioned using sampling techniques. Percentage of sampling shall be determined by the CA in the field but no less than 20% of like systems shall be sampled for HVAC systems and lighting systems. All chillers, space heat boilers, and cooling towers, (except existing systems), shall be tested. No sampling will be allowed for these major components (chillers, space heat boilers, and cooling towers). Reference the Mechanical, Electrical, and Plumbing systems equipment schedules and sheets contained in the contract drawings for equipment design information.

Cx Systems	**Require Fx Testing**	**Items Tested**
HVAC		
__ Chilled Water Plants	Yes	Controls, Sequence of Operations, Alarms
__ Hot Water Plants	Yes	Controls, Sequence of Operations, Alarms
__ Air Handling Units	Yes	Controls, Sequence of Operations, Alarms, Economizer
__ Packaged Units (RTU and HP)	Yes	Controls, Sequence of Operations, Alarms, Economizer
__ Terminal Units/VAVs	Yes	Controls, Sequence of Operations, Alarms, Economizer
__ Exhaust and Relief fans	Yes	Controls, Sequence of Operations, Alarms
__ DDC Control System *(Component Installation and System Operation)*	Yes	System calibration and function
Electrical Systems		
__ Lighting Controls	Yes	Control Software and Hardware Properly Adjusted and Programmed

Cx Systems	Require Fx Testing	Items Tested
__ Occupancy Sensors	Yes	Aiming, Status Indicator, Light Staging
__ Time Switch Controls	Yes	Programmed Schedules, Battery Backup, Override Limit, Simulate Occupied and Unoccupied Conditions
__ Daylight Responsive Controls	Yes	Accurate Locations, Calibration, Setpoint, Threshold
Plumbing Systems		
__ Service Water Heating Systems	Yes	Controls, Sequence of Operations, Alarms

PART 2 PRODUCTS

2.1 TEST EQUIPMENT

A. All standard testing equipment required to perform start-up and initial check-out and required functional performance testing shall be provided by the primary Division contractor for the equipment being tested. For example, the mechanical contractor of Division 23 shall ultimately be responsible for all standard testing equipment for the HVAC system and controls system in Division 23, except for equipment specific to and used by TAB in their commissioning responsibilities. Two-way radios shall be provided as necessary for communication between the CA and contractors during performance testing, by the Division Contactor.

B. Special equipment, tools, and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment, according to these Contract Documents shall be included in the base bid price to the Contractor and turned over to the owner for his use and shall become the sole property of the owner, except for temporary stand-alone data logging equipment that may be used by the CA and any special testing and inspection equipment used for testing of piping, ductwork, and electrical and special systems unless such equipment is required for such systems to function and operate.

C. Any and all data logging by electronic device shall be by the DDC control system where applicable, and as otherwise contracted by the owner with others.

D. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified. If not otherwise noted,

the following minimum requirements apply: Temperature sensors and digital thermometers shall have a certified calibration within the past year and a resolution of + or - 0.3ºF. 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 when dropped or damaged. Calibration tags shall be affixed or certificates readily available.

PART 3 EXECUTION

3.1 REPORTING

A. The CA will regularly communicate with all members of the commissioning team, keeping them apprised of commissioning progress and scheduling changes through memos, progress reports, etc.

B. Non-conformance and deficiency issues will be recorded on the commissioning issues log and a copy will be provided to the GC for making corrections. A copy will be provided to the owner and made available to other project team members as directed by the owner. Frequency of these reports will be determined by the progress of construction and issues discovered during the CA and owner-site observations. Issues recorded on the Cx Issues Log will be noted as complete and the CA will initial the date and verified by block only after the CA has confirmed that the item has been corrected by the contractor or noted in writing, by the owner, as accepted as is by the owner.

C. A final summary report (about four to six pages, not including backup documentation) by the CA will be provided to the owner, focusing on evaluating commissioning process issues and identifying areas where the process could be improved. All acquired documentation, logs, minutes, reports, deficiency lists, communications, findings, unresolved issues, etc., will be compiled in appendices and provided with the summary report. As appropriate, checklists, functional tests, and monitoring reports may be included to supplement the summary report. These documents will also be included in the Project Commissioning Record.

3.2 SUBMITTALS

A. Normal submittal: For MEP Systems, submittals will be provided by the GC to the CA through the Architect and concurrently with the A/E consultants review period. At a minimum, the submittal will include the manufacturer and model number, the manufacturer's printed installation and detailed start-up procedures, full sequences of operation, O&M data, performance data, any performance test procedures, control drawings, and details of owner contracted tests. In addition, the installation and check-out materials that are actually shipped inside the equipment and the actual field check-out sheet forms to be used by the factory or field technicians shall be submitted to the Commissioning Agent. All documentation requested by the CA will be included by the Subs in their O&M manual contributions. Where items are uploaded to an FTP or web-based site, the CA will be notified.

B. The CA may request additional design narrative from the A/E and Controls Contractor, depending on the completeness of the design intent documentation and sequences provided with the Specifications.

3.3 PHASED COMMISSIONING

A. Where the project requires TAB, start-up, and performance testing to be executed in phases, phasing shall be coordinated with the owner, GC, CA, and A/E and be reflected in the overall project schedule and shall include commissioning activities in the schedule by the contractor. Final performance testing of all systems will be as required by the phasing plan. The performance testing of the "systems as a whole" will be performed before final turnover of the project.

3.4 FUNCTIONAL PERFORMANCE TESTING

A. Requirements. The performance testing shall demonstrate that each system is operating according to the documented design intent and contract documents. Performance testing facilitates bringing the systems from a state of individual substantial completion to full dynamic operation. Additionally, during the testing process, areas of deficient performance are identified, corrected, and the system retested, improving the operation of the systems.

B. Coordination and Scheduling. The contractor shall provide sufficient notice, regarding their completion schedule for the construction checklists and start-up of all equipment and systems to allow the performance testing to be scheduled. The commissioning team shall oversee, witness, and document the performance of all equipment and systems. The contractor in association with the subcontractors shall execute the tests. The CA shall witness and document the results of the test. Performance testing shall be conducted after the construction checklists, and start-up has been satisfactorily completed. The control system shall be sufficiently tested and approved by the CA and engineer of record before it is used, to verify performance of other components or systems. The air side balancing and water side balancing shall be completed before performance testing of air or water-related equipment or systems. Testing proceeds from components to sub-systems to systems. When the proper performance of all interacting individual systems has been achieved, the coordinated response between systems shall be verified.

C. Development of Test Procedures:
   1. Before test procedures are finalized, the contractor shall provide to the A/E and the CA all requested documentation including changes affecting equipment or systems, an updated control points list, control schematics, control sequences, and testing parameters. Using the testing parameters and requirements in the technical specifications, the CA shall develop and update specific testing requirements and documentation for the purpose of verifying and documenting the actual performance of the related systems and equipment. Each respective contractor/subcontractor or vendor shall provide assistance to the CA as necessary and required in developing the final equipment and systems test procedures. Should the CA test and the manufacturer test requirement be at variance with one another, the manufacturer operational test requirements shall prevail.
   2. Before test procedures are written, the CA shall obtain all requested documentation and a current list of change orders affecting equipment or systems, including an updated points list, program code, control sequences, and parameters. The CA shall develop specific test procedures and forms to verify and document proper operation of each piece of equipment and system. Each Sub or vendor responsible to execute a test shall provide assistance to the CA in

developing the procedures review (answering questions about equipment, operation, sequences, etc.). Prior to execution, the CA shall provide a copy of the test procedures to the contractor who shall review the tests for feasibility, safety, equipment, and warranty protection. The CA may submit the tests to the A/E for review and comment prior to performing the test.

D. Test Methods:
   1. Functional performance testing and verification may be achieved by manual testing (persons manipulate the equipment and observe performance) or by monitoring the performance and analyzing the results using the building DDC control system.
   2. Simulated Conditions. Simulating conditions (not by an overwritten value) shall be allowed, though timing the testing to experience actual conditions is encouraged wherever practical.
   3. Overwritten Values: Overwriting sensor values to simulate a condition, such as overwriting the outside air temperature reading in a control system shall be allowed, but simulating a condition is preferable. e.g., for the above case, by heating the outside air sensor with a portable hot air device in lieu of overwriting the set point.
   4. Simulated Signals. Using a signal generator which creates a simulated signal to test and calibrate transducers and DDC constants is generally recommended over using the sensor to act as the signal generator via simulated conditions or overwritten values.
   5. Altering Set points: Rather than overwriting sensor values, and when simulating conditions is difficult, altering set points to test a sequence is acceptable. For example, to see the AC compressor lockout work at an outside air temperature below 55°F, when the outside air temperature is above 55°F, temporarily change the lockout set point to be 2°F above the current outside air temperature.
   6. Indirect Indicators. Relying on indirect indicators for responses or performance shall be allowed only after visually and directly verifying and documenting, over the range of the tested parameters, that the indirect readings through the control system represent actual conditions and responses. Much of this verification is completed during prefunctional testing.
   7. Setup: Each function and test shall be performed under conditions that simulate actual conditions as close as is practically possible. The Sub executing the test shall provide all necessary materials, system modifications, etc. to produce the necessary flows, pressures, temperatures, etc. necessary to execute the test according to the specified conditions. At completion of the test, the Sub shall return all affected building equipment and systems, due to these temporary modifications, to their pre-test condition.
   8. Sampling: Multiple identical pieces of non-life-safety or otherwise non-critical equipment may be functionally tested using a sampling strategy. Significant application differences and significant sequence of operation differences in otherwise identical equipment invalidates their common identity. A small size or capacity difference, alone, does not constitute a difference. The specific recommended sampling rates are listed in these documents. It is noted that no sampling by Subs is allowed in CHECKLIST execution. A common sampling strategy referenced in the Specifications as the “xx% Sampling-yy% Failure Rule” is defined by the following example:
      a. xx = the percent of the group of identical equipment to be included in each sample.

b. yy = the percent of the sample that if failing, will require another sample to be tested.

9. The example below describes a 20% Sampling-10% Failure Rule:
   a. Randomly test at least 20% (xx) of each group of identical equipment. In no case test less than three units in each group. This 20%, or three, constitutes the “first sample.”
   b. If 10% (yy) of the units in the first sample fail the functional performance tests, test another 20% of the group (the second sample).
   c. If 10% of the units in the second sample fail, test all remaining units in the whole group.
   d. If at any point, frequent failures are occurring and testing is becoming more troubleshooting than verification, the CA may stop the testing and require the responsible Sub to perform and document a check-out of the remaining units, prior to continuing with functionally testing the remaining units.

E. Coordination and Scheduling:
   1. The Subs shall provide sufficient notice to the CA regarding their completion schedule for the CHECKLISTS and start-up of all equipment and systems. The CA will schedule functional tests through the GC.
   2. The CA shall observe and document the results of functional testing if the results shall be provided to the owner and A/E for review and record.
   3. The Subs shall execute the tests. In general, functional performance testing is conducted after checklist verification and start-up has been satisfactorily completed and start-up reports and checklists have been reviewed by the A/E. The control system is sufficiently tested for completeness, by the controls contractor and prior to TAB work. The controls sub will provide written notification to the GC, A/E, and CA that the controls have been inspected and pre-Tested prior to beginning TAB and any Functional testing work. The air balancing and water balancing is then completed and debugged before functional testing of air-related or water-related equipment or systems. Testing proceeds from components to subsystems to systems. When the proper performance of all interacting individual systems has been achieved, the interface or coordinated responses between systems is checked.
      a. Test Equipment: All standard testing equipment required to perform start-up and initial check-out and required functional performance testing shall be provided by the Division contractor for the equipment being tested. All testing equipment shall be of sufficient quality and accuracy to test or measure system performance as required by the construction documents and specifications and functional performance testing.
      b. Problem Solving: The CA will recommend solutions to issues discovered, however the burden of responsibility to solve, correct and retest problems is with the GC, Subs, and A/E.

3.5 DOCUMENTATION, NON-CONFORMANCE, AND APPROVAL OF TESTS

A. Documentation. The CA shall witness and document the results of all functional performance tests using the specific procedural forms developed for that purpose. Prior to testing, these forms are provided to the A/E and GC for review and approval.

B. Non-Conformance:
   1. The CA will record the results of the functional test on the test form. All deficiencies or non-conformance issues shall be documented and reported to the

GC for correction and a copy provided to the A/E and owner.

2. Corrections of minor deficiencies identified may be made during the tests at the discretion of the CA. In such cases, the deficiency and resolution will be documented on the procedure form.
3. Every effort will be made to expedite the testing process and minimize unnecessary delays, while not compromising the integrity of the procedures. However, the CA will not be pressured into overlooking deficient work or loosening acceptance criteria to satisfy scheduling or cost issues, unless there is an overriding reason to do so at the request of the PM and CM. Any issue that requires more than 30 minutes to correct or multiple issues with a combined total of 90 minutes in any given day, shall be deemed failed and shall be documented as such by the Cx agent. A copy of the discrepancy shall be provided to the GC for correction and the project team members for record. Upon written notification from the GC, that the issue or issues are corrected and the system is fully operational and ready for retest, the CA will schedule with the GC for a retest of the failed system. Five working days shall be required by the GC in writing to the CA for any retest.
4. As tests progress and a deficiency is identified, the CA discusses the issue with the executing contractor.
5. When there is no dispute on the deficiency and the Sub accepts responsibility to correct it:
    a. The CA documents the deficiency and the Sub's response and intentions and they go on to another test or sequence. The CA submits the non-compliance reports to the GC, A/E, and owner. A copy is to be provided to the appropriate Sub by the GC. The Sub corrects the deficiency, signs the statement of correction at the bottom of the form certifying that the equipment is ready to be retested, and sends it back to the GC for verification. The GC provides a copy of the signed form to the A/E and CA for record.
    b. The CA reschedules the test and the test is repeated.
6. If there is a dispute about a deficiency, regarding whether it is a deficiency or who is responsible:
    a. The deficiency shall be documented with the Sub's response and a copy given to the GC, A/E, PM, and CA and to the Sub representative assumed to be responsible.
    b. Resolutions are made at the lowest management level possible. Other parties are brought into the discussions as needed. Final interpretive authority is with the A/E. Final acceptance authority is the owner.
    c. The CA documents the resolution process.
    d. Once the interpretation and resolution have been decided, the GC and CA will reschedule the test and the test is repeated.
7. Cost of Retesting:
    a. If a system scheduled for a Functional Performance Test fails to pass and perform as designed, due to improper installation of start-up by the contractor, the cost for retest including the CA's time and travel, will be charged to the General Contractor who may choose to back charge his subs to recover any losses. Minor corrections will be made on-site and the test will continue where the total time for any given system to be corrected and made fully operational, is less than 15 minutes.
    b. For a deficiency identified, not related to any Checklists or start-up fault, the following shall apply: The CA and GC will direct the retesting of the system

once at no “charge” to the sub or vendor for their time. However, the CA’s time and expenses, incurred due to additional retests of any system beyond the one retest, will be charged to the GC, who will choose to recover costs from the responsible Sub.

c. The time for the CA and GC to direct any retesting required because a specific Checklist or start-up test item, reported having been successfully completed, but determined during functional testing to be faulty, will be back charged to the GC, who may choose to recover costs from the party responsible for executing the faulty functional test.

8. The Contractor shall respond in writing to the CA, A/E, and PM at least as often as Commissioning meetings are being scheduled, concerning the status of each apparent outstanding discrepancy identified during commissioning. Discussion shall cover explanations of any disagreements and proposals for their resolution.
9. The CA retains the original Cx Issues Log until the end of the project.

C. Approval: The CA notes each satisfactorily demonstrated function on the test form. Formal approval of the functional test is made after review by the CA, A/E, and PM. The CA documents the results of each test.

3.6 OPERATION AND MAINTENANCE MANUALS

A. Standard O&M Manuals:
1. The specific content and format requirements for the Standard O&M manuals are detailed in the A/E’s project specifications.
2. CA Review and Approval: Prior to substantial completion, the CA shall review the O&M manuals, documentation, and redline as-builds for systems that were commissioned and as otherwise listed in these documents, to verify compliance with the Specifications. The CA will communicate deficiencies in the manuals to the GC, PM, or A/E, as requested. Upon a successful review of the corrections, the CA recommends approval and acceptance of these sections of the O&M manuals to the GC, PM, or A/E. The CA also reviews the MEP and special systems equipment warranty information. This review by the CA does not supersede the A/E’s responsibility to review the O&M manuals according to the A/E’s contract.

B. Commissioning Record in O&M Manuals:
1. The CA shall include the commissioning record as part of the close-out documentation or as a supplement to the O&M records. This shall be in electronic format for final deliverables to the owner. The intended format is PDF format provided on electronic medium/discs.

3.7 DEFERRED TESTING

A. Unforeseen Deferred Tests: If any check or test cannot be completed due to the building structure, required occupancy condition, or other deficiencies, execution of checklists and functional testing may be delayed upon approval of the PM. These tests will be conducted in the same manner as the seasonal tests as soon as possible. Services of necessary parties will be negotiated.

B. Seasonal Testing: Where seasonal testing is necessary or required to verify systems performance under designed conditions, these Tests will be scheduled by the GC, in coordination with the Owner and CA, and executed by the responsible Subs. The owner’s facilities staff and the CA shall be notified in writing, by the GC, of the dates such testing will be conducted and shall be available for observing the testing. All

such tests shall be scheduled no later than 60 days from substantial completion and shall be conducted no later than seven months from substantial completion. The owner shall have final approval for seasonal test dates. Any adjustments required for updating the accuracy of the O&M manuals, warranties, and as-builts due to the testing will be made by the contractor.

3.8 WRITTEN WORK PRODUCTS

A. The commissioning process generates a number of written work products described in various parts of the Specifications. The Commissioning Plan-Construction Phase lists all the formal written work products, describes briefly their contents, who is responsible to create them, their due dates, who receives and approves them, and the location of the specification to create them. In summary, the written products are:

Product		Developed By
1.	Final commissioning plan	CA
2.	Commissioning schedule	GC/CA
3.	Equipment documentation submittals	GC/Subs/A/E
4.	Sequence clarifications	A/E/Vendors
5.	Issues log (deficiencies)	CA/GC
6.	Commissioning Progress Record	CA
7.	Deficiency reports	CA/A/E/PM/GC
8.	Functional test forms	CA/AE
9.	Filled out functional tests	CA/GC/Subs
10.	O&M manuals	GC/Subs
11.	Commissioning record book	CA
12.	Final commissioning report	CA
13.	Final TAB report	TAB

END OF SECTION

SECTION 02 41 19

SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Demolition and removal of selected portions of building or structure.
   2. Removal of designated equipment and fixtures.
   3. Identification of utilities.
   4. Legal offsite disposal of demolition materials.
   5. Salvage of existing items to be reused or recycled.

1.2 DEFINITIONS

A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.

B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and store.

C. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.

D. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.

E. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

1.3 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

1.4 ACTION SUBMITTALS

A. Schedule: Submit sequence of demolition operations to Owner for review prior to start of work to prevent interruption of onsite operations.
   1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity.
   2. Coordinate shutoff, capping, and continuation of utility services as required and interruption of utility services.
   3. Details for dust and noise control protection.
   4. Coordinate with Owner's continuing occupation of portions of existing building.

5. Use of elevator and stairs.
6. Location of salvageable items.
7. Detailed sequence of selective demolition and removal work to ensure uninterrupted progress of Owner's on site operations.
8. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
9. Locations of temporary partitions and means of egress.

B. Shop Drawings: Indicate location and construction of temporary work.

C. Concrete Cutting: Submit 3 copies of proposed cutting procedures and operations for each type of concrete demolition for review and approval prior to starting the work. Outline types of equipment proposed, protections to be installed, and cutting schedule.

D. Roof Removal: Submit procedures indicating compliance with manufacturer's warranty (if required) and schedule for roof removal.

1.5 INFORMATIONAL SUBMITTALS

A. Engineering Survey: Submit engineering survey of condition of building.

B. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property form dust control and noise control. Indicate proposed locations and construction of barriers.

C. Schedule of Selective Demolition Activities:
1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on site operations are uninterrupted.
2. Interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Dust and noise control protection
5. Location of salvageable items.
6. Location of construction for temporary work
7. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed work.

D. Permits: Submit permits, notices and certificates authorizing demolition work, necessary for utility work, and for transportation and disposal of debris.

E. Project Record Documents: Accurately record actual locations of capped utilities, subsurface obstructions, and insert other pertinent items.

F. Warranties: Documentation indicating that existing warranties remain in effect after completion of selective demolition.

G. Inventory: Submit a list of items for removal and salvage prior to start of demolition.

1.6 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Comply with applicable federal, state, and local codes for demolition work, dust and noise control, safety of structure, and debris removal.
   2. Obtain required permits from authorities having jurisdiction.

B. Predemolition Conference: Conduct conference at site.
   1. Inspect and discuss condition of construction to be selectively demolished.
   2. Review structural load limitations of existing structure.
   3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
   4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
   5. Review areas where existing construction is to remain and requires protection.

1.7 FIELD CONDITIONS

A. Occupancy: Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted. Provide minimum of 72 hours' notice to Owner of demolition activities that will affect Owner's operations including but not limited to:
   1. Interruption of power.
   2. Interruption of utility services.
   3. Excessive noise.

B. Condition of Structure: Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
   1. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials: It is not anticipated that hazardous materials will be encountered in the work.
   1. Hazardous materials will be removed by Owner prior to the commencement of the work.
   2. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract. Work shall continue in other areas of project unaffected by hazardous materials.

E. Storage or sale of removed items or materials on site is not permitted.

F. Traffic: Conduct operations and debris removal to ensure minimum interference with roads, streets, drives, fire lanes, walks, accessible paths, and adjacent occupied or used facilities.

1. Do not close, block, or obstruct streets, drives, walks, or occupied or used facilities without written permission from authorities having jurisdiction. Provide alternate routes around obstructed traffic ways.

G. Flame Cutting: Do not use cutting torches for removal until flammable materials are removed. At concealed spaces, verify conditions prior to flame cutting operations. Maintain portable fire suppression devices during flame cutting operations.

H. Environmental Controls: Use water sprinkling, temporary enclosures, or other acceptable methods to limit dust and dirt migration. Comply with governing regulations pertaining to environmental protection. Do not use water when it may create hazardous or objectionable conditions.

I. Utility Services: Maintain existing utilities and protect against damage during demolition operations.

1. Do not interrupt utilities serving occupied or used facilities, except when authorized in writing by authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, acceptable to Owner and governing authorities.
2. Maintain fire protection facilities in service during selective demolition operations.

J. Protections: Provide temporary barriers to protect Owner's personnel and public from injury from work.

1. Take protective measures to provide free and safe passage to occupied portions of building.
2. Provide protection to ensure safe passage of the Owner’s personnel and the public around demolition areas and to and from occupied portions of adjacent areas, buildings, and structures.
3. Provide shoring, bracing, or support to prevent movement, settlement, or collapse of structure or element to be demolished and adjacent facilities or work to remain.
4. Protect existing work which becomes exposed during demolition operations.
   a. Protect existing improvements, appurtenances, and conditions to remain.
   b. Protect adjacent floors with coverings.
   c. Protect walls, openings, roofs, and adjacent exterior construction to remain and exposed to building demolition operations.
5. Construct temporary insulated dustproof partitions to separate areas from noisy or extensive dirt or dust operations are performed. Equip partitions with dustproof doors and security locks.
6. Provide temporary weather protection when exposing exterior conditions to prevent water leakage or damage to structure or interior areas of existing building.

K. Damages: Promptly repair damages caused to adjacent facilities by demolition work.

L. Firearms and Explosives: Firearms and explosives are not permitted at the site.

1.8 COORDINATION

A. Arrange selective demolition schedule so as not to interfere with Owner's operations.

B. Coordinate selective demolition work with cutting and patching requirements.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Demolition Standards: Comply with ASSE A10.6 and NFPA 241.

2.2 MATERIALS

A. Repair Materials: Use repair materials identical to existing materials.
   1. If identical materials are unavailable or cannot be used for exposed surfaces, use materials visually matching existing adjacent surfaces.
   2. Use materials whose installed performance equals or surpasses that of existing materials.

B. Comply with material and installation requirements specified in individual Specification Sections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify utilities have been disconnected and capped before starting selective demolition operations.

B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.

C. Perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.
   1. Perform surveys as the work progresses to detect hazards resulting from selective demolition activities.

D. Verify hazardous materials have been remediated before proceeding with building demolition operations.

E. Survey of Existing Conditions: Record existing conditions by use of measured drawings or preconstruction photographs and video.

1. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.
2. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

3.2 PREPARATION

A. Pest Control: Employ certified, licensed exterminator to treat building and to control rodents and vermin before and during selective demolition operations.

B. Site Access and Temporary Controls: Conduct selective demolition and debris removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities. Comply with requirements for access and protection.

3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
2. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
3. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.
    a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
    b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
    c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
    d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
    e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
    f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
    g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.

3.4 PROTECTIONS

A. Temporary Protection: Provide temporary barricades and protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
    a. Erect temporary pathways and means of egress necessary for ongoing operations compliant with Code and accessibility regulations.
    b. Provide temporary barricades and protection required to prevent injury and damage to adjacent buildings and facilities to remain.
2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
    a. Protect existing work which becomes exposed during demolition operations.
    b. Protect adjacent entrances from damage due to demolition activities.
    c. Protect existing improvements, appurtenances, and conditions to remain.
    d. Protect floors with covering.
    e. Protect walls, openings, roofs, and adjacent exterior construction to remain and exposed to building demolition operations.
4. Cover and protect furniture, furnishings, and equipment that have not been removed.
5. Comply with requirements for temporary enclosures, dust control, heating, and cooling.
    a. Construct temporary insulated dustproof partitions to separate areas from noisy or extensive dirt or dust operations are performed. Equip partitions with dustproof doors and security locks.
    b. Construct dustproof partitions of not less than nominal 4 inch (100mm) studs, 5/8 inch (16mm) gypsum wallboard with joints taped on occupied side, and 1/2 inch (13mm) fire retardant plywood on the demolition side.
    c. Insulate partition to provide noise protection to occupied areas.
    d. Seal joints and perimeter. Equip partitions with dustproof doors and security locks.
    e. Protect air handling equipment.
    f. Weatherstrip openings.
6. Damage: Promptly repair damages to adjacent components cause by demolition activities.

B. Temporary Partitions and Enclosures: Erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate areas from fumes and noise.

1. Construct dustproof partitions of not less than nominal 4 inch (100mm) studs, 5/8 inch (16mm) gypsum wallboard with joints taped on occupied side, and 1/2 inch (13mm) fire retardant plywood on the demolition side.
2. Insulate partition to provide noise protection to occupied areas.
3. Seal joints and perimeter to prevent dust from mitigating to occupied areas. Equip partitions with dustproof doors and security locks.

4. Protect air handling equipment.

C. Furnishings and Equipment: Cover and protect furniture, equipment, and fixtures from spoilage or damage as necessary.

D. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of selective demolition.

E. Remove temporary barricades and protections where hazards no longer exist.

3.5 SELECTIVE DEMOLITION

A. Conduct demolition to minimize interference with existing and adjacent building areas and to cause as little inconvenience to Owner and employees of occupied buildings as possible. Do not interfere with use of adjacent public streets.

1. Cease operations immediately if structure appears to be in danger and notify Architect. Do not resume operations until directed.
2. Maintain protected egress and access to work.
3. Do not burn or bury materials on site. No explosive or blasting will be allowed for demolition.

B. Demolish and remove existing construction to the extent required by new construction and as indicated. Use methods required to complete the work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame cutting operations. Maintain portable fire suppression devices during flame cutting operations.
5. Maintain fire watch during and for at least 24 hours after flame cutting operations.
6. Maintain ventilation when using cutting torches.
7. Remove decayed, vermin infested, and dangerous or unsuitable materials and promptly and legally dispose off site.
8. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.

9. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
10. Dispose of demolished items and materials promptly.

C. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

D. Removed and Salvaged Items: Remove items and equipment indicated for salvage. Photograph items with existing damage prior to removal. Submit list of damage items with supporting photographs and videos. Clean and pack or crate items after cleaning. Identify contents of containers. Store items in secure area until delivery to Owner.
1. Transport items to Owner's storage area designated by Owner. Protect items from damage during transport and storage.

E. Removed and Reinstalled Items: Clean and repair items to functional condition adequate for intended reuse.
1. Pack or crate items after cleaning and repairing. Identify contents of containers.
2. Protect items from damage during transport and storage.
3. Store items in secure storage, off ground, and covered. Protect until items are reinstalled.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

F. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in original locations after selective demolition operations are complete.

G. Patching and Repair: Repair damage to adjacent construction caused by selective demolition operations promptly.

3.6 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in small sections. Using power driven saw, cut concrete to a depth of at least 3/4 inch (19 mm) at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.

B. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power driven saw, and then remove concrete between saw cuts.

C. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power driven saw, and then remove masonry between saw cuts.

D. Concrete Slabs on Grade: Saw cut perimeter of area to be demolished, and then break up and remove.

E. Interior Slab on Grade: Use best practice removal methods to prevent cracking or structurally disturbing adjacent slabs or partitions. Use power saw where possible.

F. Below Grade Voids: Completely fill below grade areas and voids resulting from demolition work. Provide fill consisting of approved earth, gravel, or sand, free of trash and debris, stones over 6 inches (150 mm) in diameter, roots, or organic matter.

G. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI Recommended Work Practices for the Removal of Resilient Floor Coverings.

H. Partitions: Completely remove indicated interior partitions and interior finishes indicated. Leave adjacent work scheduled to remain sound and ready for patching or for new finishes.

I. Doors and Frames: Remove doors, frames, and hardware where indicated. Remove anchors, shims, trim, and attachments. Leave opening ready to receive new work. Remove from site.

J. Cut existing masonry walls for new openings where indicated. Leave openings ready to receive new work or patching.

K. Windows: Remove existing windows where indicated. Remove associated anchors, shims, blocking, operating devices, sealant, and trim. Cut back interior finishes required for plumb surface for patching. Leave openings ready for installation of new materials and finishes or to be infilled.

L. Mechanical, Electrical, and Structural Elements: If unanticipated mechanical, electrical, or structural elements conflicting with intended function or design are encountered, investigate and measure both nature and extent of the conflict.
   1. Submit written report to Architect in accurate detail. Pending receipt of directive, rearrange selective demolition schedule as necessary to continue overall job progress without undue delay.
   2. HVAC Equipment: Remove air conditioning equipment without releasing refrigerants.

3.7 REMOVAL OF STRUCTURAL ELEMENTS

A. Foundation: Demolish foundation walls to a minimum depth of 12 inches (300mm) below existing ground surface. Demolish and remove below grade wood or metal construction. Break up below grade concrete slabs.
   1. Interior Slabs on Grade: Employ removal methods to prevent cracking or structurally disturbing adjacent slabs or partitions. Use power saw where possible.
   2. Completely fill below grade areas and voids resulting from demolition work. Provide fill consisting of approved earth, gravel, or sand, free of trash and debris, stones over 6 (150mm) inches in diameter, roots, or other organic matter.

B. Pneumatic Operated Hammers: When possible, reduce use of pneumatic operated hammers. When necessary to use pneumatic tools, locate compressors as remote form occupied areas as possible.
   1. To break large pieces of concrete, isolate concrete from floor slabs and building structure to prevent structure borne vibration.

C. Saw Cutting: Locate compressors as remote as possible from occupied areas of facility.
   1. Use diamond tipped saw blades and related equipment.
   2. Saw cut portions of walls and slabs. Angle saw blade at floors and corners to cut as closely as possible to desired location.
   3. Control runoff water used with saw to prevent damage to existing materials.

3.8 ROOF REMOVAL

A. Roof Assembly: Remove existing roofing to the extent that can be covered in one day by new roofing. Maintain building interior in watertight and weathertight condition.
   1. Remove existing roof membrane, flashings, copings, and roof accessories.
   2. Remove existing roofing system down to substrate.

B. At new column extensions, cut through roofing as required for welding of new extension. Provide temporary watertight enclosure over stubs and temporarily flash to existing roof to make completely watertight.

C. At existing parapets, remove portions of roofing, flashing, stone, and masonry necessary to weld new steel and set form work. Provide temporary watertight enclosures over areas of open roof and temporarily flash to make watertight.

D. As column forms are placed, temporarily flash columns to existing roofing and cover with watertight tarpaulins before and after pouring. After column forms have been removed, temporarily flash new concrete structure into existing roofing immediately to maintain watertight roof.

E. When removing roofing to place supports for shoring of form work to transfer loads to existing columns or approved structure or to support scaffolding, work platforms, or similar loads, temporarily flash supports to make roof watertight.

F. Remove excess residue. Thoroughly clean and remove asphalt, dust, loose materials and leave ready for new work.

3.9 PATCHING AND REPAIRS

A. Promptly repair damage to adjacent construction caused by selective demolition operations. Refinish construction or item to a condition comparable or better than before selective demolition operations or replace with new.

B. Patching: Comply with Section 01 73 29 "Cutting and Patching."

C. Repairs: When necessary to repair to existing surfaces, patch to produce surfaces suitable for new materials.

1. Fill holes and depressions in existing masonry walls to remain with masonry patching material applied according to manufacturer's written recommendations.

D. Finishes: Restore exposed finishes of patched areas and extend restoration into adjoining construction in a manner that eliminates evidence of patching and refinishing.

E. Floors and Partitions: Where walls or partitions are demolished, 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 existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

1. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications.
2. Where patching occurs in a painted surface, apply primer and intermediate paint coats over patch and apply final paint coat over entire unbroken surface containing patch. Provide additional coats until patch blends with adjacent surfaces.
3. Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.

F. Ceilings: Patch, repair, or rehang existing ceilings as necessary to provide an even plane surface of uniform appearance.

3.10 DISPOSAL OF DEMOLISHED MATERIALS

A. Legally remove demolition waste materials from site.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

B. Burning: Do not burn demolished materials.

3.11 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

B. Remove partitions and temporary work. Restore surfaces to match adjacent surfaces.

END OF SECTION

SECTION 03 10 00

CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Formwork for cast-in place concrete.
2. Shoring, bracing, and anchorage.
3. Architectural form liners.
4. Form accessories.
5. Form stripping.

1.2 REFERENCES

A. American Concrete Institute:
1. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials.
2. ACI 301 - Specifications for Structural Concrete.
3. ACI 318 - Building Code Requirements for Structural Concrete.
4. ACI 347 - Guide to Formwork for Concrete.

B. American Forest and Paper Association:
1. AF&PA - National Design Specifications for Wood Construction.

C. The Engineered Wood Association:
1. APA/EWA PS 1 - Voluntary Product Standard for Construction and Industrial Plywood.

D. American Society of Mechanical Engineers:
1. ASME A17.1 - Safety Code for Elevators and Escalators.

E. ASTM International:
1. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
2. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials.

F. West Coast Lumber Inspection Bureau:
1. WCLIB - Standard Grading Rules for West Coast Lumber.

1.3 DESIGN REQUIREMENTS

A. Design, engineer and construct formwork, shoring and bracing in accordance with ACI 318 to conform to applicable code requirements to achieve concrete shape, line and dimension as indicated on Drawings.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings for Concrete Structures as required in plans: Signed and sealed by professional engineer.
   1. Submit formwork, shoring, and reshoring shop drawings.
   2. Indicate the following:
      a. Pertinent dimensions, openings, methods of construction, types of connections, materials, joint arrangement and details, ties and shores, location of framing, studding, and bracing, and temporary supports.
      b. Means of leakage prevention for concrete exposed to view in finished construction.
      c. Sequence and timing of erection and stripping assumed compressive strength at time of stripping, height of lift and height of drop during placement.
      d. Vertical, horizontal, and special loads in accordance with ACI 347, Section 2.2 and camber diagrams, when applicable.
      e. Notes to formwork erector showing size and location of conduits and piping embedded in concrete in accordance with ACI 318, Section 6.3.
      f. Procedure and schedule for removal of shores and installation and removal of reshores.

C. Product Data: Submit data on void form materials.

D. Design Data: Signed and sealed by professional engineer.
   1. Indicate design data for formwork and shoring.
   2. Indicate loads transferred to structure during process of concreting, shoring and reshoring.
   3. Include structural calculations to support design.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 347, ACI 301 and ACI 318, as applicable.

B. For wood products furnished for work of this Section, comply with AF&PA.

C. Perform Work in accordance with appropriate city and state agency requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Products storage and handling requirements.

B. Deliver void forms and installation instructions in manufacturer's packaging.

C. Store off ground in ventilated and protected manner to prevent deterioration from moisture.

1.7 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Coordinate this Section with other sections of work, requiring attachment of components to formwork.

PART 2 - PRODUCTS

2.1 WOOD FORM MATERIALS

A. Form Materials: At discretion of Contractor.

B. Lumber Forms:
1. Provide properly seasoned good-quality lumber that is free from imperfections that would affect its strength or impair the finished surface of the concrete.
2. Provide timber or lumber that meets or exceeds the requirements for species and grade in the submitted formwork plans.
3. Maintain forms or form lumber that will be reused so that it stays clean and in good condition. Do not use any lumber that is split, warped, bulged, or marred or that has defects that will produce inferior work, and promptly remove such lumber from the work.

C. Plywood Forms:
1. Application: Use for exposed finish concrete.
2. Forms: Conform to PS 1; full size 4 x 8 feet (1,200 x 2,400 mm) panels; each panel labeled with grade trademark of APA/EWA.
3. Plywood for Surfaces to Receive Membrane Waterproofing: Minimum of 5/8 inch (16 mm) thick; APA/EWA “B-B Plyform Structural I Exterior” grade.
4. Plywood where “Smooth Finish” is required, as indicated on Drawings: APA/EWA “HD Overlay Plyform Structural I Exterior” grade, minimum of 3/4 inch (19 mm) thick.

2.2 PREFABRICATED FORMS

A. Furnish materials in accordance appropriate city and state agency requirements.

B. Preformed Steel Forms: Minimum 16 gage matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.

C. Glass Fiber Fabric Reinforced Plastic Forms: Matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished concrete surfaces.

D. Pan Type: Steel of size and profile required.

E. Tubular Column Type: Round, spirally wound laminated fiber material, surface treated with release agent, non-reusable, sizes as indicated on Drawings.

F. Steel Forms: Sheet steel, suitably reinforced, and designed for particular use indicated on Drawings.

G. Form Liners: Smooth, durable, grainless and non-staining hardboard, unless otherwise indicated on Drawings.

H. Framing, Studding and Bracing: Stud or No. 3 structural light framing grade.

2.3 FORMWORK ACCESSORIES

A. Form Ties: Removable or Snap-off type, galvanized metal, fixed length, free of defects capable of leaving holes larger than 1 inch in concrete surface.

B. Spreaders: Standard, non-corrosive metal form clamp assembly, of type acting as spreaders and leaving no metal within 1 inch (25 mm) of concrete face. Wire ties, wood spreaders or through bolts are not permitted.

C. Form Anchors and Hangers:
   1. Do not use anchors and hangers exposed concrete leaving exposed metal at concrete surface.
   2. Symmetrically arrange hangers supporting forms from structural steel members to minimize twisting or rotation of member.
   3. Penetration of structural steel members is not permitted.

D. Form Release Agent: Colorless mineral oil that will not stain concrete, or absorb moisture , or impair natural bonding or color characteristics of coating intended for use on concrete.

E. Corners: Fillet or Chamfer, rigid plastic, or wood strip type.

F. Dovetail Anchor Slot: Galvanized steel, 22 gage thick, release tape sealed slots, anchors for securing to concrete formwork.

G. Vapor Retarder: Where indicated on Drawings, 6 mil (0.2 mm) thick polyethylene sheet.

H. Bituminous Joint Filler: ASTM D1751.

I. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Size, strength and character to maintain formwork in place while placing concrete.

J. Water Stops: In accordance with manufacturer’s recommendations and as specified in the plans.

2.4 COATINGS

A. Coatings for Aluminum: Polyamide epoxy finish coat with paint manufacturer's recommended primer for aluminum substrate. Apply one coat primer and one coat finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify lines, levels, and centers before proceeding with formwork. Verify dimensions agree with Drawings.

C. When formwork is placed after reinforcement resulting in insufficient concrete cover over reinforcement before proceeding, request instructions from Architect/Engineer.

3.2 INSTALLATION

A. Earth Forms, when permitted:
   1. Trench earth forms neatly, accurately, and at least 2 inches (50 mm) wider than footing widths indicated on Drawings.
   2. Trim sides and bottom of earth forms.
   3. Construct wood edge strips at top of each side of trench to secure reinforcing and prevent trench from sloughing.
   4. Form sides of footings where earth sloughs.
   5. Tamp earth forms firm and clean forms of debris and loose material before depositing concrete.

B. Formwork - General:
   1. Provide top form for sloped surfaces steeper than 1.5 horizontal to 1 vertical to hold shape of concrete during placement, unless it can be demonstrated that top forms can be omitted.
   2. Construct forms to correct shape and dimensions, mortar-tight, braced, and of sufficient strength to maintain shape and position under imposed loads from construction operations.
   3. Camber forms where necessary to produce level finished soffits unless otherwise shown on Drawings.
   4. Carefully verify horizontal and vertical positions of forms. Correct misaligned or misplaced forms before placing concrete.
   5. Complete wedging and bracing before placing concrete.

C. Forms for Smooth Finish Concrete:
   1. Use steel, plywood or lined board forms.
   2. Use clean and smooth plywood and form liners, uniform in size, and free from surface and edge damage capable of affecting resulting concrete finish.

3. Install form lining with close-fitting square joints between separate sheets without springing into place.
4. Use full size sheets of form lines and plywood wherever possible.
5. Tape joints to prevent protrusions in concrete.
6. Use care in forming and stripping wood forms to protect corners and edges.
7. Level and continue horizontal joints.
8. Keep wood forms wet until stripped.

D. Forms for Surfaces to Receive Membrane Waterproofing: Use plywood or steel forms. After erection of forms, tape form joints to prevent protrusions in concrete.

E. Framing, Studding and Bracing:
1. Space studs at 16 inches (400 mm) on center maximum for boards and 12 inches (300 mm) on center maximum for plywood.
2. Size framing, bracing, centering, and supporting members with sufficient strength to maintain shape and position under imposed loads from construction operations.
3. Construct beam soffits of material minimum of 2 inches (50 mm) thick.
4. Distribute bracing loads over base area on which bracing is erected.
5. When placed on ground, protect against undermining, settlement or accidental impact.

F. Erect formwork, shoring, and bracing to achieve design requirements, in accordance with requirements of ACI 301 and ACI 318.

G. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.

H. Obtain Architect/Engineer’s approval before framing openings in structural members not indicated on Drawings.

I. Install chamfer strips on external corners of exposed structures.

J. Install void forms in accordance with manufacturer's recommendations.

3.3 APPLICATION - FORM RELEASE AGENT

A. Apply form release agent on formwork in accordance with manufacturer's recommendations.

B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.

C. Do not apply form release agent where concrete surfaces are indicated to receive special finishes or applied coverings that are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

D. Reuse and Coating of Forms: Thoroughly clean forms and reapply form coating before each reuse. For exposed work, do not reuse forms with damaged faces or edges. Apply form coating to forms in accordance with manufacturer’s specifications. Do not

coat forms for concrete indicated to receive “scored finish." Apply form coatings before placing reinforcing steel.

3.4 INSTALLATION - INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Install formed openings for items to be embedded in or passing through concrete work.

B. Locate and set in place items required to be cast directly into concrete.

C. Coordinate with Work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other Work.

D. Install accessories straight, level, and plumb. Ensure items are not disturbed during concrete placement.

E. Install water stops continuous without displacing reinforcement.

F. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.

G. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

H. Form Ties:
1. Use sufficient strength and sufficient quantity to prevent spreading of forms.
2. Place ties at least 1 inch (25 mm) away from finished surface of concrete.
3. Leave inner rods in concrete when forms are stripped.
4. Space form ties equidistant, symmetrical and aligned vertically and horizontally unless otherwise shown on Drawings.

I. Arrangement: Arrange formwork to allow proper erection sequence and to permit form removal without damage to concrete.

J. Construction Joints:
1. Install surfaced pouring strip where construction joints intersect exposed surfaces to provide straight line at joints.
2. Just prior to subsequent concrete placement, remove strip and tighten forms to conceal shrinkage.
3. Show no overlapping of construction joints. Construct joints to present same appearance as butted plywood joints.
4. Arrange joints in continuous line straight, true and sharp.

K. Embedded Items:
1. Make provisions for pipes, sleeves, anchors, inserts, anchor slots, nailers, water stops, and other features.
2. Do not embed wood or uncoated aluminum in concrete.
3. Obtain installation and setting information for embedded items furnished under other Specification sections.

4. Securely anchor embedded items in correct location and alignment prior to placing concrete.
5. Verify conduits and pipes, including those made of coated aluminum, meet requirements of ACI 318 for size and location limitations.

L. Openings for Items Passing Through Concrete:
1. Frame openings in concrete where indicated on Drawings. Establish exact locations, sizes, and other conditions required for openings and attachment of work specified under other sections.
2. Coordinate work to avoid cutting and patching of concrete after placement.
3. Perform cutting and repairing of concrete required as result of failure to provide required openings.

M. Screeds:
1. Set screeds and establish levels for tops of concrete slabs and levels for finish on slabs.
2. Slope slabs to drain where required or as shown on Drawings.
3. Before depositing concrete, remove debris from space to be occupied by concrete and thoroughly wet forms. Remove freestanding water.

N. Screed Supports:
1. For concrete over waterproof membranes and vapor retarder membranes, use cradle, pad or base type screed supports which will not puncture membrane.
2. Staking through membrane is not be permitted.

O. Cleanouts and Access Panels:
1. Provide removable cleanout sections or access panels at bottoms of forms to permit inspection and effective cleaning of loose dirt, debris and waste material.
2. Clean forms and surfaces against which concrete is to be placed. Remove chips, saw dust and other debris. Thoroughly blow out forms with compressed air just before concrete is placed.

3.5 FORM CLEANING

A. Clean forms as erection proceeds, to remove foreign matter within forms.

B. Clean formed cavities of debris prior to placing concrete.

C. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.

D. During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out forms, unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter.

3.6 FORM REMOVAL

A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads and removal has been approved by Architect/Engineer.

B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

C. Store removed forms in manner that surfaces to be in contact with fresh concrete will not be damaged. Discard damaged forms.

D. Leave forms in place for minimum number of days as specified in ACI 347.

3.7 ERECTION TOLERANCES

A. Construct formwork to maintain tolerances required by ACI 301 and ACI 318.

3.8 FIELD QUALITY CONTROL

A. Section 01 40 00.10 - Civil Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and that supports, fastenings, wedges, ties, and items are secure.

C. Notify Architect/Engineer after placement of reinforcing steel in forms, but prior to placing concrete.

D. Schedule concrete placement to permit formwork inspection before placing concrete.

END OF SECTION

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SECTION 03 20 00

CONCRETE REINFORCING - CIVIL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Reinforcing bars.
2. Welded wire fabric.
3. Reinforcement accessories.

1.2 REFERENCES

A. American Concrete Institute:
1. ACI 301 - Specifications for Structural Concrete.
2. ACI 318 - Building Code Requirements for Structural Concrete.
3. ACI 530.1 - Specifications for Masonry Structures.
4. ACI SP-66 - ACI Detailing Manual.

B. ASTM International:
1. ASTM A82/A82M - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
2. ASTM A184/A184M - Standard Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.
3. A185/A185M-07 Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
4. ASTM A496/A496M - Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement.
5. ASTM A497/A497M - Standard Specification for Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement.
6. ASTM A615/A615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
7. ASTM A704/A704M - Standard Specification for Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement.
8. ASTM A706/A706M - Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
9. ASTM A767/A767M - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.
10. ASTM A775/A775M - Standard Specification for Epoxy-Coated Steel Reinforcing Bars.
11. ASTM A884/A884M - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement.

12. ASTM A934/A934M - Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars.
13. ASTM A996/A996M - Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement.

C. American Welding Society:
1. AWS D1.4 - Structural Welding Code - Reinforcing Steel.

D. Concrete Reinforcing Steel Institute:
1. CRSI - Manual of Standard Practice.
2. CRSI - Placing Reinforcing Bars.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Certificates: Submit AWS qualification certificate for welders employed on the Work.

C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with CRSI - Manual of Standard Practice, ACI 301, ACI 318.

B. Perform Work in accordance with appropriate city and state agency requirements.

C. Maintain one copy of document on site.

1.5 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Coordinate with placement of formwork, formed openings and other Work.

PART 2 - PRODUCTS

2.1 REINFORCEMENT

A. Reinforcing Steel: ASTM A615/A615M, 60 ksi yield grade, deformed billet bars or as shown on plans.

B. Deformed Bar Mats: ASTM A184/A184M; fabricated from ASTM A615/A615M; 60 ksi yield strength, steel bars, as shown on plans.

C. Welded Plain Wire Fabric: ASTM A185/A185M; in flat sheets; as shown on plans.

D. Dowels: ASTM A615/A615M; 60 ksi yield strength, plain steel bars; square ends with burrs removed; size and finish as indicated on drawings.

2.2 ACCESSORY MATERIALS

A. Tie Wire: Minimum 16 gage annealed type or as shown on plans.

B. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions including load bearing pad on bottom to prevent vapor retarder puncture.

C. Special Chairs, Bolsters, Bar Supports, Spacers Adjacent to Weather Exposed Concrete Surfaces: Plastic-coated steel or Plastic tipped steel type; size and shape to meet Project conditions.

D. Reinforcing Splicing Devices: Mechanical threaded type; full tension and compression; sized to fit joined reinforcing.

2.3 FABRICATION

A. Fabricate concrete reinforcement in accordance with CRSI Manual of Practice or ACI 318.

B. Form standard hooks for 180 degree bends, 90 degree bend, stirrup and tie hooks, and seismic hooks as indicated on Drawings.

C. Form reinforcement bends with minimum diameters in accordance with ACI 318.

D. Fabricate column reinforcement with offset bends at reinforcement splices.

E. Form spiral column reinforcement from minimum 3/8 inch diameter continuous deformed, plain bar or wire.

F. Weld reinforcement in accordance with AWS D1.4.

G. Locate reinforcement splices not indicated on Drawings, at point of minimum stress.

2.4 SOURCE QUALITY CONTROL

A. Section 01 40 00.10 - Civil Quality Requirements: Testing, inspection, and analysis requirements.

PART 3 - EXECUTION

3.1 PLACEMENT

A. Place, support and secure reinforcement against displacement. Do not deviate from required position beyond specified tolerance.
   1. Do not weld crossing reinforcement bars for assembly except as permitted by Architect/Engineer.

B. Do not displace or damage vapor retarder.

C. Accommodate placement of formed openings.

D. Space reinforcement bars with minimum clear spacing in accordance with ACI 318 of one bar diameter, but not less than 1 inch.

1. Where bars are indicated in multiple layers, place upper bars directly above lower bars.

E. Maintain concrete cover around reinforcement in accordance with ACI 318 as follows or as shown on plans:

Reinforcement Location		Minimum Concrete Cover
Footings and Concrete Formed Against Earth		3 inches
Concrete exposed to earth or weather	No. 6 bars and larger	2 inches
	No. 5 bars and smaller	1-1/2 inches
Supported Slabs, Walls, and Joists	No. 14 bars and larger	1-1/2 inches
	No. 11 bars and smaller	3/4 inches
Beams and Columns		1-1/2 inches
Shell and Folded Plate Members	No. 6 bars and larger	3/4 inches
	No. 5 bars and smaller	1/2 inches

F. Bond and ground reinforcement as shown in plans.

G. Place dowels to achieve paving and curb alignment as detailed.

H. Provide doweled joints at locations and spacing as shown on Plans.

I. Repair damaged epoxy coating to match shop finish.

3.2 ERECTION TOLERANCES

A. Section 01 40 00.10 - Civil Quality Requirements: Tolerances.

B. Install reinforcement within the following tolerances for flexural members, walls, and compression members:

Reinforcement Depth	Depth Tolerance	Concrete Cover Tolerance
Greater than 8 inches	plus or minus 3/8 inch	minus 3/8 inch
Less than 8 inches	plus or minus 1/2 inch	minus 1/2 inch

C. Install reinforcement within the tolerances specified in ACI 530.1 for foundation walls.

3.3 FIELD QUALITY CONTROL

A. Section 01 40 00.10 - Civil Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Perform field inspection and testing in accordance with ACI 318.

C. Provide free access to Work and cooperate with appointed firm.

D. Reinforcement Inspection:
   1. Placement Acceptance: Specified and ACI 318 material requirements and specified placement tolerances.
   2. Welding: Inspect welds in accordance with AWS D1.1.
   3. Periodic Placement Inspection: Inspect for correct materials, fabrication, sizes, locations, spacing, concrete cover, and splicing.
   4. Weldability Inspection: Inspect for reinforcement weldability when formed from steel other than ASTM A706/A706M.
   5. Continuous Weld Inspection: Inspect reinforcement as required by ACI 318.
   6. Periodic Weld Inspection: Other welded connections.

END OF SECTION

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SECTION 03 39 00

CONCRETE SEALER

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Concrete curing, sealing, and hardening compounds for concrete floor slabs.

1.2 ACTION SUBMITTALS

A. Product Data: Submit technical data including manufacturer's specifications, application instructions, and recommendations. Include data substantiating product complies with requirements of the contract documents.

1.3 QUALITY ASSURANCE

A. Applicator Qualifications: Entity having minimum 5 years documented experience who is acceptable to manufacturer and employs applicators trained in the specified system.

B. Applicator Qualifications: Entity having minimum 5 years documented experience who is acceptable to manufacturer and employs applicators trained in the specified system.

C. Preinstallation Conference: Conduct conference at site.

1.4 PROJECT CONDITIONS

A. Environmental Limitations: Comply with concrete sealer manufacturer's written instructions for substrate temperature, ambient temperature, humidity, ventilation, and conditions affecting application.

1. Apply concrete sealer when substrate temperature and surrounding air temperatures are between 50 degrees F and 95 degrees F (10 degrees F and 35 degrees C).
2. Do not apply concrete sealer in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 degrees F (3 degrees C) above the dew point; or to damp or wet surfaces.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original, unopened packages. Protect from freezing, direct sun exposure and exposure to moisture.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Curing and Sealing Compound - Type 2:
   1. Clear, Solvent Borne, Membrane Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
      a. Subject to compliance with requirements, provide one of the following:
         1) BASF Construction Chemicals - Building Systems; Kure-N-Seal 25 LV.
         2) Euclid Chemical Company (The), an RPM company; Super Diamond Clear.
         3) Laticrete International; L&M Lumiseal Plus.
         4) Meadows, W. R., Inc.; CS-309-30.
   2. Clear, Waterborne, Membrane Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
      a. Subject to compliance with requirements, provide one of the following:
         1) Euclid Chemical Company (The), an RPM company; Everclear VOX.
         2) Laticrete International; L&M Lumiseal WB.
         3) Meadows, W. R., Inc.; Vocomp-25.
         4) NoxCrete; Eco-Seal XC.

B. Grout: Nonshrink, nonmetallic grout recommended by sealer manufacturer.

C. Concrete Cleaner: Recommended by manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for conditions affecting performance and conditions of floor treatment.
   1. Verify compatibility with and suitability of substrates, including existing finishes or primers.
   2. Verify plasticizers in existing concrete substrate will not impair bond.
   3. Verify concrete surface, substrate, tolerance, levelness, plumbness, temperature, humidity, cleanliness, and applicable conditions are as required.
   4. Proceed with installation after correcting unsatisfactory conditions.

3.2 PREPARATION

A. Clean substrate, removing projections and substances detrimental to the work; comply with recommendations of manufacturer of products to be installed for proper preparation procedures. Mask off or protect adjacent surfaces not scheduled to receive sealer.

B. Remove residue and curing compounds with cleaner recommended by sealer manufacturer with a bristle brush or broom or mechanically abrade concrete surface to a uniform profile complying with ASTM D 4259. Do not acid etch.

C. Patch holes in existing concrete slabs with grout recommended by sealer manufacturer.

D. Protect adjacent surface from splatter in accordance with sealer manufacturer’s written instructions.

3.3 APPLICATION

A. Curing Compound: Apply uniformly in continuous operation by power spray or roller complying with 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.

1. 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.

B. Curing and Sealing Compounds: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller complying with manufacturer's written instructions. Repeat process 24 hours later and apply a second coat.

C. Penetrating Sealer: Spray apply sealer to comply with manufacturer's instructions except where project conditions require extra precautions or provisions to ensure satisfactory performance of the work.

1. Apply sealer to produce surface without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or surface imperfections. Produce sharp glass lines and color breaks. Do not permit sealer to pond and dry on concrete surface. Squeegee ponding sealer to spread.

3.4 CLEANING

A. After completing application, clean spattered surfaces. Remove spattered sealer by washing or other appropriate methods for coating. Do not scratch or damage adjacent finished surfaces.

B. Clean Up: Remove rubbish, empty cans, rags, and discarded materials from site daily. Rinse and recycle or legally dispose of sealer and coating containers.

3.5 PROTECTION

A. Institute protective procedures and install protective materials as required to ensure that work of this section will be without damage or deterioration at substantial completion.

3.6 FLOOR SEALER SCHEDULE

A. Curing and Sealing Compound, Type 2: Provide at existing exposed floor slabs in rooms where no other finished flooring products are scheduled such as storage rooms, MEP closets, and similar spaces.

END OF SECTION

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SECTION 05 51 36.20

METAL GRATE PLATFORMS STAIRS AND RAILS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Engineered metal grate platforms and secondary support members.
   2. Stairs and ramps with metal grating treads and landings.
   3. Metal railings attached to metal grate platforms, ramps, and stair systems.
   4. Metal handrails attached to walls adjacent to metal stairs.

1.2 SUBMITTALS

A. Product Data: Submit technical data for engineered metal grate platforms stairs, ramps, and rails including structural framing, railings, supports, and accessories.

B. Shop Drawings: Submit shop drawings detailing the fabrication and erection of each platform, platforms railings and stairs, including structural framing, railings, and supports. Show plans, elevations, sections, details, and connections. Show anchorage and accessory items.
   1. For installed products indicated to comply with design loads, include structural analysis data, for information only, signed and sealed by the qualified professional engineer responsible for their preparation.

C. Delegated Design Submittal: Submit for metal grate platforms, stairs, ramps, and rails 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. Design Calculations: Submit structural calculations for members and connections, stairs and railings. The system shall lend itself-to a rational structural analysis with section properties of framing members demonstrated by calculations.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: Submit data for professional engineer's experience with providing delegated design engineering services of the kind indicated, including documentation that engineer is licensed in the jurisdiction in which Project is located.

B. Welding certificates.

C. Evaluation Reports: ICC-ES report for framing assembly, anchor, and fastener type.

D. Certificates and Reports:
   1. Welding certificates.
   2. Mill certificates.

3. Paint Compatibility Certificates: Submit manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

1.4 QUALITY ASSURANCE

A. Fabricator/Installer Qualifications: Entity having minimum 10 years documented experience in the design, manufacture, production, and installation of platforms, railings, and stairs.

B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of metal fabrications that are similar to those indicated in material, design, and extent.

C. Sole Source Responsibility: Provide framing system components from a single manufacturer.

D. Preinstallation Conference: Conduct preinstallation conference at the project site.

1.5 COORDINATION

A. Coordinate installation of anchorages for metal stairs and railings.
1. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, blocking for attachment of wall mounted handrails, and items with integral anchors, embedded in concrete or masonry.
2. Deliver to site in time for installation.

B. Schedule installation of railings so wall attachments are made to completed walls.
1. Do not support railings temporarily by means that do not satisfy structural performance requirements.

1.6 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.
1. Established Dimensions: Where field measurements cannot be made without delaying the work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
2. Provide allowance for trimming and fitting at site.

1.7 STORAGE, DELIVERY AND HANDLING

A. Store system components in a dry, well ventilated, weathertight place and to permit easy access for inspection and identification. Deliver and handle to prevent damage to the fabricated work.
   1. Keep metal members off ground and spaced by using pallets, dunnage, or supports and spacers.
   2. Protect metal members and packaged materials from corrosion and deterioration.
   3. Do not store materials on structure that might cause distortion, damage, or overload to members or supporting structures.
      a. Repair or replace damaged materials or structures as directed.

1.8 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of platform, stair and railing assemblies anchored to or that receive other Work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver items to project site in time for installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, to design metal grate platforms, stairs, ramps, and rails, including attachment to building construction and framing members. Provide comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Metal Grate Platforms, Stairs, Ramps, and Rails Framing Assembly: Framing assembly capable of withstanding structural loads complying with design criteria without exceeding the allowable design working stress of the materials involved, including anchors and connections, or of exhibiting excessive deflections in any of the components making up the faming assembly.

C. Code Compliance Requirements: For platforms, stairs, and ramps along an egress path, at entrances, exits and areas of refuge, fabricate treads and platforms with openings in gratings no more than 1/2 inch in least dimension.

D. Structural Performance of Platforms: Provide platform framing capable of withstanding design loads within limits and under conditions indicated.
   1. Design Loads: As indicated on the Drawings, with the following as minimum requirements:
      a. Walkways and Elevated Platforms: Uniform load of 60 lbf/sq. ft. (2.87 kN/sq. m).

2. Limit deflection to L/360 or 1/4 inch (6.4 mm), whichever is less.
3. Seismic Loads: Indicated on Drawings.

E. Structural Performance of Stairs and Ramps: Metal grating stairs and ramps shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
1. Uniform Load: Designed and constructed to carry a load of five times the normal live load anticipated but not less strength than to carry safely a moving concentrated load of 1,000 pounds (454 kg).
2. Concentrated Load: Minimum 1000 lbf (454 kg) applied on an area of 4 sq. in. (2580 sq. mm).
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.

F. Structural Performance of Railings: Railings, including attachment to building construction, 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. (0.73 kN/m) applied in any direction.
   b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
   c. Uniform and concentrated loads need not be assumed to act concurrently.

G. Structural Performance of Guardrails: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
1. Guardrails and Top Rails of Guards: Capable of withstanding, without failure, a force of at least 200 pounds (890 N) applied in a downward or outward direction within 2 inches (5 cm) of the top edge, at any point along the top rail.
   a. When a 200 pound (890 N) test load is applied in a downward direction, the top rail of the guardrail system shall not deflect to a height of less than 39 inches (99 cm) above the walking/working surface.
   b. Height: Not less than 42 inches (1070 mm) from leading edge of stair tread to top of surface of top rail.
      1) Top Edge Height: Permitted to exceed 45 inches (1140 mm) provided all criteria is met.
2. Infill or Midrails of Guards:
   a. Midrails, intermediate vertical members, and intermediate members capable of withstanding, without failure, a force of at least 150 pounds (667 N) applied in any downward or outward direction at any point along the intermediate member.
   b. Height: Installed midway between top edge of guard rails and walking/working surface.

H. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
1. Temperature Change: 120 degrees F (67 degrees C), ambient; 180 degrees F (100 degrees C), material surfaces.

I. Seismic Performance: All assemblies shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

J. Coordinate building structural members, elevations, and roof layout for the design of platforms. Support platforms from structural members and distributed accordingly.

K. Overall Assembly Safety Factor: Minimum of 3.

2.2 METALS

A. Metal Surfaces: 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. Aluminum Bars for Grating Treads: ASTM B 221 (ASTM B 221M) extruded aluminum, alloys as follows:

1. 6061-T6 or 6063-T6, for bearing bars of gratings and shapes.
2. 6061-T1, for grating crossbars.

C.

D. Fasteners: Provide Type 304 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941/F 1941M, Class Fe/Zn 5 where built into exterior walls.

E. Post Installed Anchors: Torque controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency. Alloy Group 1 (A1) stainless steel bolts, ASTM F 593, and nuts, ASTM F 594.

F. Welding Electrodes: Comply with AWS requirements.

2.3 FABRICATION METAL GRATE PLATFORMS, RAMPS, AND STAIRS

A. Fabricate all platforms, supports and hangers, and arrangement of members as shown on drawings.

B. Shop Assembly: Fabricate platform sections in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

C. Cut, drill, and punch material cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form from materials of size, thickness, and shapes indicated, but not less than that needed to support indicated loads.

E. Fit exposed connections accurately together to form hairline joints.

F. Welding: Comply with AWS recommendations and 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.

G. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space the anchoring devices to secure gratings, frames, and supports rigidly in place and to support indicated loads.
   1. Fabricate toeplates to fit grating units and weld to units in shop unless otherwise indicated.
   2. Fabricate toeplates for attaching in the field.
   3. Toeplate Height: 4 inches (100 mm) unless otherwise indicated.

H. Metal Bar Grating Stairs and stair platforms: Form stair treads and stair platforms to configurations shown from metal bar grating; fabricate to comply with NAAMM MBG 531 Metal Bar Grating Manual.
   1. Fabricate treads and platforms from pressure-locked aluminum with openings in gratings no more than 1/2 inch in least dimension.
      a. Surface: Serrated.
      b. Finish: Mill.
   2. For platforms, ramps, and stairs along an egress path, at entrances, exits and areas of refuge, fabricate treads and platforms from pressure-locked aluminum with openings in gratings no more than 1/2 inch in least dimension.
      a. Surface: Serrated.
      b. Finish: Mill.

I. Grating Sections: Fabricate with banding bars attached by welding to entire perimeter of each section. Include anchors and fasteners of type indicated or recommended by manufacturer for attaching to supports.
   1. Provide no fewer than four weld lugs for each heavy duty grating section, with each lug shop welded to two bearing bars.
      a. Furnish threaded bolts with nuts and washers for securing grating to supports.

J. Do not notch bearing bars at supports to maintain elevation.

2.4 FABRICATION OF RAILINGS

A. Fabricate railings to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of member, post spacings, wall bracket spacing, and anchorage, but not less than that needed to withstand indicated loads.
   1. Rails and Posts: 1-5/8 inch (41 mm) diameter top and bottom rails and 1-1/2 inch (38 mm) square posts.

2. Picket Infill: 3/4 inch (19 mm) round pickets spaced less than 4 inches (100 mm) clear.

B. Welded Connections: Fabricate railings with welded connections.
   1. Fabricate connections that are exposed to weather in a manner that excludes water.
      a. Provide weep holes where water may accumulate internally.
   2. Cope components at connections to provide close fit, or use fittings designed for this purpose.
   3. Weld around at connections, including at fittings.
   4. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   5. Obtain fusion without undercut or overlap.
   6. Remove flux immediately.
   7. Finish welds to comply with NOMMA Voluntary Joint Finish Standards for Finish #3 - Partially dressed weld with spatter removed as shown in NAAMM AMP 521.

C. Form changes in direction of railings as follows:
   1. By radius bends of radius indicated or by inserting prefabricated elbow fittings of radius indicated or by inserting prefabricated elbow fittings of radius indicated.

D. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required.
   1. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

E. Close exposed ends of railing members with prefabricated end fittings.

F. Provide wall returns at ends of wall mounted handrails unless otherwise indicated.
   1. Close ends of returns unless clearance between end of rail and wall is 1/4 inch (6 mm) or less.

G. Connect posts to stair framing by direct welding unless otherwise indicated.

H. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work.
   1. Furnish inserts and anchorage devices for connecting to concrete or masonry work.
   2. Provide type of bracket with flange tapped for concealed anchorage to threaded hanger bolt and that provides 1-1/2 inch (38 mm) clearance from inside face of handrail to finished wall surface.

I. Fillers: Provide fillers made from metal plate, or other suitably crush resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports.
   1. Size fillers to suit wall finish thickness and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.

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. Proceed with installation after unsatisfactory conditions have been corrected.

B. Verify elevations of floors, bearing surfaces and locations of bearing plates, and other embedments for compliance with requirements.

1. For wall mounted railings, verify locations of concealed reinforcement within gypsum board and plaster assemblies.

3.2 INSTALLATION

A. Install metal framing in accordance with manufacturer written instructions, design calculations and criteria and seismic requirements.

B. Install shop fabricated framing and securely anchor to supporting structure. Screw, bolt, or weld framing to produce flush, even, true to line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch (1.5 mm).

C. Adjust platform framing to avoid interferences.

3.3 INSTALLING METAL STAIRS

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction.

1. 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 structure or to weld plates cast into concrete unless otherwise indicated.

1. Grouted Baseplates: Clean concrete and masonry bearing surfaces of bond reducing materials, and roughen to improve bond to surfaces.
    a. Clean bottom surface of baseplates.
    b. Set metal stair baseplates on wedges, shims, or leveling nuts.
    c. After stairs have been positioned and aligned, tighten anchor bolts.
    d. Do not remove wedges or shims, but if protruding, cut off flush with edge of bearing plate before packing with grout.
    e. Promptly pack grout solidly between bearing surfaces and plates to ensure that no voids remain.
        1) Neatly finish exposed surfaces; protect grout and allow to cure.
        2) Comply with manufacturer's written installation instructions for shrinkage resistant grouts.

D. Provide temporary bracing or anchors in formwork for items built into concrete, masonry, or similar construction.

E. Fit exposed connections accurately together to form hairline joints.
   1. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.
   2. 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.
   3. Comply with requirements for welding.

3.4 INSTALLING RAILINGS

A. Adjust railing systems before anchoring to ensure matching alignment at abutting joints with tight, hairline joints.
   1. Space posts at spacing required by design loads.
   2. Plumb posts in each direction, within a tolerance of 1/16 inch in 3 feet (2 mm in 1 m).
   3. Align rails so variations from level for horizontal members and variations from parallel with rake of stairs for sloping members do not exceed 1/4 inch in 12 feet (6 mm in 3.5 m).
   4. Secure posts and rail ends to building construction as follows:
      a. Anchor handrail ends to concrete and masonry with metal round flanges welded to rail ends and anchored with post installed anchors and bolts.

B. Attach handrails to wall with wall brackets.
   1. Locate brackets at spacing required to support structural loads.
   2. Secure wall brackets to building construction as required to comply with performance requirements.
      a. For concrete and solid masonry anchorage, use chemical anchors and hanger or lag bolts.
      b. For hollow masonry anchorage, use toggle bolts.
      c. For steel framed partitions, use hanger or lag bolts set into fire retardant treated wood backing between studs. Coordinate with stud installation to locate backing members.

3.5 CLEANING

A. Clean exposed surfaces. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.

END OF SECTION

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SECTION 06 41 16

PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Plastic laminate clad architectural cabinets.
   2. Wood furring, blocking, shims, and hanging strips for installing plastic laminate clad architectural cabinets that are not concealed within other construction.

1.2 DEFINITIONS

A. Exposed Surfaces:
   1. Surfaces visible when doors and drawers are closed.
   2. Bottoms of cases more than 4 feet above finish floor.
   3. Back and edges of hinged doors exposed when opened.

B. Semiexposed Surfaces:
   1. Surfaces that becomes visible when drawers and doors are open.
   2. Tops of cases 6 feet or higher above finish floor.

C. Concealed Surfaces: Surfaces not visible after installation.

1.3 ACTION SUBMITTALS

A. Product Data: Technical data for each type of product, including data for fire retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.

B. Shop Drawings:
   1. Include plans, elevations, sections, and attachment details.
   2. Show large scale details.
   3. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
   4. Show locations and sizes of cutouts and holes for items installed in plastic-laminate architectural cabinets.
   5. Apply AWI Quality Certification Program label to Shop Drawings.

C. Samples: Submit samples for:
   1. Plastic Laminates: 12 inches by 12 inches (300 mm by 300 mm), for each type, color, pattern, and surface finish required.
      a. Provide one sample applied to core material with specified edge material applied to one edge.

2. Thermoset Decorative Panels: 12 inches by 12 inches (300 mm by 300 mm), for each color, pattern, and surface finish.
   a. Provide edge banding on one edge.
3. Corner Pieces:
   a. Cabinet front frame joints between stiles and rails and at exposed end pieces, 18 inches (450 mm) high by 18 inches (450 mm) wide by 6 inches (150 mm) deep.
   b. Miter joints for standing trim.
4. Exposed Cabinet Hardware and Accessories: One full size unit for each type and finish.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: Submit data for manufacturer and Installer.

B. Product Certificates: Submit certificates for the following:
   1. Composite wood and agrifiber products.
   2. High pressure decorative laminate.
   3. Adhesives.

C. Evaluation Reports: Submit ICC-ES reports for fire retardant treated materials.

D. Field quality control reports.

1.5 CLOSEOUT SUBMITTALS

A. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.6 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Entity having minimum 5 years documented experience and that employs skilled workers who custom fabricate products similar to those required.
   1. Manufacturer's Certification: Licensed participant in AWI Quality Certification Program.

B. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC accredited certification body.

C. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.

D. Installer Qualifications: Licensed participant in AWI's Quality Certification Program.

E. Preinstallation Conference: Conduct conference at site.

1.7 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to support loads imposed by installed and fully loaded cabinets.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver cabinets until painting and similar finish operations that might damage architectural cabinets have been completed in installation areas. Store cabinets in installation areas or in areas where environmental conditions comply with requirements.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.

B. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed/concealed by construction, and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Performance Requirements: Provide millwork in accordance with AWI Architectural Woodwork Standards 2nd edition and AWI Standard Suites for Premium.

B. AWI Catalog: Catalog numbers indicated on the drawings and in the specifications are for the convenience of identifying specific cabinet types. Unless modified by notation on the drawings or otherwise specified, current description for indicated number, together with indicated or specified options or accessories, constitutes requirements for each cabinet.

1. Catalog numbers and specific requirements indicated on the drawings and in the specification are given for the purpose of establishing standard design and quality of materials, construction, and workmanship.
2. Catalog numbers noted on the drawings are based upon AW! Appendices.

C. Quality Standard: Unless otherwise indicated, comply with AWI Architectural Woodwork Standards 2nd edition and AWI Standard Suites indicated for construction, finishes, installation, and other requirements.
   1. Provide certificates from AWI certification program indicating that woodwork and installation complies with requirements of grades specified.
   2. The Contract Documents may contain requirements that are more stringent than the referenced quality standard. Comply with requirements of Contract Documents in addition to those of the referenced quality standard.

2.2 PLASTIC LAMINATE CLAD ARCHITECTURAL CABINETS

A. Architectural Woodwork Standards Grade: Premium.

B. Type of Construction: Frameless.

C. Door and Drawer Front Style: Reveal overlay.
   1. Reveal Dimension: 1/2 inch (13 mm).

D. High Pressure Decorative Laminate: NEMA LD 3, grades as indicated or as required by quality standard.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Abet Laminati Inc.
      b. ArpaUSA.
      c. Formica Corporation.
      d. Lamin-Art, Inc.
      e. Panolam Industries International, Inc. brand.
      f. Wilsonart International.

E. Manufacturer: Chemical Resistant Plastic Laminate:
   1. Chem-Surf by Wilsonart International.
   2. Chem-Guard by Panolam Industries International, Inc.
   3. Chem/Stain Resistant Laboratory Grade by Formica Corporation.

F. Laminate Cladding for Exposed Surfaces:
   1. Horizontal Surfaces: Grade HGS.
   2. Postformed Surfaces: Grade HGP.
   3. Vertical Surfaces: Grade VGS.
   4. Edges: Grade HGS.
   5. Pattern Direction: Vertically for drawer fronts, doors, and fixed panels.

G. Materials for Semiexposed Surfaces:
   1. Surfaces Other Than Drawer Bodies: High pressure decorative laminate, NEMA LD 3, Grade VGS.
      a. Edges of Plastic Laminate Shelves: PVC edge banding, 0.12 inch (3 mm) thick, matching laminate in color, pattern, and finish.

b. For semiexposed backs of panels with exposed plastic laminate surfaces, provide surface of high pressure decorative laminate, NEMA LD 3, Grade VGS.

2. Drawer Sides and Backs: Thermoset decorative panels with PVC or polyester edge banding.

3. Drawer Bottoms: Thermoset decorative panels.

H. Dust Panels: 1/4 inch (6.4 mm) plywood or tempered hardboard above compartments and drawers unless located directly under tops.

I. Concealed Backs of Panels with Exposed Plastic Laminate Surfaces: High pressure decorative laminate, NEMA LD 3, Grade BKL.

J. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.

1. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners or glued dovetail joints.

K. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces selected by Architect.

2.3 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.

1. Wood Moisture Content: 5 to 10 percent.

B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.

1. Medium Density Fiberboard (MDF): ANSI A208.2, Grade 130 composed of wood chips, minimum 45 lb. medium density, high waterproof resin binders; sanded faces.

2. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.

3. Straw Based Particleboard: ANSI A208.1, Grade M-2, except for density.

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Panel Source International, Inc.

2) Sorm Incorporated.

4. Thermoset Decorative Panels: Particleboard or MDF finished with thermally fused, melamine impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for Test Methods 3.3, 3.4, 3.6, 3.8, and 3.10.

2.4 CABINET HARDWARE AND ACCESSORIES

A. Provide cabinet hardware and accessory materials associated with architectural cabinets except for items specified in Section 08 71 00 "Door Hardware."

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Accuride International.
   b. Blum, Julius & Co., Inc.
   c. Doug Mockett.
   d. Hafale.
   e. Knape & Vogt Manufacturing Company.
   f. Stanley Hardware.

B. Butt Hinges: 2-3/4 inch (70 mm), five knuckle steel hinges made from 0.095 inch (2.4 mm) thick chrome plated steel:

1. Semiconcealed Hinges for Flush Doors: BHMA A156.9, B01361.

C. Back Mounted Pulls: BHMA A156.9, B02011.

1. Wire Pulls: Back mounted, solid metal, 5 inches (127 mm) long, 2-1/2 inches (63.5 mm) deep, and 5/16 inch (8 mm) in diameter.

D. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081.

E. Shelf Rests: BHMA A156.9, B04013; metal.

F. Drawer Slides: BHMA A156.9.

1. Drawer Slide: Full extension slides, 75 lb. capacity.
   a. Product: Subject to compliance with requirements, provide KV1300 by Knape & Vogt.
2. Grade 1: Side mounted extending under bottom edge of drawer.
   a. Type: Full extension.
   b. Material: Zinc plated steel with polymer rollers.
3. Grade 1HD-100 and Grade 1HD-200: Side mounted; full extension type; zinc plated steel ball bearing slides.
4. For drawers not more than 3 inches (75 mm) high and not more than 24 inches (600 mm) wide, provide Grade 1.
5. For drawers more than 3 inches (75 mm) high, but not more than 6 inches (150 mm) high and not more than 24 inches (600 mm) wide, provide Grade 1HD-100.
6. For drawers more than 6 inches (150 mm) high or more than 24 inches (600 mm) wide, provide Grade 1HD-200.
7. For computer keyboard shelves, provide Grade 1HD-100.
8. For trash bins not more than 20 inches (500 mm) high and 16 inches (400 mm) wide, provide Grade 1HD-200.

G. Locks: Provide as indicated on Drawings. Cores as specified in Section 08 71 00 "Door Hardware."

H. Door and Drawer Silencers: BHMA A156.16, L03011.

I. Grommets for Cable Passage through Countertops: OG Series 1-1/4 inch (32mm); SG Series 2 inch (51mm) o.d., black, molded plastic grommets and matching plastic caps with slot for wire passage.

J. Deep File Drawers: Provide Pendaflex file supports manufactured by Oxford Pendaflex Corporation.

K. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 Satin Stainless Steel: BHMA 630.

L. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.5 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post installed anchors. Use nonferrous metal or hot dip galvanized anchors and inserts at inside face of exterior walls and at floors.

C. Adhesive for Bonding Plastic Laminate: Contact cement.

2.6 FABRICATION

A. Fabricate architectural cabinets to dimensions, profiles, and details indicated.

B. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

1. Notify Architect seven days in advance of the dates and times architectural cabinet fabrication will be complete.
2. Trial fit assemblies at manufacturer's shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify various parts fit as intended and check measurements of assemblies against field measurements before disassembling for shipment.

C. Shop cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

D. Install glass to comply with applicable requirements in Section 08 80 00 "Glazing" and in GANA Glazing Manual.

1. For glass in frames, secure glass with removable stops.
2. For exposed glass edges, polish and grind smooth.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition cabinets to humidity conditions in installation areas for not less than 72 hours.

3.2 INSTALLATION

A. Architectural Woodwork Standards Grade: Install cabinets to comply with quality standard grade of item to be installed.

B. Assemble cabinets and complete fabrication at Project site to extent that it was not completed in the shop.

C. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with waferhead cabinet installation screws.

D. Install cabinets level, plumb, and true in line to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm) using concealed shims.
   1. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
   2. Install cabinets without distortion so doors and drawers fit openings and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.

3.3 FIELD QUALITY CONTROL

A. Inspections: Provide inspection of installed work through AWI's Quality Certification Program certifying that woodwork, including installation, complies with requirements of the Architectural Woodwork Standards for the specified grade.
   1. Inspection entity shall prepare and submit report of inspection.

3.4 ADJUSTING AND CLEANING

A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects. Where not possible to repair, replace architectural cabinets. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean cabinets on exposed and semiexposed surfaces.

END OF SECTION

SECTION 06 83 16

FIBERGLASS REINFORCED PANELING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Glass fiber plastic sheet paneling and trim.

1.2 ACTION SUBMITTALS

A. Product Data: Technical data including supporting documentation of compliance with surface burning characteristics for FRP and accessories.

B. Samples: Submit 12 inch by 12 inch (305 mm by 305 mm) samples of each color and texture of plastic paneling and 12 inch (310 mm) long lengths of each type of trim accessory.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain plastic paneling and trim accessories from single manufacturer.

1.4 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install plastic paneling until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface Burning Characteristics: Determined by testing identical products according to ASTM E 84 by qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Flame Spread Index: 25 or less.
   2. Smoke Developed Index: 450 or less.

B. Fire Test Response Characteristics of Plastic Panels: Determined by testing plastic materials by a qualified testing agency acceptable to authorities having jurisdiction.
   1. Self-ignition temperature of 650 degrees F (343 degrees C) or higher when tested according to ASTM D 1929 on plastic sheets in thickness indicated for the work.
   2. Burning rate of 2.5 in./min. (1.06 mm/s) or less when tested according to ASTM D 635 at a nominal thickness of 0.060 inch (1.52 mm) or thickness indicated for the work.

2.2 MATERIALS

A. Glass Fiber Reinforced Plastic Paneling: Gelcoat finished, glass fiber reinforced plastic panels complying with ASTM D 5319.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Crane Composites, Inc.
   b. Glasteel.
   c. Marlite.
   d. Nudo Products, Inc.
   e. Parkland Plastics, Inc.
2. Provide USDA accepted plastic panels for incidental food contact.
3. Nominal Thickness: Not less than 0.075 inch (1.9 mm).
4. Surface Finish: Molded pebble texture.
5. Color: White

B. Trim Accessories: One piece vinyl extrusions designed to retain and cover edges of panels. Provide division bars, inside corners, outside corners, and caps as necessary to conceal edges.

1. Color: Match panels.

C. Exposed Fasteners: Nylon drive rivets recommended by panel manufacturer.

D. Concealed Mounting Splines: Continuous, H shaped aluminum extrusions designed to fit into grooves routed in edges of factory laminated panels and to be fastened to substrate.

E. Adhesive: Type recommended by plastic paneling manufacturer.

F. Sealant: Mildew resistant, single component, neutral curing silicone sealant recommended by plastic paneling manufacturer and complying with requirements in Section 07 92 00 "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the work. Proceed with installation after correcting unsatisfactory conditions.

3.2 PREPARATION

A. Remove wallpaper, vinyl wall covering, loose or soluble paint, and materials that interfere with adhesive bond. Prepare substrate by sanding high spots and filling low spots as needed to provide flat, even surface for panel installation.

B. Clean substrates of substances that could impair adhesive bond, including oil, grease, dirt, and dust.

C. Condition panels by unpacking and placing in installation space before installation according to manufacturer's written recommendations.

D. Lay out paneling before installing. Locate panel joints to provide equal panels at ends of walls not less than half the width of full panels.
   1. Mark plumb lines on substrate at trim accessory locations for accurate installation.
   2. Locate trim accessories to allow clearance at panel edges according to manufacturer's written instructions.

3.3 INSTALLATION

A. Install plastic paneling according to manufacturer's written instructions.

B. Install panels in a full spread of adhesive.

C. Install panels with fasteners. Layout fastener locations and mark on face of panels so that fasteners are accurately aligned.
   1. Drill oversized fastener holes in panels and center fasteners in holes.
   2. Apply sealant to fastener holes before installing fasteners.

D. Install trim accessories with adhesive. Do not fasten through panels.

E. Fill grooves in trim accessories with sealant before installing panels, and bed inside corner trim in a bead of sealant.

F. Maintain uniform space between panels and wall fixtures. Fill space with sealant.

G. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

END OF SECTION

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SECTION 07 84 13

PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Penetrations in fire resistance rated walls.
   2. Penetrations in horizontal assemblies.

1.2 ACTION SUBMITTALS

A. Product Data: Product Data: Technical data for each penetrating firestopping system including illustration of firestopping system and design designation.

B. Product Schedule: Submit schedule for each penetration firestopping system indicating location, illustration of firestopping system, and design designation of qualified testing and inspecting agency.
   1. Engineering Judgments: Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping system, submit illustration, with modifications marked, approved by penetration firestopping system manufacturer's fire protection engineer as an engineering judgment or equivalent fire resistance rated assembly. Obtain approval of authorities having jurisdiction prior to submittal.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: Submit data for Installer.

B. Product Test Reports: Submit reports for each penetration firestopping system and for tests performed by a qualified testing agency.

1.4 CLOSEOUT SUBMITTALS

A. Installer Certificates: Submit certificates from Installer indicating that penetration firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Entity having minimum 5 years documented experience that has been approved by FM Global according to FM Global 4991 Approval of Firestop Contractors or evaluated by UL and found to comply with its Qualified Firestop Contractor Program Requirements and employs applicators with the required experience and training to perform the work.
   1. Manufacturer's willingness to sell its penetrating firestopping system products to Contractor or to Installer does not confer qualification on buyer.

2. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements.

B. Preinstallation Conference: Conduct conference at site.

1.6 COORDINATION

A. Do not cover up through penetration firestop system installations that will become concealed behind other construction until each installation has been examined by Owner's inspecting agency and building inspector when required by authorities having jurisdiction.
1. Notify Owner's testing agency at least seven days in advance of penetration firestopping installations; confirm dates and times on day preceding each series of installations.

B. Coordinate construction of openings and penetrating items to ensure that penetration firestopping systems can be installed according to specified firestopping system design.

C. Coordinate sizing of sleeves, openings, core drilled holes, or cut openings to accommodate penetration firestopping systems.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install penetration firestopping system when ambient or substrate temperatures are outside limits permitted by penetration firestopping system manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.

B. Install and cure penetration firestopping materials per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced air circulation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire Test Response Characteristics:
1. Perform penetration firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
2. Test in accordance with referenced standards. Provide rated systems complying with the following requirements:
a. Penetration firestopping systems shall bear classification marking of a qualified testing agency.
1) UL Fire Resistance Directory.
2) FM Global Building Materials Approval Guide.

2.2 PENETRATION FIRESTOPPING SYSTEMS

A. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and gases, and maintain original fire resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. 3M Fire Protection Products.
    b. A/D Fire Protection Systems Inc.
    c. Hilti, Inc.
    d. Nelson Firestop Products, Division of EGS Electrical Group.
    e. Passive Fire Protection Partners.
    f. RectorSeal.
    g. Specified Technologies, Inc.

B. Penetrations in Fire Resistance Rated Walls: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).

1. F-Rating: Not less than the fire resistance rating of constructions penetrated.

C. Penetrations in Horizontal Assemblies: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).

1. F-Rating: At least one hour, but not less than the fire resistance rating of constructions penetrated.
2. T-Rating: At least one hour, but not less than the fire resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
3. W-Rating: Provide penetration firestopping systems showing no evidence of water leakage when tested according to UL 1479.

D. Exposed Penetration Firestopping Systems: Flame spread and smoke developed indexes of less than 25 and 450, respectively, per ASTM E 84.

E. Manufactured Piping Penetration Firestopping System: Penetration firestopping systems with ratings determined per ASTM E814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    a. ProVent Systems, Inc.
2. F-Rating: At least one hour, but not less than the fire resistance rating of constructions penetrated.
3. T-Rating: At least one hour, but not less than the fire resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
4. W-Rating: Provide penetration firestopping systems showing no evidence of water leakage when tested according to UL 1479.
5. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast in place concrete slabs.

6. Stack Fitting: ASTM A48/A48M, gray iron, hubless pattern wye branch with neoprene O ring at base and gray iron plug in thermal release harness. Include PVC protective cap for plug.
7. Special Coating: Corrosion resistant on interior of fittings.

F. Accessories: Provide components for each penetration firestopping system necessary to install fill materials and to maintain ratings required. Use components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated.
1. Permanent forming/damming/backing materials.
2. Substrate primers.
3. Collars.
4. Steel sleeves.

2.3 FILL MATERIALS

A. Cast in Place Firestop Devices: Factory assembled devices for use in cast in place concrete floors and consisting of an outer sleeve lined with an intumescent strip, a flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.

B. Latex Sealants: Single component latex formulations that do not re-emulsify after cure during exposure to moisture.

C. Firestop Devices: Factory assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

D. Intumescent Composite Sheets: Rigid panels consisting of aluminum foil faced intumescent elastomeric sheet bonded to galvanized steel sheet.

E. Intumescent Putties: Nonhardening, water resistant, intumescent putties containing no solvents or inorganic fibers.

F. Intumescent Wrap Strips: Single component intumescent elastomeric sheets with aluminum foil on one side.

G. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.

H. Pillows/Bags: Reusable heat expanding pillows/bags consisting of glass fiber cloth cases filled with a combination of mineral fiber, water insoluble expansion agents, and fire retardant additives. Where exposed, cover openings with steel reinforcing wire mesh to protect pillows/bags from being easily removed.

I. Silicone Foams: Multicomponent, silicone based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

J. Silicone Sealants: Single component, silicone based, neutral curing elastomeric sealants.

K. Pre-installed Firestop Devices for Telecommunications and other cabling: Firestop devices designed to allow cables to penetrate fire-rated walls without the need for additional firestopping. Device shall include built-in firestop that will function through the range of 0% - partial – 100% visual cable fill. Device shall allow cables to be easily added or removed without the need to remove or reinstall firestopping materials.

1. Products: Subject to compliance with requirements, provide one of the following based on initial cable volume installed, plus 20 percent additional capacity:
   a. Hitli Firestop Speed Sleeve (CP 653). Use in conjunction with CFS-SL GP Gang Plate where more than one device is required in the same partition or other application.
   b. Hilti CFS-SL Series Firestop Gangplate – Utilize when existing cables require firestop device; select for specific installation requirements.
   c. Specified Technologies Inc; EZ Path.

2.4 MIXING

A. Penetration Firestopping Materials: For products requiring mixing before application, comply with penetration firestopping system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the work.

B. Proceed with installation after correcting unsatisfactory conditions.

3.2 PREPARATION

A. Surface Cleaning: Before installing penetration firestopping systems, clean out openings immediately to comply with manufacturer's written instructions and with requirements:

1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping materials.
2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping materials. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form release agents from concrete.

B. Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent penetration firestopping from contacting adjoining surfaces that remain exposed on completion of the work and would otherwise be permanently stained or damaged by contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing firestopping's seal with substrates.

3.3 INSTALLATION

A. Install penetration firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications.

B. Install forming materials and other accessories of types required to support fill materials during application and in the position needed to produce cross sectional shapes and depths required to achieve fire ratings.
   1. After installing fill materials and allowing to fully cure, remove combustible forming materials and accessories not forming permanent components of firestopping.

C. Install fill materials by proven techniques to produce the following results:
   1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items to achieve required fire resistance ratings.
   2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
   3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.
   4. Install firestop devices for telecommunications and other cabling in accordance with manufacturer’s tested assemblies and UL ratings. Follow all recommendations by the manufacturer for preparation, installation, and rating to match that of surrounding construction.

3.4 IDENTIFICATION

A. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches (76 mm) high and with minimum 0.375 inch (9.5 mm) strokes.
   1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 feet (4.57 m) from end of wall and at intervals not exceeding 30 feet (9.14 m).

3.5 FIELD QUALITY CONTROL

A. Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E 2174.

B. Where deficiencies are found or penetration firestopping system is damaged or removed because of testing, repair or replace penetration firestopping system to comply with requirements.

C. Proceed with enclosing penetration firestopping systems with r construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings as the work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping system manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping systems are without damage or deterioration at time of Substantial Completion. If, despite protections, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping material and install new materials to produce systems complying with specified requirements.

END OF SECTION

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SECTION 07 92 00

JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Preparation of interior and exterior joint substrate surfaces.
2. Install sealers, primers, bond breakers, and fillers as required.
3. Install interior and exterior joint sealants.

1.2 SYSTEM DESCRIPTION

A. Design Requirements:
1. Exterior: Provide elastomeric joint sealants that have been produced and installed to establish and to maintain watertight and airtight continuous seals without causing staining or deterioration of joint substrates.
2. Interior: Provide joint sealants that have been produced and installed to maintain airtight continuous seals that are water resistant and cause no staining or deterioration of joint substrates.

1.3 ACTION SUBMITTALS

A. Product Data: Submit manufacturer's product data, specifications, recommendations and instructions for surface preparation, sealant and backing installation, and related materials.

B. Samples: Submit standard color charts for selection; furnish samples of custom colors as applicable.

C. Joint-Sealant Schedule: Include the following information, using same “Type” designations indicated in Specifications:
1. Joint-sealant application and substrate.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Provide documentation of minimum three years experience approved by sealant manufacturer.

B. Pre-Installation Meeting: Prior to installation of sealant, meet at project site to review material selections, joint preparations, installation procedures and coordination with other trades. Meeting shall include the sealant Installer, Contractor, Manufacturer's representative, and representatives of other trades or subcontractors affected by sealant installation. Examine sample installations which have been prepared and determine and record whether everyone present is in agreement that the proposed installations are likely to perform as required. Notify Architect prior to meeting as to time, place, and date of meeting.

1.5 DELIVERY STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials in compliance with manufacturer's recommendation to prevent their deterioration or damage due to moisture, high or low temperatures, contaminates, or other causes.

1.6 PROJECT CONDITIONS

A. Environmental Conditions: Do not proceed with installation of joint sealants under the following conditions:
   1. When ambient and substrate conditions are outside limits permitted by joint sealant manufacturer or below 40 deg. F.
   2. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
   3. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.
   4. When joint substrates are wet.

1.7 WARRANTY

A. Exterior Sealants:
   1. Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
      a. Warranty Period: Five years from date of Substantial Completion.
   2. Special Manufacturer's Warranty for Silicone Sealants: Manufacturer's standard 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 within specified warranty period.
      a. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Substitutions: Comply with Section 01 25 00.

2.2 SEALING AND CAULKING MATERIALS

A. Polyurethane Sealant - Type No. 1:
   1. One-component, non-sag, low modulus, moisture curing, polyurethane joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT, M, A, and O.
   2. Acceptable Products:
      a. Dymonic by Tremco.
      b. MasterSeal NP 1 by BASF.
      c. Dynatrol I-XL by Pecora.
      d. Sikaflex 1a by Sika.

B. Polyurethane Sealant - Type No. 2:
   1. Multi-component, non-sag, low-modulus, chemically curing, modified polyurethane joint sealant; ASTM C 920, Type M, Grade NS, Class 25, Use NT, M, A, and O.
   2. Acceptable Products:
      a. MasterSeal NP 2 by BASF.
      b. Dynatrol II by Pecora.
      c. Dymeric 240 by Tremco.
      d. Sikaflex 2CNS by Sika.

C. Polyurethane Sealant - Type No. 3:
   1. One-component, low-modulus, moisture curing, cold applied, elastomeric, self-leveling, pourable, horizontal grade polyurethane joint sealant; ASTM C 920, Type S, Grade P, Class 25, Use T, M.
   2. Acceptable Products:
      a. Vulkem 45SSL by Tremco.
      b. Sikaflex 1c SL by Sika.
      c. MasterSeal SL 1 by BASF.
      d. Urexpan NR-201 by Pecora.

D. Polyurethane Sealant Type - Type No. 4:
   1. Multi-component, non-sag, chemically curing, cold applied, elastomeric, traffic grade, polyurethane joint sealant exceeding 1 percent slope; ASTM C 920, Type M, Grade P, Class 25, Use T.
   2. Acceptable Products:
      a. MasterSeal SL 2 by BASF.
      b. Vulkem 445SSL by Tremco.
      c. DynaTrol II-SG by Pecora.
      d. Sikaflex 2c NS TG by Sika.

E. Polyurethane Sealant - Type No. 5:
   1. Two-component, chemically curing, cold applied, elastomeric, horizontal grade, self-leveling, jet fuel resistant polyurethane joint sealant; ASTM C 920, Type M, Grade P, Class 25, Use T.
   2. Acceptable Products:
      a. Sonomeric CR 125 by BASF.
      b. Urexpan NR-300 by Pecora.
      c. THC 900 by Tremco.
      d. Sikaflex 2c SL by Sika.

F. Polyurethane Sealant - Type No. 6:
   1. One-component, moisture curing, non-sag, polyurethane joint sealants, suitable for continuous immersion in water; ASTM C920, Type S, Grade NS, Class 25/50, Use NT, M, A, O, and I.
   2. Acceptable Product:
      a. Vulkem 921 by Tremco.
      b. MasterSeal NP 1 by BASF.

G. Acrylic Latex Sealant - Type No. 7:
   1. One-component, fungicidal, readily paintable acrylic latex calk; ASTM C 834.
   2. Acceptable Products:
      a. Tremflex 834 Acrylic Latex by Tremco.
      b. Sonolac by BASF.
      c. AC-20 + Silicone by Pecora.
      d. RCS20 by GE Silicones.

H. Silicone Sealant - Type No. 8:
   1. One-component, moisture cured, non-staining, silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT, G, M, A, and O.
   2. Acceptable Products:
      a. 756 SMS by Dow Corning.
      b. Silpruf SCS9000 by General Electric.
      c. Spectrem 3 and Spectrem 4-TS by Tremco.
      d. 890 and 890 FTS by Pecora.
      e. Sikasil WS 290 or 295 by Sika.

I. Silicone Sealant Type - No. 9:
   1. One-component, low-modulus, moisture cured, elastomeric, silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Use NT, A, G, M, and O.
   2. Acceptable Products:
      a. DC-790 by Dow Corning.
      b. Silpruf LM SCS2700 by General Electric.
      c. Spectrem-1 by Tremco.
      d. 890 by Pecora.
      e. Sikasil WS 290 by Sika.

J. Silicone Sealant - Type No. 10:
   1. One-component, medium modulus, moisture cured, elastomeric silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT, A, G, M and O.
   2. Acceptable Products:
      a. DC-795 by Dow Corning.
      b. Silpruf SCS2000 by General Electric.
      c. Spectrem-2 or Spectrem-3 by Tremco.
      d. 895 by Pecora.
      e. Sikasil WS 295 by Sika.

K. Silicone Sealant - Type No. 11:

1. One-component, moisture cured, fungicidal, silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT, A, G, and O.
2. Acceptable Products:
   a. DC-786 by Dow Corning.
   b. SCS-1700 by General Electric.
   c. TremSil 200 by Tremco.
   d. 898 by Pecora.
   e. Sikasil GP by Sika.

L. Polysulfide Sealant - Type No. 12:

1. Multi-component, chemically cured, polysulfide joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use T, G, M, A, and O.
2. Acceptable Products:
   a. Sonolastic Polysulfide Sealant by BASF.
   b. Synthacalk GC 2+ by Pecora.
   c. Deck-O-Seal One Step by W. R. Meadows, Inc.

M. Butyl - Type No. 13:

1. Butyl rubber polymer sealant one-component, non-sag; ASTM C 1311(FS TT-S-001657).
2. Acceptable Products:
   a. BC-158 by Pecora.
   b. Butakauk by BASF.
   c. Butyl Sealant by Tremco.

N. Silyl-Terminated Polyether (STPE) Sealant - Type No. 14:

1. Single-component, low-modulus, moisture cured, elastomeric, silyl-terminated polyether joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT, A, G, M, and O.
2. Acceptable Products:
   a. SCS7000 by GE Construction Sealants.
   b. DynaTrol I-XL Tru-White by Pecora Corporation.
   c. MasterSeal NP 150 by BASF.

O. Silicone Sealant - Type No. 15:

1. Single-component, moisture cured, silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT, A, G, M and O.
2. Acceptable Products:
   a. 758 by Dow Corning.

2.3 ACCESSORIES

A. Joint Cleaner: Non-corrosive type recommended by sealant manufacturer, compatible with joint forming materials.

B. Primer: Non-staining type recommended by sealant manufacturer to suit application and substrate materials.

C. Backer Rod:
   1. ASTM C 1330, Type C (closed-cell material with a surface skin), or Type B (bicellular material with a surface skin), 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.
   2. Acceptable Products:
      a. Backer Rod Manufacturing; Mile High Foam.
      b. BASF; Soft Backer Rod.
      c. Nomaco; Sof Rod.
      d. Ethafoam SB, Dow Chemical.

D. Precompressed Joint Sealer:
   1. Precompressed bitumen impregnated foam; when exposed to air expands in size; size as recommended by manufacturer for joint condition and width; black color.
   2. Acceptable Products:
      a. Backerseal by Emseal Corporation.
      b. 600 by Will-Seal.

E. Bond Breaker: Pressure sensitive adhesive polyethylene tape recommended by sealant manufacturer to suit application.

F. Masking Tape: Pressure sensitive adhesive paper tape.

G. Sealant Tape:
   1. Compressible adhesive-cohesive tape of cross-linked butyl polyisobutylene rubber that accommodates variations and movement, sized as necessary to allow for joint movement of ± 25 percent.
   2. Acceptable Products:
      a. 440 by Tremco.
      b. Extru-Seal by Pecora.
      c. PTI-606 by Protective Treatments, Inc., Division of Prosoco

H. Expansion Joint Filler:
   1. Closed cell polyethylene compatible with sealant.
   2. Asphalt impregnated fiberboard not acceptable.
   3. Acceptable Product: Sonofoam Closed Cell Backer-Rod by Sonneborn.

2.4 MIXING

A. Mix components in accordance with manufacturer's recommendations.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints to be sealed for construction defects which could adversely affect execution of Work.

B. Ensure that concrete has cured 28 days minimum before commencing sealing operations.

C. Compressible Fillers: Verify actual width of each type joint to be sealed against indicated joint width to ensure compliance with specified percentage of compression required.

D. Determine in conjunction with sealant manufacturer's representative if adhesion testing is necessary prior to application of materials. Submit letter of certification from sealant manufacturer accepting substrate conditions for sealant.

3.2 PREPARATION

A. Clean joint surfaces using joint cleaner as necessary, free of dust, dirt, oil, grease, rust, lacquers, laitance, release agents, liquid water repellent, moisture or other matter which might adversely affect adhesion of sealants. Immediately after cleaning, wipe all joint surfaces with a clean dry cloth to remove any cleaner residue.

B. 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.

C. Etch concrete, masonry, and plaster joint surfaces to remove excess alkalinity. Etch with 5 percent solution of muriatic acid. Neutralize with dilute ammonia solution. Rinse thoroughly with water and allow to dry.

D. Steel Surfaces: Scrape and wire brush to remove loose mill scale. Remove dirt, oil or grease by solvent cleaning. Wipe surfaces with lintless paper towels.

E. Aluminum Surfaces:
   1. Clean off temporary protective coatings.
   2. When masking tape is used for a protective cover, remove tape just prior to applying sealant.

F. Roughen joint surfaces on non-porous materials. Rub with fine abrasive cloth or wool to produce a dull sheen.

G. Mask areas adjacent to joints as necessary.

H. Apply primer as recommended by manufacturer. Do not allow primer or sealants to spill or migrate onto adjoining surfaces.

3.3 APPLICATION

A. Install sealant materials in accordance with manufacturer's instructions.

B. Install backing material in joints using blunt instrument to avoid puncturing.

C. Install sealant backing to form joint depth of 50 percent of joint width, minimum of 1/4" deep.
   1. Do not leave gaps between ends of sealant backings.
   2. Do not stretch, twist, puncture, or tear sealant backings.
   3. Do not braid smaller diameter sealant backings to create larger ones.
   4. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

D. Apply sealant in joints using pressure gun with nozzle cut to fit joint width.

E. Deposit sealant in uniform, continuous bead.

F. Tool joints to required configuration within manufacturer's recommended setting time.

G. If masking materials are used, remove immediately after tooling.

3.4 CLEANING

A. Remove excess materials adjacent to joints as Work progresses to eliminate evidence of spillage or damage to adjacent surfaces.

B. Remove and replace improperly sealed joints.

C. Clean or replace materials or surfaces that are damaged by sealing operations.

3.5 SCHEDULE OF SEALANTS AND CAULKS

A. Interior and exterior building joints subject to dynamic movement, not exposed to foot or vehicular traffic: Sealant Type No. 2 or 9.

B. Interior and exterior horizontal joints subject to foot and vehicular traffic: Sealant Type No. 3 or 4.

C. Interior and exterior horizontal joints subject to foot and vehicular traffic resistant to jet fuel: Sealant Type No. 5.

D. Unexposed Windows Joints: Sealant Type No. 10 or 12.

E. Sealants in adjacency to Roof Membrane: Sealant Type 1.

F. Interior horizontal and vertical joints not subject to movement or traffic, subject to moisture: Sealant Type No. 7 or 11.

G. Thresholds – Exterior: Sealant Type 12 or 13.

H. Stone, masonry, EIFS, precast concrete, and metal panel substrates, for non-staining and low dirt pick-up applications subject to moisture, movement, and not exposed to foot or vehicular traffic: Sealant Type No. 8.

I. Underwater sealants in continuous immersion sealant Type 6.

J. Exterior and interior building joints subject to dynamic movement, not exposed to foot or vehicular traffic, which must be painted to match adjacent wall surfaces after installation: Sealant Type No. 14.

K. Exterior building joints in direct contact with air barrier materials: Sealant Type No. 15.

3.6 COLOR SCHEDULE

A. Exposed Locations: Manufacturer's standard color line as selected by Architect.

B. Non-exposed Locations: Manufacturer's standard.

END OF SECTION

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SECTION 08 11 13

HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Steel doors and frames.
   2. Steel opening framing.
   3. Integration of electrified hardware, access control systems, and security systems into door and frame assemblies.

1.2 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.3 ACTION SUBMITTALS

A. Product Data: Technical data including construction detail, material descriptions, core descriptions, label compliance, sound and fire resistance ratings, temperature rise ratings and finishes for each type of door and frame specified.

B. Shop Drawings: Submit drawings using same designations in door and frame schedule on the Drawings:
   1. Opening size(s), handing of doors.
   2. Frame throat dimensions
   3. Details of each frame type.
   4. Elevations and profiles of door design types.
   5. Details of door and frame construction including vertical and horizontal edge details and metal thickness.
   6. Location and installation requirements of door hardware and reinforcements, hardware group numbers.
   7. Details of anchorage, joint, field splice, and connections, details of moldings, removable stops, and glazing.
   8. Fire label requirements including fire rating time duration, maximum temperature rise requirements, and smoke label requirements.
   9. Indicate routing of electrical conduit and dimensions and locations of cutouts in doors and frames to accept electric hardware devices, signals, and control systems.

C. Schedule: Provide schedule of steel doors and frames, 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.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Submit for each type of fire rated hollow metal door and frame assembly, fire rated borrowed lite assembly, and, thermally rated door assemblies for tests performed by a qualified testing agency indicating compliance with performance requirements.

B. Certificate of Compliance for Fire Rated Doors: Provide copies of Certificate of Compliance for fire rated door assemblies, smoke and draft control door assemblies, and temperature rise rated door assemblies.

1.5 CLOSEOUT SUBMITTALS

A. Record Documents: Submit for fire rated doors, list of door numbers and applicable room name and number to which door accesses.

1.6 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Steel Door and Frame Standard: Comply with applicable provisions of Hollow Metal Manufacturers Association (HMMA) Div. of National Association of Architectural Metal Manufacturers (NAAMM):
      a. HMMA Hollow Metal Manual.
      b. HMMA 861 Guide Specifications for Commercial Hollow Metal Doors and Frames.

B. Manufacturer Qualifications: Firm having minimum five years documented experience in manufacturing steel doors and frames, with sufficient production capacity to produce required units.

C. Source Limitations: Obtain steel doors and frames from single source from single manufacturer.

D. Preinstallation Conference: Conduct conference at site.

1.7 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 to site in time for installation.

B. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver steel doors and frames palletized, packaged, or crated to provide protection during transit and 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 site with head up. Place on minimum 4 inch (102 mm) high wood blocking. Provide minimum 1/4 inch (6 mm) space between each stacked door to permit air circulation.

D. Inspect doors and frames, on delivery, for damage. Tool marks, rust, blemishes, and other damage on exposed surfaces is not acceptable. Remove and replace damaged items directed by Owner. Store doors and frames at building site in dry location and off ground to prevent deterioration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C. Provide metal labels permanently fastened on each door and frame assembly within size limitations established by the labeling authority having jurisdiction.

B. Fire Rated, Borrowed Lite Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire protection ratings indicated, based on testing according to NFPA 257 or UL 9.

C. Thermally Rated Door Assemblies: Fabricate doors and frames for thermal insulating assemblies and tested in accordance with ASTM C 518.
   1. Provide door assemblies with U-factor of not more than 0.40 degrees Btu/F x h x sq. ft. (2.27 W/K x sq. m) when tested according to ASTM C 518.

D. Accessibility Requirements: Comply with applicable requirements.
   1. U.S. Architectural and Transportation Barriers Compliance Board Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG) 2010.
   2. ICC/ANSI A117.1 Accessible and Useable Building and Facilities.
   3. Texas Accessibility Standards (TAS).

2.2 MATERIALS

A. Manufacturers: Subject to compliance with requirements, provide products complying with requirements of one of the following:
   1. Amweld International, LLC.
   2. Ceco Door Products.
   3. Curries Company.
   4. Door Components, Inc.
   5. Mesker Door Inc.
   6. Rocky Mountain Metals, Inc.

B. Cold Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

C. Hot Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

D. Metallic Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.

E. Inserts, Bolts, and Fasteners: Hot dip galvanized according to ASTM A 153/A 153M.

F. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z (12G) coating designation; mill phosphatized.
   1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot dip galvanized according to ASTM A 153/A 153M, Class B.

G. 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.

H. Mineral Fiber Insulation: ASTM C 665, 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 E 136 for combustion characteristics.

I. Grout: ASTM C 476, except with a maximum slump of 4 inches (102 mm), as measured according to ASTM C 143/C 143M.

J. Glazing: Comply with requirements in Section 08 80 00.

K. Bituminous Coating: Cold applied asphalt mastic, compounded for 15 mil (0.4 mm) dry film thickness per coat. Provide inert type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.3 EXTERIOR STEEL DOORS AND FRAMES

A. Construct steel doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Commercial Doors: NAAMM-HMMA 861. Construct doors with smooth surfaces without visible joints or seams on exposed faces.
   1. Type: Indicated in the Door Schedule.
   2. Thickness: 1-3/4 inches (44.5 mm).
   3. Face: Metallic coated steel sheet, minimum thickness of 0.067 inch (1.7 mm), with minimum G60 or A60 (ZF180) coating.
   4. Edge Construction: Steel channel, minimum 0.053 inch (1.30 mm), continuously welded to face sheet with no visible seam, extending the full width of the door.
      a. For doors with inverted top channel, provide steel closure channel, screw attached, with the web of the channel flush with face sheet.

5. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets. Seal joints against water penetration.
6. Bottom Edges: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets. Provide weep hole openings in bottoms of exterior doors to permit moisture to escape.
7. Core: Steel stiffened.
8. Fire Rated Core: Vertical steel stiffener, laminated mineral board core for fire rated doors.
9. Exposed Finish: Galvanized, primed.

C. Commercial Frames: NAAMM-HMMA 861. Close contact edges of corner joints tight with faces mitered and stops butted or mitered. Continuously weld faces and soffits and finish faces smooth.
1. Door Frames: Fabricated from 0.0966 inch (2.997 mm) thick steel sheet, metallic coated steel sheet with minimum G60 ((Z180) or A60 (ZF180) coating.
2. Construction: Full profile welded.
3. Hardware Reinforcement: Fabricate according to ANSI/NAAMM-HMMA 861 with reinforcing plates from same material as frame.
4. Head Reinforcement: Minimum 0.093 inch (2.3 mm) thick, steel channel or angle stiffener for opening widths more than 48 inches (1219 mm).
5. Fire Rating: As indicated on Drawings.
6. Exposed Finish: Galvanized, primed.

2.4 INTERIOR STEEL DOORS AND FRAMES

A. Commercial Steel Doors: NAAMM-HMMA 861. Construct doors joined at vertical edges by continuous welding full height of the door, with no visible seams on faces or vertical edges, and welds ground and finished flush.
1. Type: Indicated in the Door Schedule.
2. Thickness: 1-3/4 inches (44.5 mm).
3. Face: Uncoated steel sheet, minimum thickness of 0.053 inch (1.3 mm).
4. Edge Construction: Steel channel, minimum 0.053 inch (1.30 mm), continuously welded to face sheet with no visible seam, extending the full width of the door. For doors with inverted top channel, provide steel closure channel, screw attached, with the web of the channel flush with face sheet.
5. Vertical Edges for Single Acting Doors: Bevel edges 1/8 inch in 2 inches (3.2 mm in 51 mm).
6. Edge Closures: Spot weld metal channel not less than thickness of face sheet to face sheets not more than 6 inches (150 mm) o.c.
    a. Top Edge Closures: Close top edges of doors with inverted closures, except provide flush closures at exterior doors of same material as face sheets.
    b. Bottom Edge Closures: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets.
7. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire performance rating or where indicated. Extend

minimum 3/4 inch (19 mm) beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.

8. Core: Minimum thickness 0.026 inch (0.66 mm), steel vertical stiffeners of same material as face sheets extending full door height, with vertical webs spaced not more than 6 inches (152 mm) apart. Spot weld to face sheets no more than 5 inches (127 mm) o.c. Fill spaces between stiffeners with glass or mineral fiber insulation
   a. Fire Door Cores: Vertical steel stiffener as required to provide fire protection and temperature rise ratings indicated. Provide continuous mineral fiberboard core permanently bonded to the inside face of the outer face sheet unless otherwise required to provide fire protection and temperature rise ratings indicated.

B. Commercial Steel Frames, Interior: NAAMM-HMMA 861. Uncoated steel sheet, formed to profiles indicated, with full 5/8 inch (16 mm) stops, and of minimum thickness specified. Knock down frames are not permitted.
   1. Openings up to and Including 48 Inches (1200 mm) Wide, Interior: Flush design with 0.67 inch (1.7 mm) thick cold rolled stretcher leveled steel face sheets and metal components from hot or cold rolled steel sheets, metallic coated steel sheet with minimum G60 (Z180) coating.
   2. Door Frames for Openings More Than 48 Inches (1219 mm) Wide: Fabricated from 0.0966 inch (2.997 mm) thick steel sheet.
   3. Exposed Finish: Primed for field finish.
   4. Construction: Full profile welded; provide frames either saw mitered and full (continuously) welded, or machine mitered and full welded, on back side at frame corners and stops with edges straight and true. Grind welds smooth and flush on exposed surfaces. Provide countersunk, flat, or oval head exposed screws and bolts for exposed fasteners unless otherwise indicated.
   5. Sidelite and Transom Frames: Fabricated from same thickness material as door frame.
   6. Exposed Finish: Prime.

C. Door Hardware Reinforcement: ANSI/NAAMM-HMMA 861; fabricate reinforcing from the same material as door to comply with requirements. Offset reinforcement so that faces of mortised hardware items are flush with door surfaces.
   1. Hinges and Pivots: 0.167 inch (4.2 mm) thick by 1-1/2 inches (38 mm) wide by 9 inches (229 mm).
   2. Lock Front, Strike, and Flushbolt Reinforcements: 0.093 inch (2.3 mm) thick by size as required by hardware manufacturer.
   3. Lock Reinforcement Units: 0.067 inch (1.7 mm) thick by size as required by hardware manufacturer.
   4. Closer Reinforcements: 0.093 inch (2.3 mm) thick one piece channel by size as required by hardware manufacturer.
   5. Other Hardware Reinforcements: Required for adequate strength and anchorage; in lieu of reinforcement specified, hardware manufacturer recommended reinforcing units may be used.

6. Exit Device Reinforcements: 0.250 inch (6.35 mm) thick by 10 inches (245 mm) high by 4 inches (101 mm) wide centered on exit device case body, unless otherwise recommended by exit device manufacturer.

D. Frame Hardware Reinforcement: Fabricate reinforcements from same material as frame. Offset reinforcement so faces of mortised hardware items are flush with surface of the frame.
1. Hinges and Pivots: 0.167 inch (4.2 mm) thick by 1-1/4 inches (32 mm) wide by 10 inches (254 mm).
2. Strike, Surface Mounted Hold Open Arms, and Flushbolt Reinforcements: 0.093 inch (2.3 mm) thick by size as required by hardware manufacturer.
3. Closer Reinforcements: 0.093 inch (2.3 mm) thick one piece channel by size as required by hardware manufacturer.
4. Other Hardware Reinforcements: As required for adequate strength and anchorage.

E. Electrical Requirements: Make provisions for installation of electrical items; provide cutouts so wiring can be readily removed and replaced.
1. Provide cutouts and reinforcements required for steel doors and frames to accept security system components.
2. Doors with Electric Hinges and Pivots: Provide with metal conduit or raceway to permit wiring from electric hinge or pivot to other electric door hardware.
a. Hinge Location: Center for doors less than 90 inches (2286 mm) tall or second hinge from door bottom for doors greater than 90 inches (2286 mm); top or bottom electric hinge locations shall not be permitted.
3. Frames with Electric Hinges and Pivots: Provide welded on UL listed back boxes with metal conduit or raceway to permit wiring from electric hinge or pivot to other electric door hardware.
a. Hinge Location: Center for doors less than 90 inches (2286 mm) tall or second hinge from door bottom for doors greater than 90 inches (2286 mm); top or bottom electric hinge locations shall not be permitted.

2.5 FRAME ANCHORS

A. Jamb Anchors: Locate jamb anchors above hinges and directly opposite on strike jamb required to secure frames to adjacent construction. At metal stud partitions locate additional jamb anchor below the top hinge.
1. Masonry Type: Adjustable strap and stirrup or T shaped anchors to suit frame size, not less than 0.042 inch (1.0 mm) thick, with corrugated or perforated straps not less than 2 inches (51 mm) wide by 10 inches (254 mm) long; or wire anchors not less than 0.177 inch (4.5 mm) thick.
2. Stud Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch (1.0 mm) thick.
3. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches (610 mm) of frame height above 7 feet (2.1 m).

B. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor. Extend floor anchors for each jamb and mullion to floor; formed of same material

as frame, 0.093 inch (2.3 mm) thick; and punched with two holes to receive fasteners. Where floor fill or setting beds occur support frame by adjustable floor anchors bolted to the structural substrate. Terminate bottom of frames at finish floor surface.

C. Floor Anchors for Concrete Slabs with Underlayment: Adjustable type anchors with extension clips, allowing not less than 2 inch (51 mm) height adjustment. Terminate bottom of frames at top of underlayment.

D. Head Strut Supports: Provide 3/8 inch by 2 inch (9 mm by 50 mm) vertical steel struts extending from top of frame at each jamb to supporting construction above. Bend top of struts to provide flush contact for securing to supporting construction above by bolting, welding, or other suitable anchorage. Provide adjustable wedged or bolted anchorage to frame jamb members to permit height adjustment during installation. Adapt jamb anchors at struts to permit adjustment.

E. Head Reinforcement: For frames more than 48 inches (1200 mm) wide in masonry wall openings, provide continuous steel channel or angle stiffener, 0.093 inch (2.3 mm) thick for full width of opening, welded to back of frame at head. Do not use head reinforcements as a lintel or load bearing member for masonry.

F. Spreader Bars: Provide removable spreader bar across bottom of frames, tack welded to jambs and mullions to serve as bracing during shipment and handling and to hold frames in proper position until anchorage and adjacent construction have been completed.

G. Door Silencer Holes: Drill strike jamb stop to receive three silencers on single doorframes and for two silencers on double doorframes. Insert plastic plugs in holes to keep holes clear during installation.

H. Plaster and Grout Guards and Removable Access Plates: Provide 0.016 inch (0.4mm) thick plaster guards or dust cover boxes of same material as frame, welded to frame at back of hardware cutouts to close off interior of openings and prevent mortar or materials from obstructing hardware operation. Provide removable access plates in the heads of frames to receive overhead concealed door closers.

2.6 BORROWED LITES, LOUVERS, STOPS, MOLDINGS, PANELS

A. Borrow Lites: Fabricate of uncoated steel sheet, minimum thickness of 0.042 inch (1.0 mm).
   1. Construction: Full profile welded.
   2. Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as metal as frames.
   3. Provide countersunk, flat, or oval head exposed screws and bolts for exposed fasteners unless otherwise indicated.

B. Stops and Moldings: Provide stops and moldings around glazed lites and louvers where indicated. Form corners of moldings with hairline joints. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.

1. Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as metal as frames.
2. Provide loose stops and moldings on inside of steel door and frame work.
3. Provide stops and moldings formed of 0.032 inch (0.8mm) thick steel sheets matching steel frames. Secure with countersunk oval head machine screws spaced uniformly not more than 12 inches (300 mm) o.c. Form corners with butted hairline joints.
4. Coordinate rabbet width between fixed and removable stops with type of glass or panel and type of installation indicated.

2.7 FABRICATION

A. Fabricate steel doors and frames rigid and free from defects, warp, or buckle. Accurately form metal to required sized and profiles. Take field measurements as required for coordination with adjoining work. Where possible, fit and assemble units in manufacturer's plant. Clearly identify work which cannot be permanently factory assembled before shipment to assure proper assembly at site.

1. Metallic Core Construction: Weld cores to both door face sheets.
2. Nonmetallic Core Construction: Laminate core material to both door face sheets with waterproof adhesive.

B. Remove tool marks and surface imperfections; dress smooth exposed faces of welded joints. Use of metallic filler to conceal manufacturing defects is not acceptable.

C. Exposed Fasteners: Provide countersunk Phillips heads for exposed screws and bolts.

D. Thermal Rated (Insulating) Assemblies: Fabricate doors and frames for thermal insulating assemblies and tested in accordance with ASTM C 236 or C 976.

1. Provide thermal rated assemblies with U factor of 0.3 Btu/sq. ft. x h x degrees F (1.7 W/sq. m x K).

E. Door Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire performance rating or where indicated. Extend minimum 3/4 inch (19 mm) beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.

F. Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.

1. Sidelite and Transom Bar 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 welding , or by rigid mechanical anchors.
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 grouted frames.
4. 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.

G. Jamb Anchors:
1. Masonry Type: Locate anchors not more than 16 inches (400 m) from top and bottom of frame. Space anchors not more than 32 inches (825 mm) o.c., to match coursing:
   a. Two anchors per jamb up to 60 inches (1530 mm) high.
   b. Three anchors per jamb from 60 to 90 inches (1530 mm to 2290 mm) high.
   c. Four anchors per jamb from 90 to 120 inches (2290 mm to 3060 mm) high.
   d. Four anchors per jamb plus one additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 120 inches (3060 mm) high.
2. Stud Wall Type: Locate anchors not more than 18 inches (460 mm) from top and bottom of frame. Space anchors not more than 32 inches (815 mm) o.c.:
   a. Three anchors per jamb up to 60 inches (1530 mm) high.
   b. Four anchors per jamb from 60 to 90 inches (1530 mm to 2290 mm) high.
   c. Five anchors per jamb from 90 to 96 inches (2290 mm to 2440 mm) high.
   d. Five anchors per jamb plus one additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 96 inches (2440 mm) high.
3. Compression Type: Not less than two anchors in each frame.
4. Postinstalled Expansion Type: Locate anchors not more than 6 inches (150 mm) from top and bottom of frame. Space anchors not more than 26 inches (660 mm) o.c.

H. Head Anchors: Two anchors per head for frames more than 42 inches (1065 mm) wide and mounted in metal stud partitions.

I. Hardware Preparation: Factory prepare hollow metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping according to HMMA 831, the Door Hardware Schedule, and templates.
1. Factory reinforce doors and frames to receive nontemplated, mortised, and surface mounted door hardware. Offset reinforcement so faces of mortised hardware items are flush with door surfaces. Secure reinforcement by spot welding.

J. Glazed Lites: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted hairline joints.
1. Provide stops and moldings flush with face of door, and with square stops unless otherwise indicated.
2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so each glazed lite is capable of being removed independently.
3. Weld fixed frame moldings on outside of exterior and on secure side of interior doors and frames. Provide loose stops and moldings on inside of steel doors and frames.

4. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.
5. Provide stops for installation with countersunk flat or oval head machine screws spaced uniformly not more than 9 inches (230 mm) o.c. and not more than 2 inches (51 mm) o.c. from each corner.

K. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

L. Plaster and Grout Guards and Removable Access Plates: Provide 0.016 inch (0.4mm) thick plaster guards or dust cover boxes of same material as frame, welded to frame at back of hardware cutouts to close off interior of openings and prevent mortar or other materials from obstructing hardware operation. Provide removable access plates in the heads of frames to receive overhead concealed door closers.

M. Electrical Requirements: Coordinate provisions with installation of electrical items including electronic hardware, security system components, and similar items having electrical requirements; arrange so wiring can be readily removed and replaced.
1. Provide cutouts and reinforcements required for steel doors and frames to accept security system components.

2.8 STEEL FINISHES

A. Surface Preparation: Clean, treat and prime surfaces of fabricated steel door and frame work, inside and out, whether exposed or concealed in the construction.
1. Clean surfaces with nonpetroleum solvent so surfaces are free of dirt, oil, grease, and contaminants that could impair paint bond.
2. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 3 Power Tool Cleaning or SSPC-SP 6/NACE No. 3 Commercial Blast Cleaning.
3. After cleaning, apply conversion coating suited to organic coating applied over surface.
4. Clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint complying with ASTM A 780.
5. Galvanizing Repair Paint: High zinc dust content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

B. Factory Priming for Field Painted Finish: Apply shop primer immediately after surface preparation and pretreatment. Apply fast curing, corrosion inhibiting, lead and chromate free, universal primer complying with ANSI A224.1; compatible with substrate and field applied finish paint system indicated; providing sound foundation for field applied topcoats despite prolonged exposure. Apply primer coat of a smooth, even consistency of provide uniform dry film thickness of not less than 0.7 mils (0.02 mm). Touch up surfaces having runs, smears, or bare spots.
1. Finish Coats: Spray finish coats complying with Section 09 90 00.

C. Factory Finish: Clean, pretreat, and apply two coat, baked on finish consisting of prime coat and thermosetting topcoat, complying with ANSI/SDI A250.3.
1. Color and Gloss: Selected by Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions for compliance with requirements for installation tolerances and conditions affecting performance of the work. Examine roughing in for embedded and built in anchors to verify actual locations before frame installation.

B. Proceed with installation after correcting unsatisfactory conditions.

3.2 PREPARATION

A. Prior to installation and with installation spreaders in place, adjust and securely brace hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
   1. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb, and perpendicular to frame head.
   2. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
   3. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
   4. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a perpendicular line from head to floor.

B. Remove factory installed welded in shipping spreaders. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

C. Drill and tap doors and frames to receive nontemplated, mortised, and surface mounted door hardware. Touch up factory applied finishes where spreaders are removed.

3.3 INSTALLATION

A. Install steel doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions.

B. Steel Frames: 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 without damage to completed work.
      a. Extend frame anchorages below fills and finishes. Coordinate the installation of built in anchors for wall and partition construction required with work.
      b. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch up finishes.
      c. Install frames with removable stops located on secure side of opening.
      d. Install door silencers in frames before grouting.

e. Field apply corrosion resistant coating to backs of frames in contact with grout or plaster containing antifreezing agents.

2. Welded Frames: Set anchorage devices where required for securing frames to in place concrete or masonry construction. Set anchorage devices opposite each anchor location as specified and anchorage device manufacturer's written instructions. Leave drilled holes rough, not reamed, and free of dust and debris.
   a. Placing Frames: Set frames accurately in position; plumb; align, and brace securely until permanent anchors are set. After wall construction is complete, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.
   b. 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.
   c. Install frames with removable stops located on secure side of opening.
   d. Install door silencers in frames before grouting.
   e. Remove temporary braces necessary for installation after frames have been properly set and secured.
   f. Verify plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
   g. Field apply bituminous coating to backs of frames that will be filled with grout containing antifreezing agents.
3. Fire Rated Openings: Install frames according to NFPA 80.
4. Floor Anchors: Install floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
   a. Floor anchors may be set with power actuated fasteners in lieu of postinstalled expansion anchors if indicated and approved on Shop Drawings.
5. Metal Stud Partition: Solidly pack mineral fiber insulation inside frames.
6. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout or mortar.
7. Concrete Walls: Solidly pack mineral fiber insulation inside frames.
8. In Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
9. Installation Tolerances: Adjust hollow metal frames to specified tolerances:
   a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
   b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
   c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
   d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.

C. Steel Doors: Fit and adjust doors accurately in frames, within clearances specified.
   1. Nonfire Rated Steel Doors: Comply with NAAMM-HMMA 841 and NAAMM-HMMA guide specification indicated.
      a. Nonfire Rated Steel Doors:
         1) Between Door and Frame Jambs and Head: 1/8 inch (3 mm) plus or minus 1/32 inch (0.8 mm).
         2) Between Edges of Pairs of Doors: 1/8 inch to 1/4 inch (3 mm to 6 mm) plus or minus 1/32 inch (0.8 mm).
         3) At Bottom of Door:
            a) No Threshold or Carpet: 3/8 inch (9 mm) plus or minus 1/32 inch (0.8 mm).
            b) Threshold or Carpet: 1/8 inch (3 mm) plus or minus 1/32 inch (0.8 mm).
         4) Between Door Face and Stop: 1/16 inch to 1/8 inch (1.6 mm to 3 mm) plus or minus 1/32 inch (0.8 mm).
   2. Rated Assemblies: Place doors in frames with clearances specified in NFPA Standard No. 80:
      a. Doors, Frames, and Meeting Edges, Pairs of Doors: 1/8 inch.
      b. Bottom: Maximum 3/8 inch between door and raised noncombustible sill.
      c. Bottom: Maximum 3/4 inch above finished floor between door and floor where there is no sill.
      d. Bottom: Maximum 1/2 inch between door and nominal floor covering surface.
      e. Astragals: Comply with NFPA 80.
   3. Smoke Control Doors: Install doors according to NFPA 105.

D. Glazing: Comply with installation requirements in Section 08 80 00 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 (230 mm) o.c. and not more than 2 inches (50 mm) o.c. from each corner.

E. Hardware: Apply hardware in accordance with hardware manufacturer’s instructions and Section 08 71 00. Drill and tap for machine screws as required. Do not use self-tapping sheet metal screws. Adjust door installation to provide uniform clearance at head and jambs, and to contact stops uniformly. Adjust hardware items just prior to final inspection. Leave work in complete and proper operating condition.

3.4 ADJUSTING

A. Final Adjustments: Test and adjust 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 unacceptable.

3.5 CLEANING AND TOUCHUP

A. Remove grout and other bonding material from hollow-metal work immediately after installation.

B. 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.

C. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

D. Institute protective measures required throughout the remainder of the construction period to ensure that steel doors and frames will be without damage or deterioration, at time of substantial completion.

END OF SECTION

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SECTION 08 14 16

FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Solid core doors with wood veneer faces for transparent finish.
2. Factory finishing flush wood doors.
3. Factory fitting flush wood doors to frames and factory machining for hardware.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product, including the following:
1. Door core materials and construction.
2. Door edge construction
3. Door face type and characteristics.
4. Door louvers.
5. Door trim for openings.
6. Factory-machining criteria.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and the following:
1. Door schedule indicating door location, type, size, fire protection rating, and swing.
2. Door elevations, dimension and locations of hardware, lite and louver cutouts, and glazing thicknesses.
3. Dimensions and locations of blocking for hardware attachment.
4. Dimensions and locations of mortises and holes for hardware.
5. Clearances and undercuts.
6. Requirements for veneer matching.
7. Doors to be factory finished and application requirements.

C. Samples for Verification:
1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches (200 by 250 mm), for each material and finish. For each wood species and transparent finish, provide set of three Samples showing typical range of color and grain to be expected in finished work.
2. Corner sections of doors, approximately 8 by 10 inches (200 by 250 mm), with door faces and edges representing actual materials to be used.
3. Louver blade and frame sections, 6 inches (150 mm) long, for each material and finish specified.

4. Frames for light openings, 6 inches (150 mm) long, for each material, type, and finish required.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For door inspector.
   1. Submit copy of DHI's Fire and Egress Door Assembly Inspector (FDAI) certificate.

B. Test Reports: For results of hinge loading, cycle/slam, stile edge screw withdrawals, and stile edge split resistance for fire rated doors.

C. Field Quality-Control Reports: Provide copies of Certificate of Compliance for fire rated door and egress door assemblies.

D. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Special warranties.

B. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.5 QUALITY ASSURANCE

A. Quality Standard: Comply with the applicable provisions and recommendations of ANSI/WDMA I.S. 1A. Where standards and specifications conflict the more stringent shall be required.

B. Fire-Rated Door Inspector Qualifications: Inspector for field quality-control inspections of fire-rated door assemblies shall comply with qualifications set forth in NFPA 80, Section 5.2.3.1 and the following:
   1. DHI's Fire and Egress Door Assembly Inspector (FDAI) certification.

C. Egress Door Inspector Qualifications: Inspector for field quality-control inspections of egress door assemblies shall comply with qualifications set forth in NFPA 101, Section 7.2.1.15.4 and the following:
   1. DHI's Fire and Egress Door Assembly Inspector (FDAI) certification.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in heavy duty cardboard cartons prior to shipment from factory. Mark each door on top and bottom rail with opening number used on Shop Drawings using temporary, removable, or concealed markings.
   1. Protect wood doors during transit, storage, and handling to prevent damage, soiling, and deterioration.
   2. Store wood doors on a flat level surface in a dry, well ventilated, place.

3. Keep wood doors a minimum of 3-1/2 inches off floor surface and protected by a protective covering under the bottom door and over the top door.
4. Cover to protect wood doors from dirt, water and abuse but allow for air circulation under and around the stack.
5. Do not store wood doors in direct sunlight.

C. Handle wood doors with clean gloves. Lift and carry wood doors when moving around the site; do not drag wood doors across one another.

D. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, wet work is complete, and HVAC system is operating and maintaining temperature between 60 degrees F and 90 degrees F (16 degrees C and 32 degrees C) and relative humidity between 25 and 55 percent during remainder of construction period.

1.8 WARRANTY

A. Written warranty signed by Manufacturer 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 1/4 inch (6.4 mm) in a 42 inch by 84 inch (1067 mm by 2134 mm) section.
b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3 inch (0.25 mm in a 76.2 mm) span.
2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
3. Warranty Period for Solid Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain flush wood doors from single manufacturer.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Algoma Hardwoods, Inc., Division of Masonite.
2. Eggers Industries, Division of VT Industries.
3. Marshfield Door Systems, Inc., Division of Masonite.
4. VT Industries Inc.

2.2 PERFORMANCE REQUIREMENTS

A. Fire Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire protection ratings indicated, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.

2.3 FLUSH WOOD DOORS, GENERAL

A. Quality Standard: In addition to requirements specified, comply with ANSI/WDMA I.S. 1A.
   1. The Contract Documents may contain requirements that are more stringent than the referenced quality standard. Comply with the Contract Documents in addition to those of the referenced quality standard.

2.4 FLUSH WOOD VENEER-FACED DOORS

A. Interior Solid Core Doors:
   1. Performance Grade: ANSI/WDMA I.S. 1A Extra Heavy Duty.
   2. ANSI/WDMA I.S. 1A Grade: Premium.
   3. Faces: Single-ply wood veneer not less than 1/50 inch (0.508 mm) thick.
      a. Species: White Oak.
      b. Cut: Plain sliced (flat sliced).
      c. Match between Veneer Leaves: Slip match.
      d. Assembly of Veneer Leaves on Door Faces: Center-balance.
      e. Pair and Set Match: Provide for doors hung in same opening.
      f. Transom Match: Continuous match.
   4. Exposed Vertical and Top Edges: Same species as faces – Type A.
      a. Fire-Rated Single Doors: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed vertical edges.
      b. Fire-Rated Pairs of Doors: Provide formed-steel edges and astragals with intumescent seals.
         1) Finish steel edges and astragals with baked enamel, in color as selected by Architect from manufacturer’s full range.
      c. Mineral-Core Doors: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.
         1) Screw Holding Capability: 550 lbf (2440 N) per WDMA T.M. 10.

B. Core for Non-Fire-Rated Doors:
   1. ANSI A208.1, Grade LD-2 particleboard.
      a. Blocking: Provide wood blocking in particleboard core doors as follows:
         1) 5 inch (125 mm) top rail blocking, in doors indicated to have closers.
      b. Provide doors with structural composite lumber cores instead of particleboard cores for doors indicated to receive exit devices.
   2. WDMA I.S. 10 structural composite lumber:
      a. Screw Withdrawal, Door Face: 550 lbf (2440 N).
      b. Screw Withdrawal, Vertical Edge: 550 lbf (2440 N).

C. Core for Fire-Rated Doors: Noncombustible mineral product as required to achieve fire-protection rating indicated on Drawings, and complying with requirements of referenced quality standard and testing and inspecting agency for fire protection rating indicated.
   1. Blocking for Mineral-Core Doors: Provide composite blocking with improved screw holding capability approved for use in doors of fire protection ratings indicated:
      a. 5 inch (125 mm) top rail blocking.
      b. 5 inch (125 mm) bottom rail blocking, in doors indicated to have protection plates.
      c. 5 inch (125 mm) midrail blocking, in doors indicated to have armor plates.
      d. 5 inch (125 mm) midrail blocking, in doors indicated to have exit devices.

D. Construction: Five plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before faces and crossbands are applied. Faces are bonded to core using a hot press.

2.5 LIGHT FRAMES AND LOUVERS

A. Wood Beads for Light Openings in Wood Doors: Provide wood beads unless otherwise indicated.
   1. Wood Species: Same species as door faces.
   2. Profile: Flush rectangular beads.
   3. At wood core doors with 20 minute fire protection ratings, provide wood beads and metal glazing clips approved for use.

B. Wood Veneered Beads for Light Openings in Fire Rated Doors: Wood veneered noncombustible beads matching veneer species of door faces and approved for use in doors of fire protection rating indicated. Include concealed metal glazing clips where required for opening size and fire protection rating indicated.

C. Metal Frames for Light Openings in Fire Rated Doors: Frame formed of 0.048 inch (1.2 mm) thick, cold rolled steel sheet; with baked enamel or powder coated finish; and approved for use in doors of fire protection rating indicated.
   1. Color: As selected by Architect from manufacturer’s full range.

D. Metal Louvers:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Activar Construction Products Group, Inc.
      b. Advantage Lites and Louvers, an Allegion Company.
      c. Anemostat Products; a Mestek company.
      d. Pemko, an ASSA ABLOY Group Company.
      e. L & L Louvers, Inc.
   2. Blade Type: Vision proof, inverted V.
   3. Metal and Finish: Hot dip galvanized steel, 0.040 inch (1.0 mm) thick, with baked enamel, in color as selected by Architect from manufacturer’s full range.

2.6 FABRICATION

A. Factory fit doors to suit frame opening sizes indicated.
   1. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
   2. Comply with NFPA 80 requirements for fire rated doors.

B. Factory machine doors for hardware that is not surface applied.
   1. Locate hardware to comply with DHI-WDHS-3.
   2. Comply with final hardware schedules, door frame Shop Drawings, BHMA-156.115-W, and hardware templates.
   3. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
   4. For doors scheduled to receive electrified locksets, provide factory-installed raceway and wiring to accommodate specified hardware.
   5. Metal Astragals: Factory machine astragals and formed steel edges for hardware for pairs of fire rated doors.

C. Openings: Factory cut and trim openings through doors.
   1. Light Openings: Trim openings with moldings of material and profile indicated.
   2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 08 80 00.
   3. Louvers: Factory install louvers in prepared openings.

2.7 FACTORY FINISHING

A. Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
   1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on bottom edges, edges of cutouts, and mortises.

B. Factory finish doors.

C. Transparent Finish:
   1. Grade: Premium.
   2. Finish: WDMA TR-4 conversion varnish or TR-6 catalyzed polyurethane
   3. Staining: Selected by Architect.
   4. Effect: Semifilled finish, produced by applying an additional finish coat to partially fill the wood pores.
   5. Sheen: Satin.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames before hanging doors.
   1. Verify that installed 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: Refer to Section 08 71 00 “Door Hardware” for installation.

B. Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
   1. Install fire rated doors according to NFPA 80.
   2. Install smoke and draft control doors according to NFPA 105.

C. Job Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
   1. Clearances: Provide 1/8 inch (3.2 mm) at heads, jambs, and between pairs of doors. Provide 1/8 inch (3.2 mm) from bottom of door to top of decorative floor finish or covering unless otherwise indicated.
   2. Where threshold is shown or scheduled, provide1/4 inch (6.4 mm) from bottom of door to top of threshold unless otherwise indicated.
   3. Comply with NFPA 80 for fire rated doors.
   4. Bevel nonfire rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock and hinge edges.
   5. Bevel fire rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock edge; trim stiles and rails only to extent permitted by labeling agency.

D. Factory Fitted Doors: Align in frames for uniform clearance at each edge.

E. Factory Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 FIELD QUALITY CONTROL

A. Inspection Agency: Engage a qualified inspector to perform inspections and to furnish reports to Architect.

B. Inspections:
   1. Fire-Rated Door Inspections: Inspect each fire-rated door in accordance with NFPA 80, Section 5.2.

2. Egress Door Inspections: Inspect each door equipped with panic hardware, each door equipped with fire exit hardware, each door located in an exit enclosure, each electrically controlled egress door, and each door equipped with special locking arrangements in accordance with NFPA 101, Section 7.2.1.15.

C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

E. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 80.

3.4 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

SECTION 08 31 13

ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes access doors and frames for walls and ceilings.

1.2 ALLOWANCES

A. Access doors and frames are part of an access door and frame allowance.

1.3 ACTION SUBMITTALS

A. Product Data: Technical data for each type of product including construction details material descriptions, dimensions of individual components and profiles, and finishes.

B. Samples: Submit samples for each type of access door and frame and for each finish specified, complete assembly minimum 6 by 6 inches (150 by 150 mm) in size.

C. Product Schedule: For access doors and frames.

PART 2 - PRODUCTS

2.1 ACCESS DOORS AND FRAMES

A. Flush Access Doors with Exposed Flanges:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Acudor Products, Inc.
      b. JL Industries, Inc.; a division of the Activar Construction Products Group.
      c. Larsens Manufacturing Company.
      d. Milcor; Commercial Products Group of Hart & Cooley, Inc.
      e. Nystrom, Inc.
      f. Williams Bros. Corporation of America (The).
   2. Description: Face of door flush with frame, with exposed flange and concealed hinge.
   3. Locations: Wall and ceiling.
   4. Door Size: Indicated on Drawings.
   5. Metallic Coated Steel Sheet for Door: Nominal 0.064 inch (1.63 mm), factory finished.
   6. Frame Material: Same material, thickness, and finish as door.
   7. Latch and Lock: Cam latch, key operated.

B. Exterior Flush Access Doors:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Babcock-Davis.
   b. JL Industries, Inc.; a division of the Activar Construction Products Group.
   c. Larsens Manufacturing Company.
   d. Maxam Metal Products Limited.
   e. MIFAB, Inc.
   f. Nystrom, Inc.
   g. Williams Bros. Corporation of America (The).
2. Description: Weatherproof assembly, with face of door fit flush with frame and with exposed frame. Include extruded door gaskets and minimum 2 inch thick (50 mm thick) fiberglass insulation.
3. Locations: Wall.
4. Door Size: Indicated on Drawings.
5. Stainless Steel Sheet for Door: Nominal 0.062 inch (1.59 mm).
6. Frame Material: Same material, thickness, and finish as door.
7. Latch and Lock: Cam latch operated by handle, with keyed lock in handle.

2.2 MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A 879/A 879M, with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.

C. Metallic Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

D. Stainless Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304. Remove tool and die marks and stretch lines, or blend into finish.

E. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

2.3 FABRICATION

A. Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.
   1. For concealed flanges with drywall bead, provide edge trim for gypsum panels securely attached to perimeter of frames.
   2. For concealed flanges with plaster bead for full bed plaster applications, provide zinc coated expanded metal lath and exposed casing bead welded to perimeter of frames.

D. Latch and Lock Hardware:
   1. Quantity: Furnish number of latches and locks required to hold doors tightly closed.
   2. Keys: Furnish two keys per lock and key all locks alike.

2.4 FINISHES

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: 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.

D. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
   1. Factory Primed: Apply lead and chromate free, universal primer immediately after surface preparation and pretreatment.
   2. Factory Finished: Apply baked enamel or powder coat finish immediately after cleaning and pretreating, with minimum dry film thickness of 1 mil (0.025 mm) for topcoat.
      a. Color: Selected by Architect.

E. Stainless Steel Finishes:
   1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
   2. Bright, Cold Rolled, Unpolished Finish: No. 2B.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the work. Proceed with installation after correcting unsatisfactory conditions.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

3.3 ADJUSTING

A. Adjust doors and hardware, after installation, for proper operation.

END OF SECTION

SECTION 08 71 00

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. Sliding doors.
   3. 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 “Hollow Metal Doors and Frames."
   2. Division 08 Section “Flush Wood Doors."
   3. Division 08 Section “Aluminum-Framed Entrances and Storefronts."

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 as applicable. Any undated reference to a standard shall be interpreted as referring to the latest edition of that standard:
   1. ANSI/BHMA Certified Product Standards - A156 Series.
   2. UL10C - Positive Pressure Fire Tests of Door Assemblies.
   3. ANSI/UL 294 - Access Control System Units.
   4. UL 305 - Panic Hardware.

5. ANSI/UL 437- Key Locks.

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. 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.

E. 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.

F. 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 Procedures.

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. Certified Products: Where specified, products must maintain a current listing in the Builders Hardware Manufacturers Association (BHMA) Certified Products Directory (CPD).

C. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door 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.

D. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical 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.

E. Automatic Operator Supplier Qualifications: Power operator products and accessories are required to be supplied and installed through the Norton Preferred Installer (NPI) program. Suppliers are to be factory trained, certified, and a direct purchaser of the specified power operators and be responsible for the installation and maintenance of the units and accessories indicated for the Project.

F. 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.

G. Each unit to bear third party permanent label indicating compliance with the referenced testing standards.

H. 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.

I. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of 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.

J. At completion of installation, provide written documentation that components were applied according 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. Do not store electronic access control hardware, software, or accessories at Project site without prior authorization.

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, access control credentials, software 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 standard and electrified 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 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. Warranty Period: Unless otherwise indicated, warranty shall be one year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 HANGING DEVICES

A. Hinges: ANSI/BHMA A156.1 butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.
   1. Quantity: Provide the following hinge quantity:
      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:
   a. Non-removable Pins: With the exception of electric through wire hinges, 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. Manufacturers:
   a. McKinney (MK) - TA/T4A Series, 5 knuckle.

B. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 continuous geared hinge. with minimum 0.120-inch thick extruded 6063-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. Manufacturers:
   a. Pemko (PE).

2.2 DOOR OPERATING TRIM

A. Door Push Plates and Pulls: ANSI/BHMA A156.6 door pushes and pull units of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.

1. 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.
2. Pulls, where applicable, shall be provided with a 10” clearance from the finished floor on the push side to accommodate wheelchair accessibility.
3. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.
4. Manufacturers:
   a. Rockwood (RO).

2.3 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. Cylinder Types: Original manufacturer cylinders able to supply the following cylinder formats and types:
   1. Threaded mortise cylinders with rings and cams to suit hardware application.
   2. Rim cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
   3. Bored or cylindrical lock cylinders with tailpieces as required to suit locks.
   4. Tubular deadlocks and other auxiliary locks.
   5. 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.
   6. Keyway: Match Facility Standard.

C. Small Format Interchangeable Cores: Provide small format interchangeable cores (SFIC) as specified, core insert, removable by use of a special key; usable with other manufacturers' cylinders.

D. Keying System: Each type of lock and cylinders to be factory keyed.
   1. Supplier shall conduct a "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: Field verify and key cylinders to match Owner's existing system.

E. 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).

F. 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 transcript list in writing or electronic file as directed by the Owner.

2.4 KEY CONTROL

A. 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. Manufacturers:
      a. Lund Equipment (LU).
      b. MMF Industries (MM).
      c. Telkee (TK).

2.5 MECHANICAL LOCKS AND LATCHING DEVICES

A. Cylindrical Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.2, Series 4000, Operational Grade 1 Certified Products Directory (CPD) listed.
   1. Locks shall meet or exceed the requirements of ANSI/BHMA A156.2 Series 4000, Grade 1 with all standard trims, as follows:

a. Cycle Test: ANSI/BHMA A156.2 Grade 1 requirements with no lever sag.
b. Abusive Locked Lever Torque: Exceed 3,100 in-lb with no entry; lock to maintain egress functionality in compliance with BHMA certification requirements.
c. Offset Lever Pull: Exceed 1,600 lbs with no entry (8 times ANSI/BHMA A156.2 requirements).
d. Latch Retraction with Preload: Exceed 100 lb preload while maintaining ANSI/BHMA requirements for operation in warped doors (2 times ANSI/BHMA A156.2 requirements).

2. Heavy duty cylindrical locks shall have a seven-year warranty.
3. Vertical Impact: Exceed 100 vertical impacts (20 times ANSI/BHMA A156.2 requirements).
4. Furnish with solid cast levers, standard 2 3/4” backset, and 1/2" (3/4" at rated paired openings) throw brass or stainless steel latchbolt.
5. Locks are to be non-handed and fully field reversible.
6. Manufacturers:
   a. Corbin Russwin Hardware (RU) - CLX3300 Series.

2.6 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. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
   3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
   4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.

B. Standards: Comply with the following:
   1. Strikes for Mortise Locks and Latches: BHMA A156.13.
   2. Strikes for Bored Locks and Latches: BHMA A156.2.
   3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
   4. Dustproof Strikes: BHMA A156.16.

2.7 ELECTROMAGNETIC LOCKING DEVICES

A. Surface Electromagnetic Locks (Heavy Duty): Electromagnetic locks to be surface mounted type conforming to ANSI A156.23, Grade 2 with minimum holding force strength of 1,200 pounds. Locks to be capable of either 12 or 24 voltage and be UL listed for use on fire rated door assemblies. Electronics are to be fully sealed against tampering and allow exterior weatherproof applications. As indicated in Hardware Sets, provide specified mounting brackets and housings. Power supply to be by the same manufacturer as the lock with combined products having a lifetime replacement warranty.
   1. Manufacturers:

a. Securitron (SU) - M62 Series.
b. Securitron (SU) - M82 Series.

2.8 ELECTRIC STRIKES

A. Surface Mounted Rim Electric Strikes: Surface mounted rim exit device electric strikes conforming to ANSI/BHMA A156.31, Grade 1, and UL Listed for both Burglary Resistance and for use on fire rated door assemblies. Construction includes internally mounted solenoid with two heavy-duty, stainless steel locking mechanisms operating independently to provide tamper resistance. Strikes tested for a minimum of 500,000 operating cycles. Provide strikes with 12 or 24 VDC capability supplied standard as fail-secure unless otherwise specified. Option available for latchbolt and latchbolt strike monitoring indicating both the position of the latchbolt and locked condition of the strike. Strike requires no cutting to the jamb prior to installation.

1. Manufacturers:
   a. HES (HS) - 9400/9500/9600/9700/9800 Series.

B. Provide electric strikes with in-line power controller and surge suppressor by the same manufacturer as the strike with the combined products having a five year warranty.

2.9 CONVENTIONAL EXIT DEVICES

A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:

1. Exit devices shall have a five-year warranty.
2. 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.
3. 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.
4. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
5. 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.
6. 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.
   b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.
7. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.

8. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2” wide stiles.
9. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
10. Rail Sizing: Provide exit device rails factory sized for proper door width application.
11. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.

B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Exit device latch to be stainless steel, pullman type, with deadlock feature.
1. Manufacturers:
a. Von Duprin (VD) - 35A/98 XP Series.

C. Extruded Aluminum Removable Mullions: ANSI/BHMA A156.3 anodized, removable mullions with malleable-iron top and bottom retainers. Mullions to be provided standard with stabilizers and imbedded weatherstrip.
1. Manufacturers:
a. Same as exit device manufacturer.

D. Steel Removable Mullions: ANSI/BHMA A156.3 steel removable mullions with options for fire rating, locking, through-wire electrification and hurricane compliance as specified.
1. Manufacturers:
a. Same as exit device manufacturer.

2.10 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.
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 Americans with Disabilities Act, 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, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.

B. Door Closers, Surface Mounted (Commercial Duty): ANSI/BHMA 156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, institutional grade 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, closing sweep, and latch speed control valves. Provide non-handed units standard.

1. Manufacturers:
   a. Arrow, formerly known as Yale (YA) - 3500 Series.
   b. Corbin Russwin Hardware (RU) - DC6000 Series.
   c. Sargent Manufacturing (SA) - 1431 Series.

2.11 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 door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.

1. Manufacturers:
   a. Rockwood (RO).

C. Overhead Door Stops and Holders: ANSI/BHMA A156.8, Grade 1 Certified Products Directory (CPD) listed 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. Manufacturers:
   a. Norton Rixson (RF).
   b. Sargent Manufacturing (SA).

2.12 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 NPFA 252, Standard Methods of Fire Tests of Door Assemblies.

D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.

E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

F. Manufacturers:

1. National Guard Products (NG).
2. Pemko (PE).
3. Reese Enterprises, Inc. (RE).

2.13 ELECTRONIC ACCESSORIES

A. Push-Button Switches: Industrial grade momentary or alternate contact, back-lighted push buttons with stainless-steel switch enclosures. 12/24 VDC bi-color illumination suitable for either flush or surface mounting.

1. Manufacturers:
   a. Alarm Controls (AK) - TS Series.
   b. Securitron (SU) - PB Series.

B. Request-to-Exit Motion Sensor: Request-to-Exit Sensors motion detectors specifically designed for detecting exiting through a door from the secure area to a non-secure area. Include built-in timers (up to 60 second adjustable timing), door monitor with sounder alert, internal vertical pointability coverage, 12VDC or 24VDC power and selectable relay trigger with fail safe/fail secure modes.

1. Manufacturers:
   a. Alarm Controls (AK) - SREX Series.
   b. Securitron (SU) - XMS Series.

C. 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. Manufacturers:
   a. Securitron (SU) - DPS Series.

D. Switching Power Supplies: Provide power supplies with either single or dual voltage configurations at 12 or 24VDC. Power supplies shall have battery backup function with an integrated battery charging circuit and shall provide capability for power distribution, direct lock control and Fire Alarm Interface (FAI) through add on modules. Power

supplies shall be expandable up to 16 individually protected outputs. Output modules shall provide individually protected, continuous outputs and/or individually protected, relay controlled outputs.

1. 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.
2. Manufacturers:
   a. Securitron (SU) - AQD Series.

2.14 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.

2.15 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. DHI TDH-007-20: Installation Guide for Doors and Hardware.
   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. 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.

D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

E. 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 (Punch Report): Reference Division 01 Sections “Closeout Procedures." Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.
   1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

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.

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

A. 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.

1. Quantities listed are for each pair of doors, or for each single door.
2. The supplier is responsible for handing and sizing all products.
3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.
4. At existing openings with new hardware the supplier shall field inspect existing conditions prior to the submittal stage to verify the specified hardware will work as required. Provide alternate solutions and proposals as needed.

B. Manufacturer's Abbreviations:

1. MK - MCKINNEY
2. PE - PEMKO
3. VD - VON DUPRIN
4. RU - CORBIN RUSSWIN
5. SU - SECURITRON
6. OT - OTHER
7. HS - HES
8. RO - ROCKWOOD
9. RF - RIXSON
10. AK - ALARM CONTROLS

HARDWARE SETS

SET: 1.0
DOORS: 121.1, 121.2

2	CONTINUOUS HINGE	CFMXXSLF-HD1		PE
1	MULLION	4954	689	VD
1	RIM EXIT ONLY	99EO	626	VD
1	RIM EXIT NIGHTLATCH	99NLOP 110MD-NL	626	VD
1	PERMANENT CORE	OAK SECURITY GROUP 1C6-K-626-UN K KEYWAY		OT
1	SFIC RIM CYLINDER	AS REQUIRED	626	RU
1	ELECTRIC STRIKE	9600	630	HS
1	SMART PAC BRIDGE RECTIFIER	2005M3		HS
2	DOOR PULL	BF157 MTG-TYPE 12XHD	US32D	RO
2	SURFACE CLOSER, PA, UNITROL	DC6210 A11	689	RU
1	THRESHOLD	2005AT MSES25SS		PE
1	MULLION GASKETING	5110BL		PE
1	PERIMETER GASKETING	BY DOOR AND FRAME MANUFACTURER		OT
2	SWEEP	315CN TKSP		PE
2	POSITION SWITCH	DPS		SU
1	POWER SUPPLY	AQD W/RELAYS AS REQUIRED		SU
1	CARD READER	BY SECURITY CONTRACTOR		OT

NOTES: COORDINATE HARDWARE WITH ALUMINUM DOOR AND FRAME MANUFACTURER. PROVIDE SPECIAL TEMPLATES, BRACKETS, SPACERS, DROP PLATES AND FASTENERS AS REQUIRED. CONFIRM HARDWARE FINISH WITH ARCHITECT PRIOR TO ORDERING.DOOR NORMALLY CLOSED AND LOCKED.ENTRY BY VALID CREDENTIAL OR MANUAL KEY OVERRIDE.ALWAYS FREE EGRESS.UPON ACTIVATION OF THE FIRE ALARM OR LOSS OF POWER, DOOR REMAINS LOCKED.

SET: 2.0
DOORS: 120.1 (GMS) , 120.2 (GMS) , 121 (GMS)

1 MAGNETIC LOCK	DM62BD		SU
1 MOTION SENSOR	XMS		SU
1 PUSH BUTTON	TS-14		AK
1 POWER SUPPLY	AQD W/RELAYS AS REQUIRED		SU
1 CARD READER	BY SECURITY CONTRACTOR		OT

SET: 3.0
DOORS: 116

3 HINGE, FULL MORTISE	TA2714 4-1/2" X 4-1/2"	US26D	MK
1 STOREROOM LOCK	CL3357 PZD CT6SD	626	RU
1 PERMANENT CORE	OAK SECURITY GROUP 1C6-K-626-UN K KEYWAY		OT
1 SURFACE CLOSER, RA	DC6200 A10	689	RU
1 WALL STOP	409	US32D	RO
3 SILENCER	608-RKW		RO

SET: 4.0
DOORS: 110, 111

3 HINGE, FULL MORTISE	TA2714 4-1/2" X 4-1/2"	US26D	MK
1 ENTRANCE LOCK	CL3351 PZD CT6SD	626	RU
1 PERMANENT CORE	OAK SECURITY GROUP 1C6-K-626-UN K KEYWAY		OT
1 WALL STOP	409	US32D	RO
3 SILENCER	608-RKW		RO

SET: 5.0
DOORS: 101, 102, 103, 104, 105, 106

3 HINGE, FULL MORTISE	TA2714 4-1/2" X 4-1/2"	US26D	MK
1 CLASSROOM LOCK	CL3355 PZD CT6SD	626	RU
1 PERMANENT CORE	OAK SECURITY GROUP 1C6-K-626-UN K KEYWAY		OT
1 WALL STOP	409	US32D	RO
3 SILENCER	608-RKW		RO

SET: 6.0
DOORS: 119, 120

3 HINGE, FULL MORTISE	TA2714 4-1/2" X 4-1/2"	US26D	MK
1 PASSAGE LATCH	CL3310 PZD	626	RU
1 SURF OVERHEAD STOP	9-336	630	RF
3 SILENCER	608-RKW		RO

SET: 7.0
DOORS: 113

3 HINGE, FULL MORTISE	TA2714 4-1/2" X 4-1/2"	US26D	MK
1 PRIVACY LOCK	CL3320 PZD	626	RU
1 SURFACE CLOSER, RA	DC6200 A10	689	RU
1 WALL STOP	409	US32D	RO
3 SILENCER	608-RKW		RO

SET: 8.0
DOORS: 124.1, 124.2

3 HINGE, FULL MORTISE	TA2714 4-1/2" X 4-1/2"	US26D	MK
1 PRIVACY LOCK	CL3320 PZD	626	RU
1 WALL STOP	409	US32D	RO
3 SILENCER	608-RKW		RO

SET: 9.0
DOORS: A110LP

1 MAGNETIC LOCK	M62FGBD SASM		SU
1 POWER SUPPLY	AQD W/RELAYS AS REQUIRED		SU
1 REX DEVICE	BY SECURITY CONTRACTOR		OT
1 CARD READER	BY SECURITY CONTRACTOR		OT
1 HINGES AND CLOSER	BY GATE MANUFACTURER		OT

END OF SECTION

SECTION 08 80 00

GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Glass products.
2. Insulating glass.
3. Glazing sealants.
4. Glazing tapes.
5. Miscellaneous glazing materials.

1.2 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 in accordance with ASTM C1036.

C. Interspace: Space between lites of an insulating-glass unit.

1.3 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances to achieve proper safety margins for glazing retention under each design load case, load case combination, and service condition.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review temporary protection requirements for glazing during and after installation.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Glass: Include structural, physical, and environmental characteristics, size limitations, special handling, or installation requirements.
2. Glazing Compounds: Include functional and environmental characteristics, and special application requirements.

B. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Certificates: Submit glass and glazing manufacturer's certifications that materials meet Specification requirements and are compatible with each other.

C. Sample Warranties: For special warranties.

1.7 QUALITY ASSURANCE

A. Fabricated-Glass Manufacturer Qualifications: A qualified manufacturer of fabricated glass units who is approved by primary glass manufacturer.

B. Fabricator Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved and certified by coated-glass manufacturer.

C. Installer Qualifications: A qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AG&M) contractors and who employs glazing technicians certified under the Architectural Glass and Metal Technician (AGMT) certification program.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver glass to job in original containers bearing manufacturer's label indicating quality of contents of each package.

B. Protect glazing materials in accordance with manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

C. Do not remove labels until glass has been installed. Keep glass free from contamination by materials capable of staining glass. Do not apply marking materials to either side of glass.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 deg F (4.4 deg C).
2. Do not install glazing materials when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1.10 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. 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.

1. Warranty Period: 10 years from date of Substantial Completion.

B. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. 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.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide products by one of the following:

1. AGC Glass Company North America, Inc.
2. Guardian Industries Corp.
3. Oldcastle BuildingEnvelope™.
4. Pilkington North America.
5. Saint-Gobain.
6. Viracon, Inc.
7. Vitro Glass.

B. Source Limitations for Glass: Obtain coated glass from single source from single manufacturer.

C. Source Limitations for Glazing Accessories: For each product and installation method, obtain from single source from single manufacturer.

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. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design glazing.

C. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the IBC and ASTM E 1300.

1. Wind Loads: Design and size components of glazing systems to withstand loads caused by positive and negative wind pressure acting normal to plane of wall as calculated in accordance with ASCE/SEI 7 to establish wind pressure based on the following criteria:
   a. Basic Wind Speed: As indicated on Drawings.
   b. Importance Factor: As indicated on Drawings.
   c. Exposure Category: As indicated on Drawings.
2. Seismic Loads: As indicated on Drawings.
3. Design Snow Loads: As indicated on Drawings.
4. Other Design Loads: As prescribed by IBC Chapter 24 and ASTM E1300.
5. Probability of Breakage for Sloped Glazing: For glass sloped more than 15 degrees from vertical, design glass for a probability of breakage not greater than 0.001.
6. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch (25 mm), whichever is less.
7. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.

D. Safety Glazing: Where safety glazing is required, provide glazing that complies with 16 CFR 1201, Category II.

E. 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 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. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.3 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR A7, "Sloped Glazing Guidelines."
2. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Guidelines for Sloped Glazing."
3. IGMA TM-3000: "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

4. IGMA TM-3100: "Voluntary Guidelines for the Identification of Visual Obstructions in the Air Space of Insulating Glass Units."

B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the 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.

C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

D. Thickness: Where glass thickness is indicated, it shall be considered a minimum. Provide glass that complies with performance requirements and is not less than the thickness indicated.

1. Minimum Glass Thickness: 6 mm.

E. Strength:

1. Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article.
2. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article.
3. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.4 FULLY TEMPERED GLASS

A. Fully Tempered Glass: ASTM C 1048, Type I (transparent glass, flat), Quality-Q3 (glazing select), Class 1 (clear) or Class 2 (tinted, heat-absorbing and light-reducing), Kind FT (fully tempered), Condition A (uncoated).

B. Glass Types:

1. Type 2A – Clear.

2.5 COATED GLASS – FULLY TEMPERED

A. Fully Tempered Glass: ASTM C 1376 and ASTM C 1048, Type I (transparent glass, flat), Quality-Q3 (glazing select), Class 1 (clear) or Class 2 (tinted, heat-absorbing and light-reducing), Kind FT (fully tempered), Condition C (other coated glass).

1. Provide Low-E coating on #2 (inner) surface of glass, outer-lite paired with an inner lite-of clear glass in an insulated unit configuration, resulting in comparable appearance characteristics.

B. Glass Types:

1. Type 4A – Clear.

2.6 INSULATED GLASS

A. Insulated Glass: Sealed units of glass lites separated by dehydrated air spaces complying with ASTM E 2188, ASTM E 2189, and ASTM E 2190, with the following indicated requirements:

1. For types, classes, kinds, and conditions of each glass lite refer to specified glass types.
2. Sealing System: Dual seal, primary and secondary using manufacturer's standard sealants.
3. Spacer: Aluminum with mill or clear anodized finish.
4. Air Space Width: Nominal 1/2 inch measured perpendicularly from surfaces of glass lites at unit edge.

B. Glass Types:

1. Type 8-1: Clear.
   a. Outer Lite: Type: 4A.
   b. Inner Lite: Type: 2A.

2.7 GLAZING SEALANTS

A. General:

1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, 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 glass 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 selected by Architect from manufacturer's full range.

B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Dow Corning Corporation; Dow Corning® 790 Silicone Building Sealant.
   b. GE Construction Sealants; Momentive Performance Materials Inc.; SCS2700 SilPruf LM.
   c. Pecora Corporation; 890NST.
   d. Tremco Incorporated; Spectrem 1.

C. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 50, Use NT.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Dow Corning Corporation; Dow Corning® 795 Silicone Building Sealant.
   b. GE Construction Sealants; Momentive Performance Materials Inc.; Silpruf SCS200.
   c. Pecora Corporation; 895NST.
   d. Tremco Incorporated; Spectrem 2.

2.8 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 C 1281 and AAMA 800 for products indicated below:

1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
2. 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.

2.9 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.

1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
    a. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

B. Fully-Tempered Glass:

1. Fabrication Process: By horizontal (roller-hearth) process.
2. Heat Soaking: After tempering, heat soak 100 percent of fabricated glass units to European Union Standard EN14179 to eliminate inclusion related glass breakage. Statistical heat soaking shall not be permitted.
3. For uncoated glass, comply with requirements for Condition A.
4. For coated vision glass, comply with requirements for Condition C (other coated glass).
5. Fabrication Tolerances:
    a. Optical Distortion Tolerance: Using a LightSentry measurement system or equal, measure each pane of monolithic heat-strengthened glass against the following criteria and reject those that do not comply:
        1) Roller Wave Criteria: Maximum 0.004 inches at center and 0.008 inches at edges from peak to valley.
    b. Overall Bow and Warp Tolerance: Examine each pane of heat-treated glass to detect any lights which exceed half of the maximum bow and warp tolerances in any direction as listed in ASTM C1048, Table 2 and reject those that do not comply.

6. Orientation: Orient roller-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
   a. If width of any glass units indicated on Drawings exceeds fabrication limits, roller-wave distortion shall be oriented in a consistent direction for the entire project.

PART 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 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. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

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 (1270 mm).
   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 (3-mm) 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.

J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

L. Tempered Glazing:
   1. Do not cut, seam, nip or abrade tempered glass.
   2. Set tempered glass with tong marks completely concealed or in as inconspicuous a location as possible.
   3. Provide tempered glass in hazardous locations:
      a. Ingress and egress doors.
      b. Operable or inoperable panels adjacent to a door in building and within same wall plane as door whose nearest vertical edge is within 24" of door in closed position and whose bottom edge is less than 60" above floor or walking surface.
      c. Fixed panels which have glazed area in excess of 9 sq. ft. and lowest edge is less than 18" above finished floor level or walking surface within 36" of such glazing where panels are not protected with horizontal member not less than 1-1/2" in width located between 24" and 36" above walking surface.
      d. Other locations indicated, and where required by building code.

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, then to jambs. Cover horizontal framing joints by applying tapes to jambs, 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.

1. 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 glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. 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 glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 CLEANING AND PROTECTION

A. Immediately after installation remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. 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.

1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

C. Remove and replace glass that is damaged during construction period.

D. Wash glass on both exposed surfaces 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.

3.8 GLAZING SCHEDULE

A. Unless noted otherwise in Drawings, provide the following:

1. Interior Glazing:
   a. Typical interior windows: Type 2A.
2. Exterior Glazing:
   a. Typical vision glazing: Type 8-1.

END OF SECTION

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SECTION 09 21 16

GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Non-load-bearing steel framing systems for interior partitions.
2. Suspension systems for interior ceilings and soffits.
3. Grid suspension systems for gypsum board ceilings.
4. Interior gypsum board.
5. Acoustical accessories at interior partitions.
6. Trim accessories.
7. Joint treatments.
8. Texture finishes.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:
1. Non-load-bearing steel framing systems for interior partitions.
2. Suspension systems for interior ceilings and soffits.
3. Grid suspension systems for gypsum board ceilings.
4. Gypsum board products.
5. Acoustical accessories.
6. Trim accessories.
7. Joint treatment materials.
8. Textured finishes.

B. Samples: For the following products:
1. Textured Finishes: 12-inch- (300-mm-) square for each textured finish indicated and on same backing indicated for Work.

1.3 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of code-compliance certification for studs and tracks.

1.4 QUALITY ASSURANCE

A. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Certified Steel Stud Association, the Steel Framing Industry Association, or the Steel Stud Manufacturers Association.

1.5 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.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.
   1. Do not install interior gypsum panels and products until installation areas are enclosed and conditioned.

B. Room Temperatures: Maintain minimum 40 degrees F (4 degrees C). For adhesive attachment and finishing of gypsum board, maintain minimum 50 degrees F (10 degrees C) for 48 hours before application and continuously after until dry. Do not exceed 95 degrees F (35 degrees C) when using temporary heat sources.

C. Ventilation: Ventilate building spaces as required to dry joint treatment materials. Avoid drafts during hot, dry weather to prevent finishing materials from drying too rapidly.

D. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

E. Do not install panels that are wet, moisture damaged, and 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.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Performance Requirements: Comply with manufacturer's load tables and the following design pressures and deflections:
   1. Typical Partitions: L/240 at 5 psf.
   2. Partitions Receiving Adhered Masonry, Stone Cladding, Lath and Plaster, or Plaster Veneer: L/360 at 15 psf.
   3. Partitions Receiving Monitors, Televisions, or Heavy Audio/Visual Equipment: L/360 at 15 psf.

2.2 FRAMING SYSTEMS

A. Framing Members, General: Comply with ASTM C754 for conditions indicated.
   1. Steel Sheet Components: Comply with ASTM C645 requirements for steel unless otherwise indicated.

2. Protective Coating: Coating with equivalent corrosion resistance of ASTM A653/A653M, G40 (Z120), hot-dip galvanized unless otherwise indicated.

B. Studs and Tracks: ASTM C645. Use either conventional steel studs and tracks or embossed, high-strength steel studs and tracks.

1. Steel Studs and Tracks:
   a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
      1) CEMCO; California Expanded Metal Products Co.
      2) ClarkDietrich.
      3) Custom Stud.
      4) MarinoWARE.
      5) MBA Building Supplies.
      6) Phillips Manufacturing Co.
      7) SCAFCO Steel Stud Company.
      8) Steel Construction Systems.
      9) Telling Industries.
      10) The Steel Network, Inc.
   b. Minimum Base-Steel Thickness: As indicated on Drawings, in correlation with vertical unbraced span and horizontal deflection performance requirements.
   c. Depth: As indicated on Drawings
   d. Spacing: As indicated on Drawings.
2. Embossed, High Strength Steel Studs and Tracks: Roll-formed and embossed with surface deformations to stiffen the framing members so that they are structurally comparable to conventional ASTM C645 steel studs and tracks.
   a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
      1) CEMCO; California Expanded Metal Products Co.
      2) ClarkDietrich.
      3) MarinoWARE.
      4) MBA Building Supplies.
      5) Phillips Manufacturing Co.
      6) SCAFCO Steel Stud Company.
      7) Steel Construction Systems.
      8) Telling Industries.
      9) The Steel Network, Inc.
   b. Minimum Base-Steel Thickness: As indicated on Drawings, in correlation with vertical unbraced span and horizontal deflection performance requirements.
   c. Depth: As indicated on Drawings.

C. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

1. Minimum Base-Steel Thickness: 0.0359 inch (0.912 mm).

D. Cold-Rolled Channel Bridging: Steel, 0.0538-inch (1.367-mm) minimum base-steel thickness, with minimum 1/2-inch- (13-mm-) wide flanges.
   1. Depth: 1-1/2 inches (38 mm).
   2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches (38 by 38 mm), 0.068-inch- (1.72-mm-) thick, galvanized steel.

E. Hat-Shaped, Rigid Furring Channels: ASTM C645.
   1. Minimum Base-Steel Thickness: 0.0296 inch (0.752 mm).
   2. Depth: 7/8 inch (22.2 mm).

F. Cold-Rolled Furring Channels: 0.053-inch (1.34-mm) uncoated-steel thickness, with minimum 1/2-inch- (13-mm-) wide flanges.
   1. Depth: 3/4 inch (19 mm).
   2. Furring Brackets: Adjustable, corrugated-edge-type steel sheet with minimum uncoated-steel thickness of 0.0329 inch (0.8 mm).
   3. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062-inch- (1.59-mm-) diameter wire, or double strand of 0.048-inch- (1.21-mm-) diameter wire.

G. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches (32 mm), wall attachment flange of 7/8 inch (22 mm), minimum uncoated-steel thickness of 0.0179 inch (0.455 mm), and depth required to fit insulation thickness indicated.

2.3 SUSPENSION SYSTEMS

A. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062-inch- (1.59-mm) diameter wire, or double strand of 0.048-inch- (1.21-mm-) diameter wire.

B. Hanger Attachments to Concrete:
   1. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 AC193 AC58 or AC308 as appropriate for the substrate.
      a. Material: Carbon-steel components zinc-plated to comply with ASTM B633 or ASTM F1941 (ASTM F1941M), Class Fe/Zn 5, unless otherwise indicated.
   2. Power-Actuated Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

C. Wire Hangers: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.16 inch (4.12 mm) in diameter.

D. Flat Hangers: Steel sheet, 1 by 3/16 inch (25 by 5 mm) by length indicated.

E. Angle-Type Hangers: Angles with legs not less than 7/8-inch (22-mm) wide with a base steel thickness of 0.0538 inch (1.367 mm) and minimum 5/16-inch- (8-mm-) diameter bolted connections.

F. Carrying Channels (Main Runners): Cold-rolled, commercial-steel sheet with a base-steel thickness of 0.0538 inch (1.367 mm) and minimum 1/2-inch- (13-mm-) wide flanges.
   1. Depth: 2 inches (51 mm).

G. Furring Channels (Furring Members):
1. Cold-Rolled Channels: 0.0538-inch (1.367-mm) uncoated-steel thickness, with minimum 1/2-inch- (13-mm-) wide flanges, 3/4 inch (19 mm) deep.
2. Steel Studs and Tracks: ASTM C645.
a. Minimum Base-Steel Thickness: 0.0296 inch (0.752 mm).
b. Depth: As indicated on Drawings.
3. Embossed, High-Strength Steel Studs and Tracks: ASTM C645.
a. Minimum Base-Steel Thickness: 0.0190 inch (0.483 mm).
b. Depth: As indicated on Drawings.
4. Hat-Shaped, Rigid Furring Channels: ASTM C645, 7/8 inch (22 mm) deep.
a. Minimum Base-Steel Thickness: 0.0296 inch (0.752 mm).
5. Resilient Furring Channels: 1/2-inch- (13-mm-) deep members designed to reduce sound transmission.
a. Configuration: Asymmetrical.

H. Grid Suspension System for Gypsum Board Ceilings: ASTM C645, direct-hung system composed of main beams and cross-furring members that interlock.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Armstrong Ceiling & Wall Solutions; Drywall Grid Systems.
b. Rockfon (Rockwool International); 640/660 Drywall Ceiling Suspension.
c. USG Corporation; Drywall Suspension System.

2.4 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.

2.5 INTERIOR GYPSUM BOARD

A. Gypsum Board: ASTM C1396/C1396M.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. American Gypsum.
b. CertainTeed Gypsum.
c. Georgia-Pacific Gypsum LLC.
d. National Gypsum Company.
e. PABCO Gypsum.
f. USG Corporation.
2. Core: 5/8 inch (15.9 mm), Type X.
3. Long Edges: Tapered.

2.6 ACOUSTICAL ACCESSORIES

A. 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. Products: Subject to compliance with requirements, provide one of the following:
a. CertainTeed Corporation; NoiseReducer™.

b. Johns Manville; a Berkshire Hathaway company; Formaldehyde-free™ Unfaced thermal and acoustical batts.
c. Knauf Insulation; EcoBatt® Insulation.
d. Owens Corning; EcoTouch® Insulation.

2. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.

3. Smoke-Developed Index: Not more than 50 when tested in accordance with ASTM E84.

B. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex acoustical sealant complying with ASTM C834.

1. Products: Subject to compliance with requirements, provide one of the following:
a. GE Construction Sealants; Momentive Performance Materials Inc.; RCS20 Acoustical.
b. Hilti, Inc.; CP 506 Smoke and Acoustical Sealant.
c. QuietRock; QuietSeal Pro.
d. Specified Technologies, Inc.; SpecSeal Smoke 'N' Sound Sealant.
e. Tremco Incorporated; Tremco Acoustical Sealant.
f. USG Corporation; SHEETROCK Acoustical Sealant.

2. Colors of Exposed Acoustical Joint Sealants: White.

2.7 TRIM ACCESSORIES

A. Interior Trim: ASTM C1047, galvanized or aluminum-coated steel sheet, rolled zinc, or paper-faced galvanized-steel sheet.

1. Edge 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. Curved-Edge Cornerbead: With notched or flexible flanges.

2. Expansion (Control) Joints:
a. Products: Subject to compliance with requirements, provide the following:
1) ClarkDietrich; #93 Zinc Control Joint (ZNCJ).

B. Base-of-Wall PVC Moisture Barrier Trim: Extruded PVC, 1/2 inch (12.7 mm) high.

1. Products: Subject to compliance with requirements, provide the following:
a. Waterguard; Waterguard.

2.8 AUXILIARY MATERIALS

A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.

B. Fasteners for Steel Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

C. Steel Drill Screws For Gypsum Board: ASTM C1002 unless otherwise indicated.

1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

2.9 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C475/C475M.

B. Joint Tape:
   1. Interior Gypsum Board: Paper.

C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.
   1. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
      a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to the following:
         1) National Gypsum Company; Proform Quick Set 90 Setting Compound.
         2) USG Corporation; Sheetrock Durabond 90 Setting-Type Joint Compound.
   2. Fill Coat: For second coat, use setting-type, sandable topping compound.
      a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to the following:
         1) National Gypsum Company; Proform Quick Set 90 Setting Compound.
         2) USG Corporation; Sheetrock Durabond 90 Setting-Type Joint Compound.
   3. Finish Coat: For third coat, use drying-type, all-purpose compound.
      a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to the following:
         1) National Gypsum Company; Proform All Purpose Joint Compound, Ready-Mixed.
         2) USG Corporation; Sheetrock Brand All Purpose Joint Compound, Ready-Mixed.
   4. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound.
      a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to the following:
         1) National Gypsum Company; Proform Lite Joint Compound, Ready-Mixed.
         2) USG Corporation; Sheetrock Brand Lightweight Joint Compound, Ready-Mixed.

2.10 TEXTURE FINISHES

A. Primer: As recommended by textured finish manufacturer.

B. Polystyrene Aggregate Ceiling Finish: Water-based, job-mixed, polystyrene aggregate finish with flame-spread and smoke-developed indexes of not more than 25 when tested according to ASTM E84.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to the following:
      a. USG Corporation; SHEETROCK Ceiling Spray Texture, QT.
   2. Texture: Medium.

C. Aggregate Finish: Water-based, job-mixed, aggregated, drying-type texture finish for spray application.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to the following:
      a. National Gypsum Company; ProForm Perfect Spray.
      b. USG Corporation; SHEETROCK Wall and Ceiling Spray Texture (Aggregated).
   2. Texture: Light spatter.

D. Non-Aggregate Finish: Premixed, vinyl texture finish for spray application.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. National Gypsum Company; ProForm® Quick Set™ Lite Compound, Setting Type.
      b. USG Corporation; BEADEX FasTex Wall and Ceiling Spray Texture.
   2. Texture: Orange peel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and support framing, for compliance with requirements and other conditions affecting performance of the Work.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. 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 inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
   1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

3.3 INSTALLATION, GENERAL

A. Installation Standard: ASTM C754, except comply with framing sizes and spacing indicated.

B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.

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.

3.4 INSTALLING FRAMED ASSEMBLIES

A. Install framing system components according to spacings indicated, but not greater than 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. Install studs so flanges within framing system point in same direction.

D. Install tracks at floors and overhead supports. 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 and above ducts that penetrate partitions above ceiling.

1. Slip-Type Head Joints: 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; install track section (for cripple studs) at head and secure to jamb studs.
    a. Install two studs at each jamb unless otherwise indicated.
    b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch (13-mm) clearance from jamb stud to allow for installation of control joint in finished assembly.
    c. Extend both jamb studs through suspended ceilings and attach to underside of overhead structure.
3. 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.
4. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
5. 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 (150 mm) o.c.

E. Direct Furring:

1. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (610 mm) o.c.

F. Z-Shaped Furring Members:

1. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (610 mm) o.c.
2. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches (305 mm) from corner and cut insulation to fit.

G. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by faces of adjacent framing.

3.5 INSTALLING CEILING 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 (1219 mm) o.c.
2. Carrying Channels (Main Runners): 48 inches (1219 mm) o.c.
3. Furring Channels (Furring Members): 16 inches (406 mm) 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.
   a. 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.
   a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by ASTM C 754.
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. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure

and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.

5. Do not attach hangers to steel roof deck.
6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
8. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

E. Installation Tolerances:

1. Install suspension systems that are level to within 1/8 inch in 12 feet (3 mm in 3.6 m) measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.
2. Where sprinkler heads, diffusers, and speakers are arranged in alignment, variation from exact alignment shall not vary more than 1/2-inch (13-mm) either side of centerline through various element openings.

3.6 INSTALLATION OF ACOUSTICAL ACCESSORIES

A. Place acoustical insulation in partitions tight within spaces, around cut openings, behind and around electrical and mechanical items within or behind partitions, and tight to items passing through partitions.

B. Install acoustical sealant at partitions in accordance with manufacturer's instructions.

3.7 INSTALLATION AND FINISHING OF 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 (1.5 mm) 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 in chases braced internally.
   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. (0.7 sq. m) 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- to 3/8-inch- (6.4- to 9.5-mm-) wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) 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. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.8 INSTALLATION OF INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:
   1. Type X: All framed surfaces unless otherwise indicated.
   2. Acoustically Enhanced Type: As indicated on Drawings.
   3. High Performance, Acoustically Enhanced Type: As indicated on Drawings.

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 Z-shaped furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
   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. On Z-shaped furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
   3. Fastening Methods: Fasten base layers with screws; fasten face layers with adhesive and supplementary fasteners.

3.9 INSTALLATION OF TRIM ACCESSORIES

A. General: 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. Interior Trim: Install in the following locations:
   1. Cornerbead: Use at outside corners unless otherwise indicated.
   2. Bullnose Bead: Use where indicated on Drawings.
   3. LC-Bead: Use at exposed panel edges.
   4. L-Bead: Use where edge trim can only be installed after gypsum board is installed.
   5. U-Bead: Use at exposed panel edges not intended to receive joint compound.
   6. Curved-Edge Cornerbead: Use at curved openings.

3.10 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, rounded or beveled edges, 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:
   1. Level 0: No taping, finishing, or accessories required.
   2. Level 1:
      a. Joints: Tape set in joint compound.
      b. Interior Angles: Tape set in joint compound.
      c. Surface: Tool marks and ridges acceptable. Surface free of excess joint compound.
   3. Level 2:
      a. Joints: Tape embedded in joint compound and wiped with a joint knife, leaving a thin coat of compound over tape.
      b. Interior Angles: Tape embedded in joint compound and wiped with a joint knife, leaving a thin coat of compound over tape.
      c. Accessories: Shall be covered to one separate coat of joint compound.
      d. Fasteners: Shall be covered by one separate coat of joint compound.
      e. Surface: Surface shall be free of excess joint compound. Tool marks and ridges acceptable. Joint compound applied over the body of the tape at the time of tape embedment shall be considered a separate coat of joint compound and shall satisfy the conditions of this level.
   4. Level 3:
      a. Joints: Taped as in Level 2, then covered with one separate coat of joint compound.
      b. Interior Angles: Taped as in Level 2, then covered with one separate coat of joint compound.

c. Accessories: Shall be covered by two separate coats of joint compound.
d. Fasteners: Shall be covered by two separate coats of joint compound.
e. Surface: Joint compound shall be smooth and free of tool marks and ridges.

5. Level 4:
   a. Joints: Taped as in Level 2, then covered with two separate coats of joint compound.
   b. Interior Angles: Taped as in Level 2, then covered with one separate coat of joint compound.
   c. Accessories: Shall be covered by three separate coats of joint compound.
   d. Fasteners: Shall be covered by three separate coats of joint compound.
   e. Surface: Joint compound shall be smooth and free of tool marks and ridges.
6. Level 5:
   a. Joints: Taped as in Level 2, then covered with two separate coats of joint compound.
   b. Interior Angles: Taped as in Level 2, then covered with one separate coat of joint compound.
   c. Accessories: Shall be covered by three separate coats of joint compound.
   d. Fasteners: Shall be covered by three separate coats of joint compound.
   e. Surface: A thin skin coat of joint compound, or a material manufactured especially for this purpose, shall be applied to the entire surface. The surface shall be smooth and free of tool marks and ridges.

E. Gypsum Board Finish Level Schedule: Finish panels to levels indicated below and according to ASTM C840:
1. Level 0: Not used.
2. Level 1: Ceiling plenum areas, concealed areas, service corridors and other areas not normally exposed to view.
3. Level 2: Panels that are substrates for tile.
4. Level 3: Not used.
5. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.
   a. Primer and its application to surfaces are specified in Section 09 91 23 "Interior Painting."
6. Level 5: Not used.

3.11 INSTALLATION OF TEXTURE FINISHES

A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth.

B. Texture Finish Application: Mix and apply finish using powered spray equipment, to produce a uniform texture matching approved mockup and free of starved spots or other evidence of thin application or of application patterns.

C. Prevent texture finishes from coming into contact with surfaces not indicated to receive texture finish by covering them with masking agents, polyethylene film, or other means. If, despite these precautions, texture finishes contact these surfaces, immediately remove droppings and overspray to prevent damage according to texture-finish manufacturer's written instructions.

3.12 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, and 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.

END OF SECTION

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SECTION 09 30 00

TILING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Mosaic tile.
2. Porcelain tile.
3. Wall tile.
4. Waterproof membrane.
5. Metal edge strips.

1.2 DEFINITIONS

A. High Performance Tile Grout: Factory prepared grouting material mixture of cement and other ingredients, including a redispersible latex/polymer powder, to which only water is added at the jobsite, or a liquid latex additive.

B. Improved Modified Dry Set Mortar (Thinset): Modified Dry Set Mortar with a minimum bond strength of 400 psi to impervious ceramic tile.

C. Large and Heavy Tile (LHT): Any tile material weighing 5 lbs./sq. ft. or greater, or a tile with a least horizontal dimension of 15 inches or more.

D. Modified Dry Set Mortar for Large and Heavy Tile (LHT): Also referenced as medium bed mortar, is a modified dry set mortar formulated to have a bond coat thickness between 3/32 inch (2.4 mm) and 1/2 inch (13 mm) after tile embedment and declared as an “LHT” setting material by the manufacturer based on these characteristics.

E. Modified Dry Set Mortar (Thinset): A factory prepared setting material mixture of cement and other ingredients, including a redispersible latex/polymer powder, to which only water is added at the jobsite, or a liquid latex additive.

1.3 ACTION SUBMITTALS

A. Product Data: Technical data for each type tile, mortar and grout, under tile membranes, and installation methods.

B. Shop Drawings: Indicate locations of each type of tile and tile pattern. Show layout, patterns, color arrangements, widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

C. Samples: Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required.
   1. Size: Minimum 12 inches (300 mm) square, but not fewer than four tiles. Use grout of type and in color or colors approved for completed work.
   2. Full size units of each type of trim and accessory.
   3. Stone thresholds in 6 inch (150 mm) lengths.
   4. Metal edge strips in 6 inch (150 mm) lengths.

1.4 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Build a 5 foot square mockup of each type of floor tile installation where directed by Architect.
   2. Build 5 foot square mockup of each type of wall tile installation where directed by Architect.
   3. Subject to compliance with requirements, approved mockups may become part of the completed work if undisturbed at time of Substantial Completion.

B. Preinstallation Conference: Conduct conference at site.
   1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.

1.5 COORDINATION

A. Sequence tile installation with work to minimize possibility of damage and soiling during remainder of construction period.

B. Install tile and accessories after other finishing operations, including painting, are completed.

C. Coordinate installation of tile with base cabinets and permanent items that have the potential of being reconfigured or moved in the future.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store aggregates where grading and required characteristics can be maintained and contamination can be avoided.

D. Store liquid materials in unopened containers and protected from freezing.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

B. Maintain temperatures at 50 degrees F or more in tiled areas during installation and for 7 days after completion, unless higher temperatures are required by referenced installation standard or manufacturer's instructions.

C. Critical Lighting: Install tile after permanent lighting is installed for maximum opportunity to reduce undesirable shadows.

1. Where permanent lighting cannot be installed prior to tile installation, provide temporary lighting mimicking permanent lighting effects prior to the installation of tile. In addition, use specialized installation techniques joints to minimize undesirable shadows.

1.8 WARRANTY

A. Total System Warranty: Written warranty signed by setting materials manufacturer and installer in which the manufacturer agrees to provide labor and tile setting materials (including mortar, grout, and waterproof/crack isolation membrane materials) that do not comply with requirements, that are determined defective due to manufacturing defects, and will not break down or deteriorate under normal usage within the specified warranty period.

1. Warranty Period: 10 years from date of Substantial Completion.
2. Warranty Condition: Installation requires the use of manufacturer approved products for a total system.
3. Exclusion: Cracking due to structural movement or excessive deflection is excluded.

B. Installer Warranty: Written warranty signed by Installer in which Installer agrees to warrant its work.

1. Warranty Period: Three years from the date of Substantial Completion.
2. Warranty includes removing and reinstalling tile, mortar, grout, and waterproofing/crack isolation membranes, and related accessories.

1.9 EXTRA MATERIAL

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Tile and Trim Units: Furnish quantity of full size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.
2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
   1. Provide tile complying with Standard grade requirements.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, referenced ANSI standards, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and specified requirements.

C. Floor and Wall Surface for Large Heavy Tile: Finish floor and wall surfaces to specified tolerances, according to ASTM E 1155 (ASTM E 1155M), for randomly trafficked floor surface and wall surfaces receiving large format or heavy thin porcelain or ceramic tile, large format or heavy thin stone tile, and where very flat surface is required or recommended to accommodated large tiles:
   1. Specified Overall Values (SOV):
      a. Flatness: FF 50 (1/8 inch in 10 feet).
   2. Minimum Local Values (MLV):
      a. Flatness: FF 35 (1/4 inch in 10 feet).
   3. Longest Tile Side Dimension: ASTM E 1155 (ASTM E 1155M).
      a. Longest Side Tile Dimension, Up to 16 inches (400 mm): FF 60 (1/8 inch in 10 feet).
         1) Grout Joint Width: 1/8 inch (3 mm).
      b. Longest Side Tile Dimension, Greater than 16 inches to less than 36 inches (400 mm to 900 mm): FF 60 (1/8 inch in 10 feet)
         1) Grout Joint Width: 1/8 inch (3 mm).
         2) .
      c. Longest Side Tile Dimension, 36 inches and over (900 mm): FF 60 (1/8 inch in 10 feet).
         1) Grout Joint Width: 1/8 inch (3 mm) (1/8 inch in 10 feet).
      d. Location: Floors scheduled to receive large format tile, large heavy tile, or stone, set in high performance mortar bed.

D. Dynamic Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with values determined by testing identical products per ANSI A 326.3: Minimum 0.42 DCOF.

E. Accessibility Requirements: Comply with applicable requirements.
   1. U.S. Architectural and Transportation Barriers Compliance Board Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG) 2010.
   2. ICC/ANSI A117.1 Accessible and Useable Building and Facilities.
   3. Texas Accessibility Standards (TAS) 2012.

2.2 TILE PRODUCTS

A. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

B. Mounting: For factory mounted tile, provide back or edge mounted tile assemblies as standard with manufacturer unless otherwise indicated.
   1. Where tile is indicated for installation in wet areas, do not use back or edge mounted tile assemblies unless tile manufacturer specifies in writing that tile type of mounting is suitable for installation indicated and has a record of successful in-service performance.

C. Basis of Design: Indicated in Finish Schedule; subject to compliance with requirements, provide products by one of the following:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. American Marazzi Tile, Inc.
      b. American Olean; a division of Dal-Tile Corporation.
      c. Crossville, Inc.
      d. Daltile.
      e. Deutsche Steinzeug America, Inc.
      f. Endicott Tile LLC.
      g. Florida Brick & Clay Company Inc.
      h. Florida Tile, Inc.
      i. Grupo Porcelanite.
      j. Interceramic.
      k. Lone Star Ceramics; Elgin Butler.
      l. Pantheon Tile.
      m. Portobello America, Inc.
      n. Quarry Tile Co.
      o. Seneca Tiles, Inc.

D. Porcelain Tile:
   1. Certification: Tile certified by the Porcelain Tile Certification Agency.
   2. Face: As indicated by product designations on Drawings.
   3. Face Size Variation: Rectified.
   4. Thickness: As indicated by product designations on Drawings, but not less than 3/8 inch.
   5. Face: As indicated by product designations on Drawings.
   6. Dynamic Coefficient of Friction: For products on floor surfaces, not less than 0.42.
   7. Tile Color and Pattern: As indicated on Drawings.
   8. Grout Color: As indicated on Drawings.
   9. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide the following coordinating shapes where indicated on Drawings:
      a. Base Cap: Metal edge strips.
      b. Wainscot Cap: Metal edge strips.

c. External Corners: Metal edge strips.

E. Large Format Tile: WT-1.
1. Certification: Tile certified by the Porcelain Tile Certification Agency.
2. Face Size: Indicated in Finish Schedule.
3. Face Size Variation: Rectified.
4. Face: Indicated in Finish Schedule.
5. Tile Color and Pattern: Selected by Architect.
6. Grout Color: Selected by Architect.
7. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes selected from standard shapes:
   a. Base: Coved or straight as indicated.
   b. Wainscot Cap: Metal edge strips.
   c. External Corners: Metal edge strips.
   d. Internal Corners: Field-butted square corners. For coved base and cap use angle pieces designed to fit with stretcher shapes.

F. Wall Tile: WT-2
1. Module Size: As indicated by product designations on Drawings.
2. Thickness: 5/16 inch (8 mm).
3. Face: As indicated by product designations on Drawings.
4. Finish: As indicated by product designations on Drawings.
5. Tile Color and Pattern: As indicated on Drawings.
6. Grout Color: As indicated on Drawings.
7. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes selected from standard shapes:
   a. Base: Coved or straight as indicated.
   b. Wainscot Cap: Metal edge strips.
   c. External Corners: Metal edge strips.
   d. Internal Corners: Field-butted square corners. For coved base and cap use angle pieces designed to fit with stretcher shapes.

2.3 SETTING MATERIALS

A. Modified Dry Set Mortar (Thinset): ANSI A118.4.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Custom Building Products.
   b. H.B. Fuller Construction Products Inc. / TEC.
   c. Laticrete International, LLC.
   d. Mapei Corporation.
2. Provide prepackaged, dry mortar mix combined with acrylic resin or styrene-butadiene-rubber liquid latex additive at Project site.
3. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.

2.4 GROUT MATERIALS

A. High Performance Tile Grout: ANSI A118.7.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Custom Building Products.
      b. H.B. Fuller Construction Products Inc. / TEC.
      c. Laticrete International, LLC.
      d. Mapei Corporation.
   2. Polymer Type: Ethylene vinyl acetate or acrylic additive, in dry, redispersible form, prepackaged with other dry ingredients.
   3. Polymer Type: Acrylic resin or styrene-butadiene rubber in liquid latex form for addition to prepackaged dry grout mix.

2.5 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex modified, portland cement based formulation provided or approved by manufacturer of tile setting materials for installations indicated.

B. Vapor Retarder Membrane: Polyethylene sheeting, ASTM D 4397, 4.0 mils (0.1 mm) thick.

C. Metal Edge Strips: Angle or L-shaped, height to match tile and setting bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications; stainless steel, ASTM A 666, 300 Series exposed edge material.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Blanke Corporation.
      b. Ceramic Tool Company, Inc.
      c. Schluter Systems L.P.

D. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

E. Floor Sealer: Manufacturer recommended product for sealing grout joints and that does not change color or appearance of grout.

2.6 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. Verify substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile setting materials, including curing compounds and substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
2. Verify that concrete substrates for tile floors installed with thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
    a. Verify surfaces that received a steel trowel finish have been mechanically scarified.
    b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

B. Proceed with installation after correcting unsatisfactory conditions.

3.2 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. Remove coatings, including curing compounds, and other substances containing soap, wax, oil, or silicone and are incompatible with tile setting materials by using concrete grinder, drum sander, or polishing machine equipped with heavy duty wire brush.

C. Provide concrete substrates for tile floors installed with dry set or latex portland cement mortars complying with flatness tolerances specified in referenced ANSI A108 series of tile installation standards for installations indicated.

1. Use trowelable leveling and patching compounds per tile setting material manufacturer's written instructions to fill cracks, holes, and depressions.
2. Remove protrusions, bumps, and ridges by sanding or grinding.

D. Prepare substrates to receive waterproofing membrane by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot (1:50) toward drains.

E. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 INSTALLATION

A. Tile: Comply with TCNA Handbook for Ceramic, Glass, and Stone Tile Installation for TCNA installation methods specified in tile installation schedules. Comply with applicable requirements of the ANSI A118.3 Specifications for Installation of Ceramic Tile referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

1. Comply with procedures in the ANSI A118 series for tile installation standards for providing 95 percent mortar coverage:
   a. Exterior tile floors.
   b. Tile floors in wet areas.
   c. Tile floors consisting of tiles 8 inches by 8 inches (200 mm by 200 mm) or larger.
   d. Tile floors consisting of rib backed tiles.
2. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
3. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
4. Provide trim shapes where necessary to eliminate exposed tile edges.
5. Where accent tile differs in thickness from field tile, vary setting bed thickness so tiles are flush.

B. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.

C. Wainscots: Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

D. Expansion Joints: Provide expansion joints and other sealant filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw cut joints after installing tiles.

1. Install control and expansion joints in accordance with TCNA EJ171.
2. Keep expansion and control joints free of adhesives and grout. Install backer rod and sealant in accordance with Section 07 92 00 "Joint Sealants."
3. Fill joint around plumbing fixtures with sanitary sealants in accordance with Section 07 92 00 "Joint Sealants."

4. Where joints occur in concrete substrates, locate joints in tile surfaces directly above.
5. Install control joints where tile abuts restraining surfaces including perimeter walls, curbs, columns, wall corners and directly over cold joints and control joints in structural surfaces conforming to architectural details. Install control joint in floors not exceeding 20 feet (6.1 m) on center. Rake or cut control joints through setting bed to supporting slab or structure.

E. Cut and fit tile tight to penetrations through tile. Form corners and bases neatly. Align base and wall joints.

F. Place tile joints uniform in width, and of the minimum size recommended by tile manufacturer, subject to variance in tolerance allowed in tile size. Make joints watertight, without voids, cracks, excess mortar, or excess grout.
1. Pattern and joint sizes shall follow tile manufacturer’s recommendation unless otherwise directed by Architect.

G. Sound tile after setting. Replace hollow sounding units.

H. Grouting: Allow tile to set for minimum of 48 hours prior to grouting.
1. Grout tile joints.
2. Before grouting, tiles must be firmly set, paper and glue removed from face of mounted tiles, and spacers, strings, ropes, or pegs removed.
3. Use caution when grouting to prevent damaging or scratching surface of installed tiles.
4. Install grout with uniform color in accordance with manufacturer's recommendations and in accordance with ANSI 108.10. Pack joints full, free of pinholes, voids, or low spots, before mortar takes initial set.
5. Finish cushion edge tile even to depth of cushion. Finish square edge tile flush with surface.

I. Metal Edge Strips: Install at locations indicated.

3.4 EXPANSION AND CONTROL JOINTS

A. Keep expansion and control joints free of adhesive or grout. Install backer rod and sealant in joints.

B. Fill joints around toilet fixtures with sanitary sealant specified in Section 07 92 00 "Joint Sealants."

C. Install control joints where tile abuts restraining surfaces such as perimeter walls, curbs, columns, wall corners and directly over cold joints and control joints in structural surfaces conforming to architectural details. Rake or cut control joints through setting bed to supporting slab or structure.

D. Install control and expansion joints in accordance with TCNA Handbook Method No. EJ171.

E. Floor Sealer: Apply floor sealer to cementitious grout joints in tile floors according to floor sealer manufacturer's written instructions. As soon as floor sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.5 ADJUSTING AND CLEANING

A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and to eliminate evidence of replacement.

B. Cleaning: On completion of placement and grouting, clean ceramic tile surfaces so they are free of foreign matter.
   1. Remove grout residue from tile as soon as possible.
   2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use cleaners recommended by tile and grout manufacturers and after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3.6 PROTECTION

A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

3.7 THINSET INTERIOR CERAMIC TILE INSTALLATION SCHEDULE

A. Wall Installations:
   1. Thinset Mortar: Modified dry-set mortar. Use modified dry-set mortar approved for LHT applications for large and heavy tile.
   2. Grout: High-performance grout.

END OF SECTION

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SECTION 09 51 13

ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Acoustical ceiling panels and suspension system.
   2. Perimeter trim.

1.2 ACTION SUBMITTALS

A. Product Data: Technical data for each ceiling panel and gird component with installation instructions indicating special procedures and perimeter conditions requiring special attention conditions.

B. Shop Drawings: Submit grid layout and related dimensioning, splicing, junctions with adjacent work or ceiling finishes, interrelation of mechanical and electrical items related to system.

C. Samples: Submit 12 inches by 12 inches (300 mm by 300 mm) samples illustrating material and finish of acoustical units; submit 12 inch (300 mm) long sample of each suspension system main runner, cross runner, edge trim, and retention clips.
   1. Acoustical Panels: Set of 12 inches by 12 inches (300 mm by 300 mm) Samples of each type, color, pattern, and texture.
   2. Exposed Suspension System Members, Moldings, and Trim: Set of 12 inch (300 mm) long Samples of each type, finish, and color.

D. Certificate: Submit manufacturer's certification that suspension system is capable of supporting light fixtures, grilles, and acoustical panels.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
   1. Ceiling suspension system members.
   2. Structural members to which suspension systems will be attached.
   3. Method of attaching hangers to building structure.
      a. Furnish layouts for cast in place anchors, clips, and other ceiling attachment devices whose installation is specified in other Sections.
   4. Carrying channels or other supplemental support for hanger wire attachment where conditions do not permit installation of hanger wires at required spacing.
   5. Size and location of initial access modules for acoustical panels.

6. Items penetrating finished ceiling and ceiling-mounted items including the following:
   a. Lighting fixtures.
   b. Diffusers.
   c. Grilles.
   d. Speakers.
   e. Sprinklers.
   f. Access panels.
   g. Perimeter moldings.
7. Show operation of hinged and sliding components covered by or adjacent to

B. Product Test Reports: Submit for each acoustical panel ceiling, for tests performed by manufacturer and witnessed by a qualified testing agency or a qualified testing agency.

1.4 QUALITY ASSURANCE

A. Qualifications:
   1. Grid Manufacturer: Entity having minimum 5 years documented experience who specializes in manufacturing ceiling grids.
   2. Acoustical Unit Manufacturer: Entity having minimum 5 years documented experience who specializes in manufacturing acoustical units.
   3. Installer: Entity having minimum 5 years documented experience who employs trained and experienced installers.

B. Source Limitations:
   1. Acoustical Ceiling Panel: Obtain each type through one source from a single manufacturer.
   2. Suspension System: Obtain each type through one source from a single manufacturer.

C. Preinstallation Conference: Conduct conference at site.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension system components, and accessories to site and store in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings

is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

B. Coordinate layout and installation of acoustical ceiling units and suspension system components with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire suppression system components (if any) and partition system (if any).

1.7 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Units: Full size panels equal to 2 percent of quantity installed.
2. Suspension System Components: Quantity of each exposed component equal to 2 percent of quantity installed.
3. Hold Down Clips: Equal to 2 percent of quantity installed.
4. Impact Clips: Equal to 2 percent of quantity installed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Acoustical Panel Standard: Provide ceiling panels complying with ASTM E 1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.

B. Surface Burning Characteristics: Ceiling panels with surface burning characteristics complying with IBC Chapter 8 and ASTM E 1264 for Class A materials determined by testing identical products in accordance with ASTM E 84.

2.2 ACOUSTICAL PANELS

A. Manufacturer: Subject to compliance with requirements, provide ceiling panels and grid systems by one of the following:

1. Acoustic Ceiling Panel:
   a. Armstrong World Industries, Inc.
   b. CertainTeed Corporation.
   c. USG Interiors.

B. Acoustical Panel:

1. Nominal Size: 24 inch by 24 inch by 5/8 inch (610 mm by 610 mm by 15 mm).
2. Composition: Wet formed mineral fiber, ASTM E 1264, Class A.
3. Finish: Factory applied vinyl latex paint.
4. Color: White.
5. Ceiling Attenuation Class: 33 db.

6. Noise Reduction Coefficient: 0.55.
7. Light Reflectance: LR-1, over 80 percent.
8. Edge: Square.
9. Pattern: Type III, Form 2, C or E
10. Basis of Design:
    a. Fine Fissured Humiguard Plus by Armstrong
    b. Radar ClimaPlus by USG.
    c. Vantage 10 by CertainTeed.

2.3 METAL SUSPENSION SYSTEM

A. Manufacturer: Subject to compliance with requirements, provide ceiling panels and grid systems by one of the following:
   1. Concealed and Exposed Suspension Grid:
      a. Armstrong World Industries, Inc.
      b. CertainTeed Corporation.
      c. Chicago Metallic; Rockfon (Roxul Inc.).
      d. Hunter Douglas.
      e. USG Interiors.

B. Metal Suspension System Standard: Provide direct hung, metal suspension system and accessories according to ASTM C 635/C 635M and designated by type, structural classification, and finish indicated.

C. Standard Exposed Tee Grid: ASTM C 635, nonfire rated.
   1. Structural Classification: Intermediate duty system.
   2. End Condition of Cross Runners: Override (stepped) or butt edge type.
   3. Face Design: Flat, flush.
   4. Cap Material: Commercial quality cold rolled steel with galvanized coating.
   5. Face Flange Width: 15/16 inch (23.5 mm)
   6. Exposed Finish: Baked on enamel, white satin finish
   7. Products: Subject to compliance with requirements, provide products of one of the following:
      a. Prelude XL by Armstrong World Industries.
      b. Classic Stab System by CertainTeed Corp.
      c. Donn Suspension System DX by USG Interiors, Inc.

D. Rough Suspension: Galvanized steel carrying channels and hangers, sized and type to suit application and to rigidly secure complete acoustic unit ceiling system, with maximum deflection of L/360.

E. Grid Accessories: Stabilizer bars, furring clips, splices, retention clips, and edge moldings as required to complete and compliment suspended ceiling grid system.

2.4 ACCESSORIES

A. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1 Direct Hung unless otherwise indicated. Comply with seismic design requirements.

B. Wire Hangers, Braces, and Ties: Provide wires:
   1. Zinc Coated, Carbon Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
   2. Stainless Steel Wire: ASTM A 580/A 580M, Type 304, nonmagnetic.
   3. Size: Wire diameter sufficient for its stress at three times hanger design load (ASTM C 635/C 635M, Table 1 Direct Hung) will be less than yield stress of wire, but not less than 0.106 inch (2.69 mm) diameter wire.

C. Hanger Rods: Mild steel, zinc coated or protected with rust inhibitive paint.

D. Flat Hangers: Mild steel, zinc coated or protected with rust inhibitive paint.

E. Angle Hangers: Angles with legs not less than 7/8 inch (22 mm) wide; formed with 0.04 inch (1 mm) thick, galvanized steel sheet complying with ASTM A 653/A 653M, G90 (Z275) coating designation; with bolted connections and 5/16 inch (8 mm) diameter bolts.

F. Hold Down Clips: Standard hold down.

G. Impact Clips: Impact clip system designed to absorb impact forces against acoustical panels.

H. Acoustical Sealant: Comply with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
   1. Exposed and Concealed Joints: Nonsag, paintable, nonstaining latex sealant.
   2. Concealed Joints: Nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic rubber sealant.

2.5 METAL EDGE MOLDINGS AND TRIM

A. Roll Formed, Sheet Metal Edge Moldings and Trim: Type and profile necessary for edges and penetrations that comply with design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.
   1. Edge moldings shall fit acoustical panel edge details and suspension systems indicated and match width and configuration of exposed runners unless otherwise indicated.
   2. For lay in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
   3. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut for compliance with requirements that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.

C. Proceed with installation after correcting unsatisfactory conditions.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less than half width panels at borders unless otherwise indicated and comply with layout shown on reflected ceiling plans.

B. Layout openings for penetrations centered on the penetrating items.

3.3 INSTALLATION

A. Install acoustical panel ceilings according to ASTM C 636/C 636M and manufacturer's written instructions.

B. Exposed Grid Suspension System: Suspend ceiling hangers from building's structural members:
   1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
   2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
   3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
   4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structure or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
   5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.

6. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
7. Do not attach hangers to steel deck tabs.
8. Do not attach hangers to steel roof deck. Attach hangers to structural members.
9. Space hangers not more than 48 inches (1220 mm) o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.
10. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.

C. Edge Moldings: Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends. Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

D. Install suspension system runners to be square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

E. Acoustical Panels: Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide precise fit.
1. For square edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.
2. Where bullnose concrete block corners occur, provide preformed closers to match edge molding.

3.4 ERECTION TOLERANCES

A. Suspended Ceilings: Install main and cross runners level to a tolerance of 1/8 inch in 12 feet (3 mm in 3.6 m), noncumulative.

B. Moldings and Trim: Install moldings and trim to substrate and level with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3 mm in 3.6 m), noncumulative.

3.5 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.

B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

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SECTION 09 61 05

MOISTURE VAPOR EMISSION AND ALKALINITY CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Water vapor reduction system on new and existing concrete slabs where necessary to obtain a minimum moisture vapor emissions rate of 75 percent maximum for moisture sensitive flooring schedule to receive floor covering.

1.2 UNIT PRICES

A. Unit Price: Work of this section is affected by unit prices specified in Section 01 22 00:
   1. Unit Price No. 2: Topical moisture vapor emission and alkalinity control of concrete floor slabs in sheet carpeted areas and areas with resinous flooring products.

1.3 DEFINITIONS

A. MVE: Moisture vapor emission.

B. MVER: Moisture vapor emission rate.

1.4 ACTION SUBMITTALS

A. Product Data: Technical data for each type of product used in moisture vapor emission (MVE) control system.

1.5 INFORMATIONAL SUBMITTALS

A. Product Schedule: Submit schedule for identifying each floor area to receive moisture vapor emission and alkalinity control system. Use same room label and numbering designations indicated on Drawings.
   1. Distinguish between those areas required to receive cementitious surfacing over moisture vapor emission and alkalinity control system and those areas where not required.

B. Qualification Data: Submit data for installer.

C. Product Test Reports:
   1. Submit test reports performed by manufacturer and witnessed by a qualified testing agency or a qualified testing agency.
   2. Preinstallation Moisture Vapor Field Test Reports: For each area receiving floor covering, submit test result reports for vapor and moisture testing and alkalinity and adhesion testing for new and existing concrete substrates.

D. Preconstruction Test Reports: Submit test reports for alkalinity, calcium chloride, and relative humidity of concrete slabs for each area receiving floor covering.

E. Warranty: Submit for warranty for vapor emission control coating system and certificate of underwriter's coverage of manufacturer's warranty.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Entity having minimum five years documented experience in the manufacturer of MVE control system and who employs factory trained personnel available for consultation and site inspection.
   1. The water vapor emission reduction system must be specifically formulated and marketed for water vapor emission reduction and alkalinity control without change of system design for a minimum period of 10 years.

B. Installer Qualifications: Entity having minimum 5 years documented experience in the installation of MVE control systems who is an authorized representative and is trained and approved by manufacturer.

C. Testing Agency Qualifications: Moisture and pH testing shall be performed by an International Concrete Repair Institute (ICRI), Certified Concrete Slab Moisture Testing Technician – Grade 1.

D. Preinstallation Testing Service: At least 28 days after placement of concrete and prior to floor covering installation, engage a qualified independent testing agency to perform the following tests on floor areas to receive moisture vapor emission and alkalinity control system:
   1. Calcium chloride testing per ASTM F 1869.
   2. Relative humidity testing per ASTM F 2170.
   3. Alkalinity testing per ASTM F 710.

E. Preinstallation Conference: Conduct conference at site. Review methods and procedures related to installation including, but not limited to, the following:
   1. Review substrate conditions, moisture and pH test results, manufacturer's installation instructions, and warranty requirements.
   2. Document proceedings, including required corrective measures.

1.7 COORDINATION

A. Coordinate testing agency to test concrete slabs no sooner than one week or more than 5 weeks prior to scheduled flooring installation.
   1. Apply treatment to areas with moisture vapor emission or relative humidity rates which exceed floor covering manufacturer's written limits, as determined by ASTM F 1869 and ASTM F 2170 testing.

B. Coordinate testing with installation of floor coverings. Ensure flooring installation complies with MVE control system manufacturer's warranty requirements.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating directions for storage and mixing with other components.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Comply with MVE control system manufacturer's written instructions for substrate and ambient temperatures, humidity, ventilation, and other conditions affecting system installation.
   1. Store system components in a temperature controlled environment and protected from weather and at ambient temperature of not less than 65 degrees F (18 degrees C) and not more than 85 degrees F (29.4 degrees C) at least 48 hours before use.
   2. Maintain ambient temperature and relative humidity in installation areas within range recommended in writing by MVE control system manufacturer, but not less than 65 degrees F (18 degrees C) or more than 85 degrees F (29.4 degrees C) and not less than 40 or more than 60 percent relative humidity, for 48 hours before installation, during installation, and for 48 hours after installation unless longer period is recommended in writing by manufacturer.
   3. Install MVE control systems where concrete surface temperatures will remain a minimum of 5 degrees F (3 degrees C) higher than the dew point for ambient temperature and relative humidity conditions in installation areas for 48 hours before installation, during installation, and for 48 hours after installation unless longer period is recommended in writing by manufacturer.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. MVE Control System Capabilities: Capable of suppressing MVE without failure where installed on concrete that exhibits the following conditions:
   1. MVER: Maximum 25 lb of water/1000 sq. ft. (11.34 kg of water/92.9 sq. m) when tested according to ASTM F 1869.
   2. Relative Humidity: Maximum 90 percent when tested according to ASTM F 2170 using in situ probes.

B. Water-Vapor Transmission: Through MVE control system, maximum 0.02 perm (1.15 ng/Pa x s x sq. m) when tested according to ASTM E 96/E 96M.

C. Tensile Bond Strength: For MVE control system, greater than 200 psi (1.38 MPa) with failure in the concrete according to ASTM D 7234.

D. Surface Alkalinity: ASTM 710, pH between 7.0 and 8.5.

2.2 CONTROL SYSTEM

A. Products: Subject to compliance with requirements, provide one of the following:
   1. ARDEX Americas; ARDEX MC™ RAPID One-Coat Moisture Control System.
   2. Floor Seal Technology, Inc.; MES 100 Remedial Treatment.
   3. KOSTER American Corporation; VAP I 2000 UFS.
   4. Schönox; HPS North America, Inc.; Schönox EPA RAPID.

B. System Description: Multicomponent or single component, fluid applied penetrants or coatings intended to seal or stabilize internal humidity by restricting excessive moisture and pH (alkalinity), and to mechanically regulate permeability and suppress the volume of moisture reaching concrete surfaces, for compliance with subsequent floor covering manufacturer's written limitations.
   1. Determine application methods by site conditions, presence of subslab vapor barriers for slabs on grade, concrete mix design and contaminants, age of concrete substrate, results of ASTM F1869 calcium chloride testing, if required, and finish floor covering manufacturer's recommendations.

C. MVE and Alkalinity Control System: ASTM F 3010 qualified two component, fluid applied penetrants or coatings intended to seal or stabilize internal humidity by restricting excessive moisture and pH (alkalinity), and to mechanically regulate permeability and suppress the volume of moisture reaching concrete surfaces, for compliance with subsequent floor covering manufacturer's written limitations.
   1. Physical Properties:
      a. Water Vapor Transmission: ASTM E 96; Minimum 94% reduction under laboratory conditions
      b. Alkali Resistance: ASTM D 1308; Pass, up to pH of 14
      c. Adhesion Strength: ASTM D 4541; 500 psi (100% Concrete Adhesive Failure)
      d. Relative Humidity: Resists up to 100% Relative Humidity as measured by ASTM F 2170.
   2. Substrate Primer: Provide MVE control system manufacturer's concrete substrate primer if required for system indicated by substrate conditions.
   3. Cementitious Underlayment Primer: If required for subsequent installation of cementitious underlayment products, provide MVE control system manufacturer's primer to ensure adhesion of products to MVE control system.

D. Accessories:
   1. Patching and Leveling Material: Moisture, mildew, and alkali resistant portland cement product recommended in writing by MVE control system manufacturer and with minimum of 3000 psi (20.68-MPa) compressive strength after 28 days when tested according to ASTM C 109/C 109M.
   2. Crack Filling Material: Resin based material recommended in writing by MVE control system manufacturer for sealing concrete substrate crack repair.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for maximum moisture content, installation tolerances, and conditions affecting performance of the work.

B. Prepare written report listing conditions detrimental to performance.

C. Proceed with installation after correcting unsatisfactory conditions. Commencement of installation of system indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Preinstallation Testing:
   1. Testing Agency: Engage a qualified testing agency to perform tests.
   2. Surface Alkalinity Testing: Perform pH testing according to ASTM F 710. Install MVE control system in areas where pH readings are less than 7.0 and in areas where pH readings are greater than 8.5.
   3. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft. (304.8 sq. m), and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
      a. Anhydrous Calcium Chloride Test: ASTM F 1869. Install MVE control system in locations where concrete substrate MVER exceeds 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
      b. Internal Relative Humidity Test: Using in situ probes, ASTM F 2170. Install MVE control system in locations where concrete substrates exhibit relative humidity level greater than 75 percent.
   4. Tensile Bond Strength Testing: For typical locations indicated to receive installation of MVE control system, install minimum 100-sq. ft. (9.29-sq. m) area of MVE control system to prepared concrete substrate and test according to ASTM D 7234.
      a. Proceed with installation where tensile bond strength is greater than 200 psi (1.38 MPa) with failure in the concrete.

B. Concrete Substrates: Prepare and clean substrates according to MVE control system manufacturer's written instructions to ensure adhesion of system to concrete.
   1. Remove coatings and substances incompatible with MVE control system and that contain soap, wax, oil, or silicone, using mechanical methods recommended in writing by MVE control system manufacturer. Do not use solvents.
   2. When required by manufacturer, provide concrete surface profile complying with ICRI 310.2R CSP 3 by shot blasting using apparatus that abrades the concrete surface with shot, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
   3. After shot blasting, repair damaged and deteriorated concrete according to MVE control system manufacturer's written instructions.
   4. Protect substrate voids and joints to prevent resins from flowing into or leaking through them.

5. Fill surface depressions and irregularities with patching and leveling material.
6. Fill surface cracks, grooves, control joints, and other nonmoving joints with crack filling material.
7. Allow concrete to dry, undisturbed, for period recommended in writing by MVE control system manufacturer after surface preparation, but not less than 24 hours.
8. Remove dirt, debris, or existing sealant from cracks and joints. Treat dynamic joints with coating by applying a layer into the joint to completely coat walls of the cavity. After curing, fill joint with backer rod while leaving joint top open for sealant treatment.
9. Prior to installation of MVE control systems, broom sweep and vacuum prepared concrete.

C. Protect walls, floor openings, electrical openings, door frames, and obstructions during installation.

3.3 INSTALLATION

A. Apply MVE and alkalinity control system in accordance with ASTM F 3010 and manufacturer’s written instructions to produce a uniform, monolithic surface free of surface deficiencies such as pin holes, fish eyes, and voids.
   1. Install primers as required to comply with manufacturer's written instructions.

B. Do not apply MVE control system across substrate expansion, isolation, and moving joints.

C. Apply system, including component coats if any, in thickness recommended in writing by MVE control system manufacturer for MVER indicated by preinstallation testing.

D. Cure MVE control system components according to manufacturer's written instructions. Prevent contamination or other damage during installation and curing processes.

E. After curing, examine MVE control system for surface deficiencies. Repair surface deficiencies according to manufacturer's written instructions.

F. Retain Paragraph below if required for “moisture intolerant” flooring products.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform installation inspections.

B. Installation Inspections: Inspect substrate preparation and installation of system components to ensure compliance with manufacturer's written instructions and to ensure that a complete MVE control system is installed without deficiencies.
   1. Verify surface preparation meets requirements.
   2. Verify component coats and complete MVE control system film thickness comply with manufacturer's written instructions.
   3. Verify MVE control system components and installation areas that evidence deficiencies are repaired according to manufacturer's written instructions.

C. MVE control system will be considered defective if it does not pass inspections.

3.5 PROTECTION

A. Protect MVE control system from damage, wear, dirt, dust, and contaminants before floor covering installation. Use protective methods and materials, including temporary coverings, recommended in writing by MVE control system manufacturer.

B. Do not allow subsequent preinstallation examination and testing for floor covering installation to damage, puncture, or compromise the MVE control system membrane.

END OF SECTION

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SECTION 09 65 00

RESILIENT FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Requirements including but not limited to:
   1. Luxury vinyl tile.
   2. Vinyl sheet flooring.
   3. Resilient base.
   4. Resilient accessories.

1.2 ACTION SUBMITTALS

A. Product Data: Technical data, installation instructions, and maintenance procedures for each product specified for each type of product.

B. Shop Drawings: Submit for each type of resilient flooring. Include floor covering layouts, edges, columns, doorways, enclosing partitions, built in furniture, cabinets, and cutouts.
   1. Show details of special patterns.

C. Samples: Submit full size units of each color and pattern of floor tile required showing full range of variations anticipated.
   1. For heat welding bead, not less than 9 inches (230 mm) long, of each color required applied to rigid backing.
   2. For resilient accessories, submit samples not less than 12 inches (300 mm) long, of each resilient accessory color and pattern specified.
   3. Welded Seam Samples: For seamless installation technique indicated and for each flooring product, color, and pattern required; submit seam running lengthwise and in center of 9 inch by 9 inch (230 mm by 230 mm) Sample applied to a rigid backing and prepared by Installer.

D. Product Schedule: Submit for resilient flooring using same designations indicated on Drawings.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: Submit data for Installer.

B. Test Reports: Submit test result reports for:
   1. Vapor and moisture testing.
   2. Alkalinity and adhesion testing.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: Submit data for each type of resilient flooring to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Entity having minimum 5 years documented experience who employs trained or certified by manufacturer for required installation techniques and are competent in techniques required for resilient flooring and seaming method.

1. Engage an installer who employs workers trained or certified by resilient flooring manufacturer for installation techniques required.

B. Source Limitations:

1. Tile: Obtain floor products of same type and color or finish from one source or producer. Obtain tile from same production run and of consistent quality in appearance and physical properties for each contiguous area.
2. Sheet Materials: Obtain sheet materials from same production run and of consistent quality in appearance and physical properties for each contiguous area.
3. Setting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. 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 degrees F (10 degrees C) or more than 85 degrees F (29 degrees C). Store floor tiles on flat surfaces.

1.7 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 degrees F (21 degrees C) or more than 85 degrees F (29 degrees C), in spaces to receive flooring during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 degrees F (13 degrees C) or more than 95 degrees F (35 degrees C).

C. Close spaces to traffic during floor installation.

D. Close spaces to traffic for 48 hours after floor installation.

E. Where demountable partitions, cabinets, and similar items are indicated for installation on top of resilient flooring, install tile before these items are installed.

F. Do not install flooring over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive, as determined by flooring manufacturer's recommended bond and moisture test.

G. Install flooring after other finishing operations, including painting, have been completed.

1.8 MAINTENANCE MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Sheet Flooring: Minimum 10 linear feet for each 500 linear feet (150 linear m) or fraction thereof, in roll form for each different type, color, and pattern installed.
   2. Base: Minimum 10 linear feet for each 500 linear feet (150 linear m) or fraction thereof for each different type and color installed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire Test Response Characteristics: For resilient tile flooring, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
   1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.
   2. Smoke Density: Maximum specific optical density of 450 per ASTM E 662 or NFPA 258.
   3. Flame Spread: Maximum 75 per ASTM E 84.
   4. Smoke Developed: Maximum 450 per ASTM E 84.

B. Accessibility Requirements: Comply with applicable requirements.
   1. U.S. Architectural and Transportation Barriers Compliance Board Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG) 2010.
   2. ICC/ANSI A117.1 Accessible and Useable Building and Facilities.

2.2 MATERIALS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following
   1. Rubber Base:
      a. Burke Mercer Flooring Products; a division of Burke Industries Inc.
      b. Flexco.
      c. Johnsonite; A Tarkett Company.
      d. Roppe Corporation, USA.

B. Luxury Vinyl Tile: ASTM F 1700. Class III, Type B. LVT
   1. Wearing Surface: Embossed.
   2. Thickness: 0.120 inch (3 mm).
   3. Wearlayer Thickness: 20 mil (0.5 mm).
   4. Finish: Polyurethane.

5. Colors and Patterns: Indicated in Finish Schedule.

C. Unbacked Vinyl Sheet Flooring: ASTM F 1913. SV and SVB
1. Thickness: 0.079 inch.
2. Wearing Surface: Smooth.
3. Sheet Width: 6 feet (1.8 m).
4. Seamless Installation Method: Heat welded.
5. Colors and Patterns: Selected by Architect.
6. Integral base.

D. Thermoset Rubber Base ASTM F 1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous). RB
1. Style and Location:
a. Style A, Straight: Provide in areas with carpet.
b. Style B, Cove: Provide in areas with resilient flooring.
2. Thickness: 0.125 inch (3.2 mm).
3. Height: 6 inches (152 mm).
4. Lengths: Coils in 100 foot lengths. Field cut to size.
5. Outside Corners: Job formed or preformed.
6. Inside Corners: Job formed or preformed.
7. Colors: Selected by Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for maximum moisture content and other conditions affecting performance of the work.
1. Verify levelness and flatness of concrete floor surface is within tolerances recommended by resilient tile manufacturer.
2. Verify finishes of substrates comply with specified tolerances and requirements and substrates are free of cracks, ridges, depressions, scale, and foreign deposits that interfere with adhesion of floor tile.

B. Proceed with installation after correcting unsatisfactory conditions. Installation of resilient flooring and accessories indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Prepare substrates according to flooring manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare horizontal and vertical surfaces according to ASTM F 710.
1. Verify substrates are dry and free of curing compounds, sealers, and hardeners.

2. Remove substrate coatings and substances incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.

C. Moisture and Alkalinity Tests and Remediation: Test for moisture and alkalinity as specified in Section 09 61 05 "Moisture Vapor Emission and Alkalinity Control." If test exceed manufacturer's recommendations, treat flooring per Section 09 61 05 "Moisture Vapor Emission and Alkalinity Control."

D. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

E. Do not install flooring until materials are the same temperature as the installation space.
1. At least 48 hours in advance of installation, move resilient flooring and installation materials into installation.

F. Immediately before installation, sweep and vacuum clean substrates covered by resilient flooring.

3.3 INSTALLATION

A. Comply with manufacturer's written instructions for installing flooring. Scribe and cut flooring to butt neatly and tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Extend flooring into toe spaces, door reveals, closets, and similar openings.

B. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on flooring as marked on substrates. Use chalk or other nonpermanent marking device.

C. Install flooring on covers for telephone and electrical ducts and similar items in finished floor areas. Maintain overall continuity of color and pattern between pieces of flooring installed on covers and adjoining flooring. Tightly adhere flooring edges to substrates that abut covers and to cover perimeters.

D. Adhere flooring to 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.

E. Sheet Flooring: Comply with manufacturer's written instructions for installing resilient sheet flooring. Unroll resilient sheet flooring and allow it to stabilize before cutting and fitting.
1. Lay out resilient sheet flooring:
a. Maintain uniformity of flooring direction.
b. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches (152 mm) away from parallel joints in flooring substrates.
c. Match edges of flooring for color shading at seams.
d. Avoid cross seams.

2. Seamless Installation:
   a. Chemically Bonded Seams: Bond seams with chemical-bonding compound to permanently fuse sections into a seamless flooring. Prepare seams and apply compound to produce tightly fitted seams without gaps, overlays, or excess bonding compound on flooring surfaces.

F. Resilient Base: Comply with manufacturer's written instructions for installing resilient base. 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.
   1. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.
   2. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
   3. Do not stretch resilient base during installation.
   4. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
   5. Preformed Corners: Install preformed corners before installing straight pieces.
   6. Job Formed Corners:
      a. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches (76 mm) in length.
      b. Form without producing discoloration (whitening) at bends.
      c. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches (76 mm) in length.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.

B. Perform cleaning operations immediately after completing flooring 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 flooring from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover flooring until Substantial Completion.

E. Clean floor surfaces not more than 4 days before dates scheduled for inspections intended to establish date of Substantial Completion in each area of Project. Clean products according to manufacturer's written recommendations.
   1. Before cleaning, strip protective floor polish.
   2. Reapply polish to floor surfaces to restore protective floor finish according to flooring manufacturer's written recommendations.

END OF SECTION

SECTION 09 67 23

RESINOUS FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Resinous flooring system.
   2. Integral cove base accessories.

1.2 ACTION SUBMITTALS

A. Product Data: Technical data for each type of product including application instructions, and recommendations for each resinous flooring component required.

B. Samples: Submit for each resinous flooring system required, 6 inches (150 mm) square, applied to a rigid backing by Installer.

1.3 INFORMATIONAL SUBMITTALS

A. Installer Certificates: Certification signed by manufacturer certifying that installers comply with specified requirements.

B. Material Certificates: Submit certificates for each resinous flooring component, from manufacturer indicating compliance with requirements.

C. Material Test Reports: Submit reports for each resinous flooring system, by a qualified testing agency.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For resinous flooring to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Entity having minimum five years documented experience who is a manufacturer authorized representative trained and approved for installation of flooring systems by the manufacturer.
   1. Engage an installer who is certified in writing by resinous flooring manufacturer as qualified to apply resinous flooring systems indicated.

B. Manufacturer Field Technical Service Representatives: Resinous flooring manufacture shall retain the services of Field Technical Service Representatives trained specifically in the installation of the specified system.
   1. Field Technical Services Representatives shall be employed by the system manufacture to assist in the quality assurance and quality control process of the installation and available to perform field problem solving issues with the installer.

C. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, from single source from single manufacturer. Provide secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from source recommended by manufacturer of primary materials.

D. Preinstallation Conference: Conduct conference at site.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.

B. Store materials to prevent deterioration from moisture, heat, cold, direct sunlight, or other detrimental effects.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring application.
   1. Maintain constant ambient room temperature of plus or minus 15 degrees F (plus or minus 7 degrees C) with a minimum temperature of 50 degrees F (10 degrees C) and maximum temperature of 85 degrees F (30 degrees C).

B. Conditioning Period: Commence minimum 7 days before coating application, is continuous through application, and continues minimum 3 days after application.
   1. During conditioning period, maintain an ambient temperature between 65 degrees F and 85 degrees F (18 degrees C and 30 degrees C) and not more than 50 percent relative humidity in spaces to receive flooring.
   2. After conditioning period, maintain relative humidity and ambient temperature planned for building occupants.

C. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.

D. Close spaces to traffic during resinous flooring application and for 24 hours after application unless manufacturer recommends a longer period.

1.8 WARRANTY

A. Written warranty signed by Manufacturer and Applicator in which the Manufacturer and Applicator agree to repair or replace components of resinous floor installation that fails in materials or workmanship within specified warranty period.
   1. Warranty Period: Minimum one year from the date of substantial completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire Test Response Characteristics: Determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency. Critical Radiant Flux Classification of Class I, not less than 0.45 W/sq. cm.

B. Flammability: Self-extinguishing according to ASTM D 635.

2.2 RESINOUS FLOORING

A. Resinous Flooring System: Abrasion, impact, and chemical resistant, aggregate filled, and resin based monolithic floor surfacing designed to produce a seamless floor and integral cove base.

1. Basis-of-Design: Subject to compliance with requirements, provide product listed on Drawing comparable products by one of the following:
    a. BASF Corp. - Construction Chemicals.
    b. Crossfield Products Corp.
    c. Duraflex, Inc.
    d. Neogard; a division of Jones-Blair, Inc.
    e. Polymerica, Incorporated.
    f. Sherwin-Williams Company, General Polymers.
    g. Sika Corporation; Flooring.
    h. Stonhard, Inc.
    i. Tamms; a brand of Euclid Chemical Company; an RPM Company.

B. System Characteristics: System consisting of two component epoxy primer, high performance three component mortar, and two component, epoxy coating.

1. Color and Pattern: Selected by Architect.
2. Wearing Surface: As indicated on Drawings.
3. Overall System Thickness: 1/8 inch (3.2 mm).

C. System Physical Properties: Provide resinous flooring system with the following minimum physical property requirements when tested in accordance with test methods indicated:

1. Flexural Strength: 2,000 psi minimum in accordance with ASTM D790.
2. Flexural Modulus of Elasticity: 850,000 psi minimum in accordance with ASTM C790.
3. Impact Resistance: 75 in/lbs, in accordance with ASTM D2794.
4. Hardness: 45, Shore D in accordance with ASTM D2240.

D. Patching and Fill Material: Resinous product of or approved by resinous flooring manufacturer and recommended by manufacturer for application indicated.

2.3 INTEGRAL COVE BASE ACCESSORIES

A. Precast, Integral Cove Base: Impact resistant, polymer resin, cove base moldings with a grit profile to promote adhesion of resinous flooring and recommended in writing by resinous flooring manufacturer.
   1. Radius Cove: Cove molding with approximately 1 inch (25 mm) radius for adhesive installation at floor to wall joint as substrate to receive resinous flooring system to form an integral cove base.
   2. Radius Cove Base: Base molding that provides approximately 1 inch (25 mm) radius cove at floor to wall joint; for adhesive installation as substrate for resinous flooring system to form an integral cove base.

B. Installation Adhesive: Recommended in writing by accessory manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine concrete substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the work.
   1. Verify surfaces are smooth and flat within maximum variation of 1/4 inch in 10 feet (6 mm in 3 m) and are ready to receive work.
   2. Verify substrate is free of imperfections including voids, honeycombs, fins, cracks, ridges, depressions, scale, and foreign deposits that interfere with adhesion of resinous flooring systems.
   3. Verify floor and lower wall surfaces are free of substances that impair adhesion of materials.

B. Proceed with installation after correcting unsatisfactory conditions, including flatness and levelness tolerances.

3.2 PREPARATION

A. Prepare and clean substrates according to resinous flooring manufacturer's written instructions for substrate indicated. Provide clean, dry substrate for resinous flooring application.

B. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form release agents, dust, dirt, grease, oil, and contaminants incompatible with resinous flooring.
   1. Roughen concrete substrates:
      a. Shot blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
      b. Mechanically abrade concrete surface until free of incompatible contaminants.
      c. Comply with ASTM C 811 requirements unless manufacturer's written instructions are more stringent.

2. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written instructions.
   a. Patched or Repaired Areas of Substrate: Test area for surface tensile strength of minimum 200 psi.
3. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft. (18.6 sq. m) and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
4. Alkalinity and Adhesion Testing: Perform tests recommended in writing by resinous flooring manufacturer. Proceed with installation only after substrate alkalinity is not less than 6 or more than 8 pH unless otherwise recommended in writing by flooring manufacturer,

C. Patching and Filling: Use patching and fill material compatible with resinous flooring to fill holes and depressions in substrates according to manufacturer's written instructions.
1. Control Joint Treatment: Treat control joints and nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring in accordance with manufacturer's written instructions.
2. Construction and Cold Joints: Treat construction and cold joints as recommended by manufacturer on horizontal and vertical surfaces.
   a. Discontinue resinous floor at vertical and horizontal contraction and expansion joints by installing backer rod and sealant upon completion of installation.
      1) Sealant: Provide sealant recommended by manufacturer for traffic conditions and chemical exposures to be encountered in accordance with Section 07 92 00.

D. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.

3.3 APPLICATION

A. Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.
1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.
2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
3. Expansion and Isolation Joint Treatment: At substrate expansion and isolation joints, comply with resinous flooring manufacturer's written instructions.

B. Primer: Apply primer over prepared substrate at manufacturer's recommended spreading rate.

C. Integral Cove Base: Apply cove base mix to wall surfaces before applying flooring. Apply according to manufacturer's written instructions and details, including those for taping, mixing, priming, troweling, sanding, and topcoating of cove base. Round internal and external corners.

D. Self-Leveling Body Coats: Apply self-leveling slurry body coats in thickness indicated for flooring system.

1. Aggregates: Broadcast aggregates at rate recommended by manufacturer and, after resin is cured, remove excess aggregates to provide surface texture indicated.

E. Terminations: Chase edges to bind resinous flooring to concrete substrate along lines of termination.

1. Penetration Treatment: Lap and seal resinous flooring to perimeter of penetrations to compensate for possible movement.
2. Trenches: Continue resinous flooring into trenches to maintain monolithic flooring. Treat cold joints to ensure bridging of potential cracks.
3. Treat floor drains by chasing the coating to lock in place at point of termination.

3.4 PROTECTION

A. Cure resinous flooring in compliance with manufacturer's directions, taking care to prevent contamination during stages of application and prior to completion of curing process. Close area of application for a minimum of 18 hours.

B. Protect resinous flooring from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring manufacturer.

C. Cleaning: Remove temporary covering and clean resinous flooring prior to substantial completion. Use cleaning materials and procedures recommended by resinous flooring manufacturer.

END OF SECTION

SECTION 09 68 13

TILE CARPETING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes modular carpet tile.

1.2 ACTION SUBMITTALS

A. Product Data: Technical data for each type of carpet tile including manufacturer's written data on physical characteristics, durability, and fade resistance.
   1. Include manufacturer's written installation recommendations for each type of substrate.

B. Shop Drawings: Indicate dimensions of carpet areas showing starting points, walls or partitions, fixed built in equipment, including:
   1. Columns, doorways, enclosing walls or partitions, and locations where cutouts are required in carpet tiles.
   2. Carpet tile type, color, and dye lot.
   3. Type of subfloor.
   4. Type of installation.
   5. Pattern of installation.
   6. Pattern type, location, and direction.
   7. Pile direction.
   8. Type, color, and location of insets and borders.
   9. Type, color, and location of edge, transition, and other accessory strips.
   10. Transition details to other flooring materials.

C. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
   1. Carpet Tile: Full size Sample.
   2. Exposed Edge, Transition, and Other Accessory Stripping: 12 inch (300 mm) long Samples.

1.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports:
   1. Submit reports for carpet, for tests performed by a qualified testing agency.
   2. Test results for vapor and moisture testing.
   3. Test results for alkalinity and moisture testing.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: Submit data for carpet tiles to include in maintenance manuals. Include the following:

1. Methods for maintaining carpet tile, including cleaning and stain removal products and procedures and manufacturer's recommended maintenance schedule.
2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Installer having minimum 5 years documented experience, who is certified by the International Certified Floorcovering Installers Association.

B. Preinstallation Conference: Conduct conference at site.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI Carpet Installation Standard.

B. Deliver and store materials at site in original factory packaging and containers. Store materials flat, above ground, in well ventilated area protected from weather, moisture, soiling, humidity, and extreme temperature.

1.7 FIELD CONDITIONS

A. Comply with CRI Carpet Installation Standard for temperature, humidity, and ventilation limitations.

B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at levels planned for building occupants during the remainder of the construction period.

C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.

D. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

1.8 WARRANTY

A. Written warranty signed by manufacturer in which manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.

1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
2. Failures include, but are not limited to, the following:
   a. More than 10 percent edge raveling, snags, and runs.

b. Dimensional instability.
c. Excess static discharge.
d. Loss of tuft-bind strength.
e. Loss of face fiber.
f. Delamination.

3. Warranty Period: 10 years from date of Substantial Completion.

1.9 MAINTENANCE MATERIALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Carpet Tile: Full size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd. (8.3 sq. m).

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Finish surfaces to specified tolerances, according to ASTM E 1155 (ASTM E 1155M), for a randomly trafficked floor surface receiving carpet or carpet tile:

1. Specified overall values (SOV):
   a. Flatness: FF 25.
   b. Levelness: FL 20.
2. Minimum local values (MLV):
   a. Flatness: FF 17.
   b. Levelness: FL 15.

B. Fire Test Response Characteristics: Provide products with the critical radiant flux classification determined by testing identical products in accordance with ASTM E 648. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.2 CARPET TILE

A. Basis of Design: Indicated in Finish Schedule.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Atlas Carpet Mills, Inc.
2. Bentley Prince Street, Inc.
3. Interface, LLC.
4. J&J Invision; J&J Industries, Inc.
5. Mannington Mills, Inc.
6. Milliken & Company.
7. Mohawk Group (The); Mohawk Carpet, LLC.
8. Patcraft; a division of Shaw Industries, Inc.
9. Philadelphia Commercial; a division of Shaw Industries, Inc.

10. Shaw Contract Group; a Berkshire Hathaway company.

2.3 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex modified, hydraulic cement based formulation provided or recommended by carpet tile manufacturer.

B. Adhesives: Water resistant, mildew resistant, nonstaining, pressure sensitive type to suit products and subfloor conditions indicated, that comply with flammability requirements for installed carpet tile, and are recommended by carpet tile manufacturer for releasable installation.

C. Metal Edge/Transition Strips: Extruded aluminum with mill finish of profile and width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

1. Provide edge and transition strips by Schluter Systems.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and conditions affecting carpet tile performance.

B. Examine carpet tile for type, color, pattern, and potential defects.

C. Proceed with installation after correcting unsatisfactory conditions.

3.2 PREPARATION

A. Comply with CRI Carpet Installation Standards, ASTM F710 and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile.

B. Concrete Slabs: Verify slab finishes comply with requirements specified in Section 03 30 00 and that surfaces are free of cracks, ridges, depressions, scale, curing compounds, sealers, hardeners, and foreign deposits. Perform alkalinity and moisture testing per Section 09 61 05 "Moisture Vapor Emission and Alkalinity Control."

1. Alkalinity Testing: Perform tests recommended by carpet tile manufacturer. Proceed with installation after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
2. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft. (18.6 sq. m) and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
    a. Anhydrous Calcium Chloride Test: ASTM F 1869. Proceed with installation after substrates have maximum moisture vapor emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.

b. Relative Humidity Test: Using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
c. Perform additional moisture tests recommended in writing by adhesive and carpet tile manufacturers. Proceed with installation only after substrates pass testing.

3. Perform additional vapor and moisture tests recommended by manufacturer. If substrates fail to meet manufacturers recommended moisture content, remediate moisture. Proceed with floor covering installation after substrates past testing.

C. Remediation: Provide alkalinity and moisture vapor emissions control system specified in Section 09 61 05 "Moisture Vapor Emission and Alkalinity Control" should the moisture test results indicated the concrete substrate fails to obtain the minimum moisture vapor emissions rate required by the flooring covering manufacturer.

D. 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 1/8 inch (3 mm) wide or wider, and protrusions more than 1/32 inch (0.8 mm) unless more stringent requirements are required by manufacturer's written instructions.

E. Concrete Substrates: 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 adhesive and carpet tile manufacturers.

F. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

A. Comply with CRI Carpet Installation Standard, Section 18 Modular Carpet and with carpet tile manufacturer's written installation instructions.

B. Installation Method: Comply with manufacturer’s recommended method for glue down; install every tile with full spread, releasable, pressure sensitive adhesive..

C. Maintain dye lot integrity. Do not mix dye lots in same area.

D. Maintain pile direction patterns recommended in writing by carpet tile manufacturer.

E. Cut and fit carpet tile 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 tile manufacturer.

F. Extend carpet tile into toe spaces, door reveals, closets, open bottomed obstructions, removable flanges, alcoves, and similar openings.

G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet tile as marked on subfloor. Use nonpermanent, nonstaining marking device.

H. Install pattern parallel to walls and borders.

I. Edge Trim: Install edge strips where carpet terminates at other floor coverings and at carpet bases in accordance with manufacturer's recommendations.

1. Use full length pieces butted tightly to vertical surfaces. Where splicing cannot be avoided, butt ends tight and flush.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet tile:

1. Remove excess adhesive and other surface blemishes using cleaner recommended by carpet tile manufacturer.
2. Remove yarns that protrude from carpet tile surface.
3. Vacuum carpet tile using commercial machine with face beater element.

B. Protect installed carpet tile to comply with CRI Carpet Installation Standard, Section 20 Protecting Indoor Installations.

C. Protect carpet tile 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 tile manufacturer.

END OF SECTION

SECTION 09 91 23

INTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: surface preparation and the application of paint systems on interior substrates.

B. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.

1. Prefinished items include the following shop- and factory-finished components:
    a. Architectural woodwork and casework.
    b. Metal lockers.
    c. Prefinished elevator entrance doors and frames.
    d. Elevator equipment.
    e. Finished mechanical and electrical equipment.
    f. Light fixtures.
    g. Distribution cabinets.
2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:
    a. Furred areas.
    b. Ceiling plenums.
    c. Pipe spaces.
    d. Duct shafts.
    e. Elevator shafts.
3. Finished metal surfaces include the following:
    a. Door hardware.
    b. Aluminum.
    c. Brass.
    d. Bronze.
    e. Chromium plate.
    f. Copper.
    g. Nickel.
    h. Stainless steel.
4. Labels: Do not paint over Underwriters Laboratories (UL), Factory Mutual (FM), or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.
5. Operating parts including moving parts of operating equipment and the following:
    a. Valve and damper operators.
    b. Linkages.
    c. Sensing devices.
    d. Motor and fan shafts.

1.2 DEFINITIONS

A. Gloss Factors: Values of various degrees of luster when tested in accordance with ASTM D 523 shall comply with following:
   1. Gloss Level 1 – Flat: Not more than five units at 60 degrees and 10 units at 85 degrees.
   2. Gloss Level 2 – Low Sheen: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees.
   3. Gloss Level 3 – Eggshell: 1 0 to 25 units at 60 degrees and 10 to 35 units at 85 degrees.
   4. Gloss Level 4 – Satin: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees.
   5. Gloss Level 5 – Semigloss: 35 to 70 units at 60 degrees.
   6. Gloss Level 6 – Gloss: 70 to 85 units at 60 degrees.
   7. Gloss Level 7 – High Gloss: More than 85 units at 60 degrees.

1.3 COORDINATION

A. Coordination of Work: Coordinate field finishing of shop primed metals are provided to ensure compatibility of total systems for various substrates.

1.4 ACTION SUBMITTALS

A. Product Data: Technical data and product information for block fillers, primers, paints, and coatings, including label analysis and instructions for handling, storing, surface preparation, and application for each paint and coating system.
   1. For field painting of factory primed metal products and fabrications, submit technical data for each type of paint product, surface preparation requirements, and application instructions.
   2. Indicate manufacturer's instructions for special surface preparation procedures and substrate conditions requiring special attention.
   3. Product List: Provide inclusive list of required coating materials. Indicate each material and cross reference specific coatings, finish system, and application. Identify each material by manufacturer's catalog number, series, and general classification. Use same designations indicated in Finish Schedules.

B. Samples: Submit aged (minimum seven day old) paint samples for each type of paint system and each color and gloss of topcoat.
   1. Provide stepped draw-down samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing samples for review. Resubmit until required sheen, color, and texture are achieved.
      a. Label draw-down samples with the following:
         1) Paint manufacturer.
         2) Manufacturer’s color name, number, and sheen.
         3) Paint formula employed to produce designated color and sheen.
         4) Date paint was mixed.
   2. Provide list of material and application for each coat of each sample. Label each sample as to location and application.

3. Submit samples on substrates for review of color and texture:
   a. Concrete: Two 4 inch (50 mm) square samples for each color and finish.
   b. Concrete Masonry: Two 4 by 8 inch (100 by 200 mm) samples of masonry, with mortar joint in the center, for each finish and color.
   c. Painted Wood: Two 12 inch (305 mm) square samples of each color and material on hardboard.
   d. Ferrous and Nonferrous Metals: Two 4 inch (100 mm) square samples of flat metal and two 8 inch (200 mm) long samples of solid metal for each color and finish.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For applicator.

B. Quality Control Submittals: Furnish certificates from manufacturer that products supplied comply with VOC content limits and emission in accordance with local, state, and federal regulations.

1.6 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with Federal and local toxicity and air quality regulations and with Federal requirements on content of for heavy metals including but not limited to lead and mercury. Do not use solvents in paint products that contribute to air pollution.

B. Applicator Qualifications: Entity having minimum 5 years documented experience in applying paints and coatings similar in material, design, and extent to those indicated.

C. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Architect will select one surface to represent surfaces and conditions for application of each paint system.
      a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
      b. Other Items: Architect will designate items or areas required.
   2. Final approval of color selections will be based on mockups.
      a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
   3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Container Labels: Include manufacturer's name, type of paint, brand name, lot number and date of manufacturer, brand code, coverage rate, surface preparation, instructions

for mixing and reducing drying time, cleanup requirements, color designation, and application instructions.

B. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 degrees F (7 degrees C).
   1. Maintain containers in clean condition, free of foreign materials and residue.
   2. Remove rags and waste from storage areas daily.

1.8 FIELD CONDITIONS

A. Do not thin or add water to waterbased paints, including waterbased alkyds.

B. Weather Conditions:
   1. Apply paints when temperature of surfaces to be painted and ambient air temperatures are between 50 degrees F and 95 degrees F (10 degrees C and 35 degrees C).
   2. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 degrees F (3 degrees C) above the dew point; or to damp or wet surfaces.
   3. Minimum Application Temperatures for Latex Paints: 45 degrees F (7 degrees C) for interiors; 50 degrees F (35 degrees C) for exterior, unless otherwise indicated by manufacturer’s Product Data Sheet.

C. Apply solvent thinned paints when temperatures of surfaces to receive paint and surrounding air are between 45 degrees F. and 95 degrees F (7 degrees F and 35 degrees C).
   1. Minimum Application Temperature for Varnish Finishes: 65 degrees F (18 degrees C) for interior or exterior, unless required otherwise by manufacturer's instructions.

D. Painting may continue during inclement weather if surfaces and areas to receive paint and coatings are enclosed and heated within temperature limits specified by the manufacturer during application and drying periods.

E. Provide lighting level of 80 foot-candles (860 lx) measured mid-height at substrate surface.

1.9 SURPLUS MATERIALS

A. Inquire and coordinate with Owner regarding disposition of excess and leftover paint materials. If Owner wishes to retain excess materials for maintenance and touch-up purposes, deliver excess materials to designated storage area as directed by Owner.
   1. Any materials not retained by Owner shall become the property of the Contractor and shall be removed from the site.

PART 2 - PRODUCTS

A. Source Limitations: Obtain block fillers, primers, and undercoats for each coating system from the same manufacturer as the finish coats.

B. Acceptable Manufacturers: Provide first quality, 100% acrylic, commercial or industrial products of one of the specified manufacturers. Residential-grade products are not permitted.
   1. Benjamin Moore & Co. (Moore).
   2. The Comex Group: Kwal, Frazee, Colorwheel, Parker, General Paint.
   3. Dunn Edwards (DE).
   4. Glidden Professional Paints (AN).
   5. Kelly-Moore Paint Company Inc. (KM).
   6. PPG Industries, Pittsburgh Paints (PPG).
   7. The Sherwin-Williams Company (S-W).

2.2 PERFORMANCE REQUIREMENTS

A. Performance and Durability:
   1. ASTM D 16 Standard Test Method for Load Testing Refractory Shapes at High Temperatures.
   2. ASTM D 2486 Standard Test Method for Scrub Resistance of Interior Wall Paint.
   3. ASTM D 2805 Standard Test Method for Hiding Power of Paints by Reflectometry.
   4. ASTM D 4828 Standard Test Method for Practical Washability of Organic Coatings.

B. Chemical Components of Field Applied Interior Paints and Coatings: Provide topcoat paints and anticorrosive and antirust paints applied to ferrous metals that comply with chemical restrictions; these requirements do not apply to paints and coatings applied in a fabrication or finishing shop:
   1. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
   2. Restricted Components: Paints and coatings shall not contain components restricted by the EPA.

2.3 MATERIALS

A. Material Compatibility:
   1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
   2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

B. Accessories: Linseed oil, shellac, turpentine, paint thinners, and similar materials not specifically indicated but necessary to achieve the finishes specified for commercial quality.

C. Patching Materials: Latex filler compatible with paint systems.

D. Fastener Head Cover Materials: Latex filler.

E. Colors: As indicated in Finish Schedule on Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Test substrates after repairing and cleaning substrates but prior to application of paint and coatings.
   1. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
      a. Concrete: 12 percent.
      b. Masonry (Clay and CMUs): 12 percent.
      c. Portland Cement Plaster: 12 percent.
      d. Gypsum Board: 12 percent.
   2. Test cementitious substrates and plaster cement/stucco for alkalinity (pH).

C. Gypsum Board Substrates: Verify joints are properly taped and finishing compound is sanded smooth.

D. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
   1. Verify previously painted surfaces can be stripped to bare substrate, repaired if necessary, and prepared to receive new paint or coating system consisting of primer and two top coats at a minimum.
      a. When previously painted surfaces have failed to accept new paint systems, determine cause of failure and take corrective measures to ensure each surface accepts new paint or coating system. Failure of new paint system is not permitted.
   2. Shop Primed Metals: Inspect shop primed metals to determine if primer is in condition to receive and is compatible with topcoats.

E. Commence paint and coating application after correcting unsatisfactory conditions and surfaces are dry. Application of coating indicates applicator’s acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations applicable to substrates and paint systems indicated.

B. Coordination of Work:
   1. Preprimed Substrates: Inspect existing conditions in which primers are factory applied to ensure compatibility of the total system for each substrate. Notify Architect of anticipated problems when using the materials specified over factory primed or preprimed substrates.

2. Existing Painted Surfaces: Inspect previously painted surfaces to ensure compatibility of the existing paints with new paint system for each substrate. Notify Architect of anticipated problems.
3. Repair defects and clean surfaces affecting bond with paint system. Remove existing paints exhibiting loose surface defects showing signs of rust, scale, or delamination.
4. Seal marks which may bleed through surface finishes.
5. Touch up shop primer or previously painted surfaces prior to application of topcoats.

C. Surface Cleaning and Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each substrate condition.

D. Provide barrier coats over incompatible primers or remove and reprime. If removal is impractical or impossible because of size or weight of item, provide surface applied protection before surface preparation and painting
1. Before applying paint or surface treatments, clean substrates of substances that impair bond of the various coatings. Remove oil and grease before cleaning. Schedule cleaning and painting so dust and contaminants from the cleaning process will not fall on wet, newly painted surfaces.
2. Remove hardware, covers, plates, and similar items in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface applied protection before surface preparation and painting.
    a. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface applied protection.
3. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
4. Seal marks which may bleed through surface finishes with shellac.
5. Provide barrier coats over incompatible primers or remove and reprime.
6. Correct defects and clean surfaces which affect the Work.
7. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

E. Cementitious Substrates: Remove release agents, curing compounds, efflorescence, chalk, dust, dirt, grease, oils, release agents, mold, mildew, and existing paint. Roughen as necessary to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.
1. Use abrasive blast cleaning methods if recommended by paint manufacturer.
2. Do not paint surfaces if moisture content or alkalinity of surfaces exceeds that permitted in manufacturer's written instructions.
    a. Determine alkalinity and moisture content of surfaces by performing appropriate pH testing. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct condition prior to application of paint.
    b. Anhydrous Calcium Chloride Test: ASTM F 1869. Proceed with installation after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m).

c. Relative Humidity Test: Using in situ probes, ASTM F 2170. Proceed with installation after substrates have obtained percent relative humidity level recommended by paint manufacturer.
d. Perform additional moisture tests when recommended by manufacturer. Proceed with installation when moisture content complies with that permitted in manufacturer's written instructions.
e. Remove stains caused by weathering of corroding metals with solution of sodium metasilicate after thoroughly wetting with water. Allow to thoroughly dry.

3. Clean concrete floors to receive paint or coating with a 5 percent solution of muriatic acid or etching cleaner. Flush floors with clean water to remove acid; neutralize with ammonia, rinse, allow to dry; vacuum before painting.

F. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.

G. Ferrous Metals: Remove rust, loose mill scale, and shop primer. Clean ungalvanized ferrous metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC recommendations.

1. SSPC-SP 11.

H. Shop Primed Ferrous Metal Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop primed surfaces.

1. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
2. Touch up bare areas and damaged shop applied prime coats. Wire brush, clean with solvents recommended by paint manufacturer, and touch up with same primer as the shop coat.

I. Galvanized Ferrous Metal Substrates: Clean galvanized surfaces with nonpetroleum based solvents leaving surface free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

J. Cotton or Canvas Insulation Covering Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

K. Plastic Trim Fabrication Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

L. Mildew and Mold Removal: Remove mildew and mold by high power washing (pressure range of 1500 to 4000 psi) with solution of trisodium phosphate and bleach. If substrate is too soft for high power washing, scrub substrate with solution. Rinse with clean water and allow surface to dry.

M. Protective Coverings: Provide protections for duration of the Work, including covering furnishings and decorative items. Protect and mask adjacent finishes and components against damage, marking, overpainting, and injury. Clean and repair or replace damage caused by painting.

N. Renovated Surfaces: Clean surface free of loose dirt and dust. Except at gypsum board surfaces, remove existing paint and coatings to bare substrate and prepare substrates to receive new paint system. Test substrate to verify it will bond with primer and receive new paint system without failure. If test fails, clean surface to base substrate and apply barrier coat. Retest to verify surface will accept new paint system.

1. Remove surface film preventing proper adhesion and bond.
2. Wash glossy paint with a solution of sal soda and rinse thoroughly.
3. Remove loose, blistered, and defective paint and varnish; smooth edges with sandpaper.
4. Clean corroded iron and steel surfaces.
5. Repair and blend into portland cement plaster.
6. Prime bare surfaces.
7. Tone varnished surfaces with stain bringing to uniform color.
8. If existing surfaces cannot be put in acceptable condition for finishing by customary cleaning, sanding, and puttying operations, notify Owner and do not proceed until correcting unsatisfactory conditions.

O. Gypsum Board Surfaces: Fill minor defects with filler compound. Spot prime defects after repair.

P. Pipe Covering and Insulation: Remove loose, foreign, and objectionable material before applying sealing coat.

Q. Preparation of Substrates for Wallcovering: Prime and seal substrate with release coat in accordance with wallcovering manufacturer's recommendations for substrate.

1. Assure compatibility with product of wall covering manufacturer.
2. Fill indentations in substrate and prime with opaque white primer before applying release coat.
3. Apply release coat in accordance with manufacturer's recommendations.

R. Barrier Coat: Provide barrier coats over incompatible primers or remove and reprime. Notify Owner in writing of anticipated problems using specified finish coat material over previously coated substrates.

S. Paint and Coating Preparation: Mix and prepare paint materials according to manufacturer's written instructions.

1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
3. Do not use thinners for water based paints.

4. Tinting: Tint each undercoat a lighter shade to facilitate identification of each coat where multiple coats of the same material are applied. Tint undercoats to match the color of the finish coat. Provide sufficient differences in shade of undercoats to distinguish each separate coat.

T. Asphalt, Creosote, or Bituminous Surfaces Scheduled for Paint Finish: Remove foreign particles to permit adhesion of finishing materials. Apply compatible sealer or primer.

U. Impervious Surfaces: Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

V. Wood and Metal Doors: Seal top and bottom edges with primer.

3.3 APPLICATION

A. Comply with manufacturer's written instructions and recommendations applicable to substrates and paint systems indicated.
1. The term exposed surfaces includes areas visible when permanent or built in fixtures, grilles, convector covers, covers for finned tube radiation, and similar components are in place. Extend coatings in these areas to maintain system integrity and provide desired protection.
2. Provide finish coats compatible with primers.
3. Use applicators and techniques suited for paint and substrate indicated.
4. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
5. Paint exposed surfaces. If an item or a surface is not specifically mentioned, paint item or surface the same as similar adjacent materials or surfaces.
a. Field painting of exposed surfaces include bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron supports, and surfaces of mechanical and electrical equipment that do not have a factory applied final finish.
b. Areas visible when permanent or built in fixtures, grilles, convector covers, covers for finned tube radiation, and similar components are in place.
c. Extend coatings in areas, as required, to maintain system integrity and provide desired protection.
d. Finish doors on tops, bottoms, and side edges the same as exterior faces.
6. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
7. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
8. rating, or nomenclature plates.
9. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or surface imperfections. Cut in sharp lines and color breaks.
10. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
11. Paint entire exposed surface of window frames and sashes.

12. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
13. Sand lightly between each succeeding enamel or varnish coat.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Minimum Coating Thickness: Apply paint materials to dry film thickness indicated in pain schedule but no thinner than manufacturer's recommended spreading rate to achieve dry film thickness indicated. Provide total dry film thickness of the entire system as recommended by manufacturer.
1. Measure film thickness on magnetic surfaces by use of Elcometer thickness gauge and on nonmagnetic surfaces by pit gauge or Tooke Gauge.

F. Application: Apply first coat to surfaces that have been cleaned, pretreated, or prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
1. The number of coats and film thickness required are the same regardless of application method. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer.
2. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished after removing rust and scale and priming or touching up surface sand if acceptable to topcoat manufacturers.
3. If undercoats, stains, or conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive dry film thickness equivalent to that of flat surfaces.
4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried and cured to where it feels firm, and does not deform or feel sticky under moderate thumb pressure, and until application of another coat of paint does not cause undercoat to lift or lose adhesion.

G. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and occupied spaces.
1. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
2. Prime and paint uninsulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, heat exchangers, tanks, ductwork, conduit, switchgear, and paintable insulation except where items are prefinished.

3. Paint interior surfaces of air ducts, and convector and baseboard heating cabinets visible through grilles and louvers with one coat of flat black paint, to visible surfaces. Paint dampers exposed behind louvers, grilles, and convector and baseboard cabinets to match face panels.
4. Paint both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.
5. Color code equipment, piping, conduit, and exposed ductwork in accordance with requirements indicated. Color band and identify with flow arrows, names, and numbering.
6. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.
7. Concealed Members: Wherever steel and metal parts to receive paint are built into and concealed by construction, paint as specified for exposed parts so finish painting is complete before members are concealed.
8. Paint the following work where exposed to view:
   a. Equipment, including panelboards and switch gear.
   b. Uninsulated metal piping.
   c. Uninsulated plastic piping.
   d. Pipe hangers and supports.
   e. Metal conduit.
   f. Plastic conduit.
   g. Tanks that do not have factory applied final finishes.
   h. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or paintable jacket material.
9. Paint the following work where exposed in occupied spaces:
   a. Equipment, including panelboards.
   b. Uninsulated metal piping.
   c. Uninsulated plastic piping.
   d. Pipe hangers and supports.
   e. Metal conduit.
   f. Plastic conduit.
   g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
   h. Other items as directed by Architect.
10. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

H. Items not to Receive Paint: Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.

I. Electrostatic Spray Painting: Apply coating electrostatically to finished surfaces, free from runs, sags, visible overlaps, holidays, craters, pinholes and other defects detrimental to protective and decorative qualities of coating.
   1. Thickness of Coatings: 1.5 to 2.0 mils dry film thickness. Measure dry film thickness with magnetic gauge.
   2. Use application techniques, equipment, materials, and preparation procedures recommended by manufacturer.

J. Block Fillers: Apply block fillers to concrete masonry block at rate to ensure complete coverage with pores filled.

K. Prime Coats: Before applying finish coats, apply prime coat, recommended by manufacturer, to material required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn through or defects due to insufficient sealing.

L. Finish Coats: Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance without bleed through.

1. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or surface imperfections is not acceptable.
2. Transparent (Clear) Finishes: Use multiple coats to produce glass smooth surface film of even luster. Provide a finish free of laps, cloudiness, color irregularity, runs, brush marks, orange peel, nail holes, or other surface imperfections. Provide satin finish for final coats.

M. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

N. Touch Up: Touch up marred, scraped, and blemished areas of surfaces which were factory primed or previously coated.

1. Prepare and touch up scratches, abrasions, and blemishes and remove foreign matter before proceeding with succeeding coats.
2. Touch up marred, scraped, and blemished areas of factory primed or previously coated surfaces.
3. Feather touch up coating overlapping minimum 2 inches onto adjacent unblemished areas producing smooth, uniform surface.
4. As soon after erection and installation as possible, touch up fasteners, welded surfaces and surroundings, field connections, and areas on which shop coat has been abraded or damaged with specified primer before corrosion and other damage occurs from exposure.

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.

1. Contractor shall touch up and restore painted surfaces damaged by testing.
2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 WASTE MANAGEMENT

A. Paint products are considered hazardous materials. Do not empty or allow excess paint to enter storm drainage systems. Comply with manufacturer's written instructions for disposal of leftover paint and paint buckets.

B. Waste Disposal: Legally dispose of metal, plastic, and product waste, including accessories and used items, by recycling or reusing waste materials.

C. Clean and recycle plastic paint containers. Do not dispose of paint containers in landfills.

D. Do not dispose of unused paints, stains, and coatings by pouring into storm drainage or sewer systems.

E. Do not allow run off water resulting from washing paint containers and applicators to seep into the ground or run into the storm drainage or sewer systems.

1. Prior to disposing, allow unused paint to dry in can before legally disposing.

F. Legally dispose of unused paint, stain, and coatings and the containers in accordance with manufacturer’s recommendations and environmental regulations.

3.6 CLEANING AND PROTECTION

A. Clean Up: At end of each day, remove rubbish, empty cans, rags, and other discarded materials from site. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

B. Protections: Protect Work of other trades against damage from paint application. Correct damage to Work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

C. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

D. At completion of painting activities, touch up and restore damaged or defaced painted surfaces.

E. Provide Wet Paint signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work. After related Work is complete, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

3.7 INTERIOR PAINT AND COATING SCHEDULE

A. Cotton or Canvas Covering over Insulation:
   1. Finish: Interior, flat, latex-based paint.
      a. AN: Glidden Ultra-Hide No VOC Interior Flat Paint 1209 (0 g/L VOC), 1.3 - 1.5 mils dft/coat.
      b. Moore: 219 Eco Spec Interior Latex Flat 9) g/L VOC), 1.2 mils dft/coat minimum.
      c. PPG: 9100 Series Pure Performance Interior flat Latex (0 g/L VOC), 1.8 mils dft/coat minimum.
      d. S-W: ProMar 200 Zero VOC Interior Flat Paint B30-2600 (0 G/L VOC), 1.6 mils dft/coat minimum.
      e. KM: 1500 Enviro-Coat 100% Acrylic Interior Flat Wall Paint (0 g/L VOC) 1.5 - 2.0 mils dft/coat.
      f. Comex: UltraTech C115 Interior Latex Flat Finish (35g/L VOC) 1.5 - 2.0 mils

B. Gypsum Board: Ceilings Only.
   1. Finish: Lusterless (flat) latex; primer and two finish coats.
   2. Primer: No Substitutions.
      a. GP: Glidden Lifemaster No VOC Interior Primer Sealer 9116-1200, (0 g/L VOC), 1.4 mils dft minimum.
      b. Moore: Ultra Spec 500 Waterborne Interior Primer Sealer N534, (0 g/L VOC), 1.8 mils dft minimum.
      c. PPG: Speedhide Interior Latex Primer Sealer 6-2, (<50 g/L VOC), 1.0 mils dft minimum.
      d. S-W: ProMar 200 Zero VOC Interior Latex Primer B28W2600 (0 G/L VOC), 1.5 mils dft minimum.
      e. KM: 971 Acry-Plex Zero VOC Interior PVA Primer/Sealer (0 g/L VOC), 2.0 mils dft minimum.
      f. Comex: Ultratech Interior Latex Primer Sealer C152, (44 g/L VOC), 2.0 mils dft minimum.
   3. Finish Coats:
      a. GP: Glidden Lifemaster No VOC Interior Flat Paint 9100 (0 g/L VOC), 1.3 - 1.5 mils dft/coat.
      b. Moore: Waterborne Ceiling Paint, Flat, 0 VOC, 508, 1.4 mils dft/coat
      c. PPG: 6-4110XI Speedhide zero Interior Flat Latex (0 g/L VOC), 1.8 mils dft/coat minimum.
      d. S-W: ProMar 200 Zero VOC Interior Flat Paint B30-2600 (0 G/L VOC), 1.6 mils dft/coat minimum.
      e. KM: 1005 KM PROFESSIONAL Interior Acrylic ZERO VOC Flat Wall Paint (0 g/L VOC) 1.5-2.0 mils dft.
      f. Comex: UltraTech C129 Int Low Odor Zero VOC Flat (0g/L VOC) 1.6 mils dft/coat minimum.

C. Gypsum Board: Walls.
   1. Finish: Satin latex enamel; primer and two finish coats.
   2. Primer: No Substitutions.
      a. DE: Vinylastic Premium Interior Wall Sealer VNPR00-1 (<51 g/L VOC)
      b. BM: Eco Spec WB Interior Latex Primer N372/F372 (<51 g/L VOC)
      c. PPG: Speedhide Interior Latex Primer Sealer 6-2, (<50 g/L VOC), 1.0 mils dft minimum.
      d. S-W: ProMar 200 Zero VOC Interior Latex Primer B28W2600 (0 G/L VOC), 1.5 mils dft minimum.
   3. Finish Coats:
      a. BM: Premium Interior Latex Eggshell W626/K626 (<51 g/L VOC)
      b. DE: Low Odor Zero VOC Interior Velvet Paint EVER20 (<51 g/L VOC)
      c. PPG: 6-411 Series Speedhide Interior Enamel Eggshell Latex (73 g/L VOC), 1.5 – 1.7 mils dft/coat.
      d. S-W: ProMar 200 Zero VOC Interior Eggshell Paint B30-2600 (0 G/L VOC), 1.6 mils dft/coat minimum.

D. Ferrous Metal: Unless noted otherwise.
   1. Finish: Semi-Gloss latex enamel; primer and two finish coats.
   2. Primer:
      a. AN: Devoe Coatings Devflex 4020PF DTM Primer & Finish (75 g/L VOC), 2.2 – 3.5 mils dft.
      b. Moore: 363 IronClad Latex Low Lustre Metal & Wood Enamel (<150 g/L VOC), 1.6 mils dft minimum.
      c. PPG: 90-712 Series Pitt-Tech Interior/Exterior Primer/Finish DTM Industrial Enamel (123 g/L VOC), 2.0 – 3.0 mils dft.
      d. S-W: Pro Industrial Pro-Cryl Univeral Acrylic Primer B66-310 (<100 g/L VOC), 2.0 – 4.0 mils dft.
      e. KM: 5725 DTM Acrylic Metal Primer (125 g/L VOC) 1.5 - 2.0 mils dft.
      f. Comex: UltraTech C309 Universal Water-based Metal Primer (85g/L VOC) 1.5 - 2.0 mils dft.
   3. Finish Coats:
      a. AN: Glidden Ultra-Hide No VOC Interior Semi-Gloss Paint 1415 (0 g/L VOC), 1.3 dft/coat minimum.
      b. Moore: 276 Moorcraft Super Spec Latex Semi-Gloss Enamel (< 150 g/L), 1.2 mils dft/coat minimum.
      c. PPG: 6-500 Series Speedhide Interior Semi-Gloss Acrylic Latex (90 g/L VOC), 1.5 – 1.7 mild dft/coat.
      d. S-W: S-W: ProMar 200 Zero VOC Interior Latex Semi-Gloss Enamel B31-2600 (0 G/L VOC), 1.6 mils dft/coat minimum.
      e. KM: 2020 Green Coat –ZERO VOC- Interior Latex Semi-Gloss Enamel (0 g/L VOC) 1.7 - 2.2 mils dft.
      f. Comex: UltraTech C413 High Perf DTM Semi Gloss Acrylic (240g/L VOC) 1.5-2.0 mils dft/coat.

E. Ferrous Metal – Doors, Frames:
   1. Finish: Semi-gloss, waterborne light industrial coating; primer and two finish coats.
   2. Primer:
      a. AN: Devoe, Devflex 4020 Direct to Metal Primer & Flat Finish (91 g/L VOC) 2.2 – 3.5 mils dft.
      b. PPG: Pitt-Tech Plus, Int/Ext DTM Industrial Primer 90-912 (<90 g/L VOC) 2.0 – 4.0 mils dft.
      c. S-W: Pro Industrial Pro-Cryl Universal Acrylic Primer B66-310 (<100 g/L VOC) 2.0 – 4.0 mils dft.
   3. Finish Coats:
      a. AN: Devoe High Performance Devflex 4216 High Performance WB Acrylic Semi-Gloss Enamel 4216L (<150 g/L VOC) 2.0 – 4.0 mils dft/coat.
      b. PPG: Pitt-Glaze WB1, Pitt-Glaze WBI Int. Semi-Goss Acrylic Epoxy 16-510 (<100 g/L VOC) 1.5 mils dft/coat minimum.
      c. S-W: Pro Industrial, Pre-Catalyzed Waterbased Epoxy Semi-Gloss (<143 g/L VOC) 1.5 mils dft/coat minimum.

F. Ferrous Metal – Galvanized:
   1. Finish: Semi-Gloss latex enamel; primer and two finish coats.
   2. Primer:
      a. AN: Devoe Coatings Devflex 4020 DTM Primer & Finish (75 g/L VOC), 2.2 – 3.5 mils dft.
      b. Moore: 363 IronClad Latex Low Lustre Metal & Wood Enamel (<150 g/L VOC), 1.6 mils dft minimum.
      c. PPG: 90-712 Series Pitt-Tech Interior/Exterior Primer/Finish DTM Industrial Enamel (123 g/L VOC), 2.0 – 3.0 mils dft.
      d. S-W: Pro Industrial Pro-Cryl Univeral Acrylic Primer B66-310 (<100 g/L VOC), 2.0 – 4.0 mils dft.
      e. KM: 1725 Acry-Shield 100% Acrylic Metal Primer (100 g/L VOC) 1.5 - 2.0 mils dft.
      f. Comex: UltraTech C309 Universal Water-based Metal Primer (85g/L VOC) 1.5 - 2.0 mils dft.
   3. Finish Coats:
      a. AN: Glidden Ultra-Hide No VOC Interior Semi-Gloss Paint 1415 (0 g/L VOC), 1.3 dft/coat minimum.
      b. Moore: 276 Moorcraft Super Spec Latex Semi-Gloss Enamel (<150 g/L VOC), 1.2 mils dft/coat minimum.
      c. PPG: 6-500 Series Speedhide Interior Semi-Gloss Acrylic Latex (90 g/L VOC), 1.5 – 1.7 mild dft/coat.
      d. S-W: S-W: ProMar 200 Zero VOC Interior Latex Semi-Gloss Enamel B31-2600 (0 G/L VOC), 1.7 mils dft/coat minimum.
      e. KM: 2020 Green Coat –ZERO VOC- Interior Latex Semi-Gloss Enamel (0 g/L VOC) 1.7 - 2.2 mils dft/coat.
      f. Comex: UltraTech C136 Int Low Odor Zero VOC Semi-Gloss Finish (0g/L VOC) 1.5 - 2.0 mils dft/coat.

G. Concrete, Masonry, and Plaster:
   1. Finish: Semi-Gloss, three coat system.
   2. Basis-of-Design: Provide the following or comparable products:
      a. Block Filler: Heavy Duty Block Filler B42W46 Series or Luxon Block Surfacer A24W200.
      b. Primer: Loxon Concrete and Masonry Primer/Sealer A24W8300 Series.
      c. First Coat: Pro Industrial Acrylic B66-650 Series.
      d. Second Coat: Pro Industrial Acrylic B66-650 Series.
   3. Coats:
      a. Block Filler: DFT Minimum 8.8 mils.
         1) VOC: 50 g/l maximum.
         2) % Solids, Volume: 50%/55%.
         3) % Solids, Weight: 70%/60%.
      b. Primer: DFT Minimum 3.2 mils.
         1) VOC: 50 g/l maximum
         2) % Solids, Volume: 41%.
         3) % Solids, Weight: 55%.
      c. First Coat: DFT Minimum 1.7 mils.
         1) VOC: 50 g/l maximum.
         2) % Solids, Volume: 43%.
         3) % Solids, Weight: 54%.
      d. Second Coat: DFT Minimum 1.7 mils.
         1) VOC: 50 g/l maximum.
         2) % Solids, Volume: 42%.
         3) % Solids, Weight: 54%.

END OF SECTION

SECTION 10 11 00

VISUAL DISPLAY UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Wall mounted markerboards and tackboards assemblies.
   2. Markerboard accessories.

1.2 ACTION SUBMITTALS

A. Product Data: Technical data including construction details, material descriptions, dimensions of individual components and profiles, finishes, and accessories for visual display units.

B. Shop Drawings: Submit plans, elevations, sections, details, and attachment to other work.
   1. Show locations of panel joints. Show locations of field assembled joints for factory fabricated units too large to ship in one piece.
   2. Show locations and layout of special purpose graphics.
   3. Include sections of typical trim members.

C. Samples: Submit for each type of visual display unit indicated.
   1. Fabric: 12 inch square (305 mm square) off each fabric type and color.

D. Product Schedule: Submit visual display unit schedule using same designations indicated on Drawings.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: Submit data for visual display units to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An entity having minimum 5 years documented experience that employs installers and supervisors trained and approved by manufacturer.

B. Preinstallation Conference: Conduct conference at site.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver factory fabricated visual display units completely assembled in one piece. If dimensions exceed maximum manufactured unit size, or if unit size is impracticable to

ship in one piece, provide two or more pieces with joints in locations indicated on approved Shop Drawings.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install visual display units 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.

1.7 WARRANTY

A. Porcelain Enamel Face Sheets: Written warranty sighed by the manufacturer in which the manufacturer agrees to repair or replace porcelain enamel face sheets that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Surfaces lose original writing and erasing qualities.
      b. Surfaces exhibit crazing, cracking, or flaking.
   2. Warranty Period: 50 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Flame Spread Index: 25 or less.
   2. Smoke-Developed Index: 450 or less.

2.2 VISUAL DISPLAY BOARD ASSEMBLY

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. BestRite Chalkboards Company, MooreCo, Inc.
   2. Claridge Products and Equipment, Inc.
   3. PolyVision Corporation, a Steelcase company.
   4. US Porcelain Manufacturers.

B. Visual Display Board Assembly: Factory fabricated.
   1. Assembly: Markerboard and tackboard.
   2. Corners: Square.
   3. Width: Indicated on Drawings.
   4. Height: Indicated on Drawings.
   5. Mounting Method: Direct to wall.

C. Porcelain Enamel Markerboard Panels: Balanced, high pressure, factory laminated markerboard assembly of three ply construction, consisting of moisture barrier backing, core material, and porcelain enamel face sheet with low gloss finish. Laminate panels under heat and pressure with flexible waterproof adhesive.
   1. Panel Backing: Steel plate, minimum 0.021 inch (0.50 mm) uncoated base metal thickness.
   2. Porcelain Enamel Coating: 0.0025 inch (0.0635 mm) Nickel Cobalt primer; 0.003 inch (0.0762 m) thick writing surface; and 0.0025 inch (0.0635 mm) Nickel Cobalt ground coat, reverse side complying with O'Hammel Model M-894; ASTM C 346.
   3. Core: 7/16 inch (11 mm) MDF with moisture barrier backing.
   4. Laminating Adhesive: Moisture resistant thermoplastic type recommended by manufacturer.
   5. Joints: Concealed splice joints for writing surfaces or H-bar joint strip.
   6. Color: White.
   7. Basis of Design: Claridge LCS3.

D. Tackboard Panel: Vinyl fabric wrapped tackboard panel laminated to hardwood backing with wrapped edge.
   1. Fabric Wrapped Edge: Wrap edge of tackboard panel with fabric facing.
   2. Core: 1/4 inch (6 mm) thick hardboard.
   3. Color and Pattern: Selected by Architect.
   4. Basis of Design: Claridge 3400 Series.

E. Aluminum Frames and Trim: Fabricated from not less than 0.062 inch (1.57 mm) thick, extruded aluminum; standard size and shape.
   1. Field Applied Trim: Snap on trim with no visible screws or exposed joints.
   2. Aluminum Finish: Clear anodic finish.

F. Joints: Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, indicated on approved Shop Drawings.

G. Combination Assemblies: Provide hidden spline between abutting sections of visual display panels.

H. Chalktray: Continuous, solid type; extruded aluminum with ribbed section and smoothly curved exposed ends.

I. Special Purpose Graphics: Fuse or paint music staff lines graphic onto surface of visual display unit, in locations indicated.

2.3 ACCESSORIES

A. Accessory Starter Kit: Set of four dry erase markers, eraser, magnets, recommended board cleaner for each markerboard and glass writing surface.

B. Magnetic Marker Holder: Magnetic cup with eraser holder.

C. Markerboard Cleaner: Type recommended by marker board manufacturer.

2.4 MATERIALS

A. Porcelain Enamel Face Sheet: PEI-1002, with face sheet manufacturer's two or three coat process.

B. Vinyl Fabric: Mildew resistant, washable, complying with ASTM F 793/F 793M, Type II, burlap weave; weighing not less than 13 oz./sq. yd. (440 g/sq. m); with surface burning characteristics indicated.

C. Hardboard: ANSI A135.4, tempered.

D. Extruded Aluminum: ASTM B 221 (ASTM B 221M), Alloy 6063.

E. Adhesives for Field Application: Mildew resistant, nonstaining adhesive for use with specific type of panels, sheets, or assemblies; and for substrate application; as recommended in writing by visual display unit manufacturer.

2.5 FINISH REQUIREMENTS

A. Comply with NAAMM/NOMMA 500 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: Noticeable variations in same piece are unacceptable. 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.

2.6 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances, surface conditions of wall, and conditions affecting performance of the work. Examine walls and partitions for proper preparation and backing for visual display units. Proceed with installation after correcting unsatisfactory conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions for surface preparation.

B. Clean substrates of substances, including dirt, mold, and mildew, that impair the performance of and affect the smooth, finished surfaces of visual display boards.

C. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, projections, depressions, and substances that will impair bond between visual display units and wall surfaces.

D. Prime wall surfaces indicated to receive visual display units and as recommended in writing by primer/sealer manufacturer and visual display unit manufacturer.

3.3 INSTALLATION

A. Install visual display surfaces in locations and at mounting heights indicated on Drawings, or if not indicated, at heights indicated below. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

B. Factory Fabricated Visual Display Board Assemblies: Attach concealed clips, hangers, and grounds to wall surfaces and to visual display board assemblies with fasteners at not more than 16 inches (400 mm) o.c. Secure tops and bottoms of boards to walls.

C. Visual Display Board Assembly Mounting Heights: Install visual display units at mounting heights indicated on Drawings, or if not indicated, at heights indicated below.

1. Mounting Height for Grades K through 3: 24 inches (610mm) inches (mm) above finished floor to top of chalktray.
2. Mounting Height for Grades 4 through 6: 28 inches (711 mm) inches (mm) above finished floor to top of chalktray.
3. Mounting Height for Grades 7 and Higher: 36 (914) inches (mm) above finished floor to top of chalktray.

3.4 CLEANING AND PROTECTION

A. Clean visual display units in accordance with manufacturer's written instructions. Attach one removable cleaning instructions label to visual display unit in each room.

B. Touch up factory applied finishes to restore damaged or soiled areas.

C. Cover and protect visual display units after installation and cleaning.

END OF SECTION

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SECTION 10 21 13.19

PLASTIC TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Solid plastic toilet partitions configured as toilet enclosures and urinal screens.

1.2 ACTION SUBMITTALS

A. Product Data: Technical data including construction details, material descriptions, dimensions of individual components and profiles, and finishes for toilet compartments.

B. Shop Drawings: Submit plans, elevations, sections, details, and attachment details.
   1. Show locations of cutouts for compartment-mounted toilet accessories.
   2. Show locations of centerlines of toilet fixtures.
   3. Show locations of floor drains.

C. Samples: Upon requires of Architect, submit actual sample of finished products for each type of toilet compartment indicated.
   1. Size: 6 inch (152 mm) square, of same thickness indicated for work.

D. Product Schedule: Submit schedule prepared by or under the supervision of supplier, detailing location and selected colors for toilet compartment material.

1.3 INFORMATIONAL SUBMITTALS

A. Certificates:
   1. Product Certificates: Submit for each type of toilet compartment by manufacturer.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: Submit data to include in maintenance manuals.

1.5 COORDINATION

A. Coordinate requirements for blocking, reinforcing, and other supports concealed within wall.

1.6 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements, and coordinate before fabrication.

1.7 WARRANTY

A. Written warranty signed by manufacturer in which manufacturer agrees to repair or replace components of toilet enclosure units that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including detachment of components from each other or from the substrates, delamination, and permanent deformation beyond normal use.
      b. Deterioration of metals, metal finishes, plastics, and materials beyond normal use.
   2. Warranty Period: Five years from date of Substantial Completion.

1.8 EXTRA MATERIALS

A. Extra Stock Material: Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Door Hinges: One hinge(s) with associated fasteners.
   2. Latch and Keeper: One latch(es) and keeper(s) with associated fasteners.
   3. Door Bumper: One bumper(s) with associated fasteners.
   4. Door Pull: One door pull(s) with associated fasteners.
   5. Fasteners: 10 fasteners of each size and type.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire Performance: Tested in accordance with, and pass the acceptance criteria of, NFPA 286.

B. Accessibility Requirements: Comply with applicable requirements.
   1. U.S. Architectural and Transportation Barriers Compliance Board Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG) 2010.
   2. ICC/ANSI A117.1 Accessible and Useable Building and Facilities.
   3. Texas Accessibility Standards.

2.2 SOLID PLASTIC TOILET PARTITIONS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Accurate Partitions Corp., an ASI Group Company.
   2. AJW Architectural Products.
   3. American Sanitary Partition Corporation.
   4. Ampco by AJW.
   5. General Partitions Mfg. Corp.

6. Global Partitions Corp., an ASI Group Company.
7. Hadrian Manufacturing Inc.
8. Marlite.
9. PSISC.
10. Scranton Products.
11. Weis-Robart Partitions, Inc.

B. Toilet Enclosure Style: Overhead braced.

C. Urinal Screen Style: Wall hung.

D. Door, Panel , Screen, and Pilaster Construction: Solid, high density polyethylene (HDPE) panel material, not less than 1 inch (25 mm) thick, seamless, with eased edges, no sightline system, and with homogenous color and pattern throughout thickness of material.
1. Color and Pattern: One color and pattern in each room.

E. Pilaster Shoes: Polymer or Stainless steel.
1. Polymer Color and Pattern: Matching pilaster.

F. Brackets (Fittings):
1. Full Height (Continuous) Type: Standard design; stainless steel.

G. Overhead Cross Bracing for Ceiling Hung Units: As recommended by manufacturer and fabricated from solid polymer.

2.3 HARDWARE AND ACCESSORIES

A. Hardware and Accessories, Heavy Duty: Heavy duty operating hardware and accessories.
1. Hinges: Minimum 0.062 inch (1.59 mm) thick stainless steel continuous, cam type that swings to a closed or partially open position, allowing emergency access by lifting door. Mount with through bolts.
2. Latch and Keeper: Heavy duty, surface mounted, cast stainless steel latch unit, designed to resist damage due to slamming, with combination rubber faced door strike and keeper, and with provision for emergency access. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible. Mount with through bolts.
3. Coat Hook: Heavy duty combination cast stainless steel hook and rubber tipped bumper, sized to prevent inswinging door from hitting compartment mounted accessories. Mount with through bolts.
4. Door Bumper: Heavy duty, rubber tipped, cast stainless steel bumper at outswinging doors. Mount with through bolts.
5. Door Pull: Heavy duty, cast stainless steel pull at outswinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible. Mount with through bolts.

B. Overhead Bracing: Standard continuous, extruded aluminum head rail with antigrip profile and in manufacturer's standard finish.

C. Anchorages and Fasteners: Standard exposed fasteners of stainless steel, finished to match the items that are being secured, 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 compatible with related materials.

2.4 MATERIALS

A. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304, stretcher leveled standard of flatness.

B. Stainless Steel Castings: ASTM A743/A743M.

2.5 FABRICATION

A. Fabrication: Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories where required for attachment of toilet accessories.

B. Overhead Braced Units: Provide corrosion resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.

C. Door Size and Swings: Unless otherwise indicated, provide 24 inch (610 mm) wide, inswinging doors for standard toilet compartments and 36 inch (914 mm) wide, outswinging doors with a minimum 32 inch (813 mm) wide, clear opening for compartments designated as accessible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.
   1. Confirm location and adequacy of blocking and supports required for installation.

B. Proceed with installation after correcting unsatisfactory conditions.

3.2 INSTALLATION OF PLASTIC TOILET COMPARTMENTS

A. 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:
      a. Pilasters and Panels: 1/2 inch (13 mm).
      b. Panels and Walls: 1 inch (25 mm).

2. Full Height (Continuous) Brackets: Secure panels to walls and to pilasters with full height brackets.
   a. Locate bracket fasteners, so holes for wall anchors occur in masonry or tile joints.
   b. Align brackets at pilasters with brackets at walls.

B. Overhead Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches (44 mm) into 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.

3.3 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on inswinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on outswinging doors to return doors to fully closed position.

END OF SECTION

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SECTION 10 28 13

TOILET ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes.
   1. Toilet accessories.
   2. Underlavatory guards.
   3. Custodial accessories.

B. Related Requirements:
   1. Section 08 83 00 "Mirrors" for frameless mirrors.

1.2 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
   2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
   3. Include electrical characteristics.

B. Samples: Full size, for each exposed product and for each finish specified.
   1. Approved full-size Samples will be returned and may be used in the Work.

C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
   1. Identify locations using room designations indicated.
   2. Identify accessories using designations indicated.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For accessories to include in maintenance manuals.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver accessories to site until rooms in which they are to be installed are ready to receive them.

B. Pack accessories individually in a manner to protect accessory and its finish.

C. Deliver materials in original unopened containers and store in enclosed location providing protection from damage and exposure to elements.

D. Damaged or deteriorated materials shall be removed from premises.

1.6 PROTECTION

A. Protect adjacent or adjoining finished surfaces and work from damage during installation of work of this section.

1.7 WARRANTY

A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, visible silver spoilage defects.
   2. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 MATERIALS

A. Stainless Steel: ASTM A666, Type 304, 0.031-inch (0.8-mm) minimum nominal thickness unless otherwise indicated.

B. Brass: ASTM B19, flat products; ASTM B16/B16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B30, castings.

C. Steel Sheet: ASTM A1008/A1008M, Designation CS (cold rolled, commercial steel), 0.036-inch (0.9-mm) minimum nominal thickness.

D. Galvanized-Steel Sheet: ASTM A653/A653M, with G60 (Z180) hot-dip zinc coating.

E. Galvanized-Steel Mounting Devices: ASTM A153/A153M, hot-dip galvanized after fabrication.

F. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.

G. Chrome Plating: ASTM B456, Service Condition Number SC 2 (moderate service).

H. Mirrors: ASTM C1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.3 TOILET ACCESSORIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. American Specialties, Inc.
   2. Bobrick Washroom Equipment, Inc.
   3. Bradley Corporation.

B. Grab Bars:
   1. Material: 1-1/2" diameter stainless steel, 18 gage, Type 304, brushed satin finish with peened gripping surface.
   2. Mounting: Concealed plates, without exposed fasteners; concealed anchor kit for type of wall.
   3. Products: Subject to compliance with requirements, provide one of the following:
      a. 36" Units: Toilet Compartments:
         1) B-6806.99 x 36 by Bobrick
         2) ASI 3801-36P
         3) Bradley 812-2-001-36 (Safety-Grip Finish)
      b. 42" Units: Toilet Compartments:
         1) B-6806.99 x 42 by Bobrick
         2) ASI 3801-42P
         3) Bradley 812-2-001-42 (Safety-Grip Finish)
      c. Shower:
         1) B-68616 by Bobrick
         2) ASI 3850

C. Toilet Tissue Dispenser:
   1. Material: Heavy duty cast aluminum, satin finish; molded plastic spindles; concealed locking device.
   2. Mounting: Surface.
   3. Capacity: Two toilet paper rolls.
   4. Products: Subject to compliance with requirements, provide one of the following:
      a. B-2740 by Bobrick
      b. ASI 0264-1A
      c. Bradley 5241-50.

D. Feminine Napkin-Tampon Disposal:
   1. Material: 22 gage, Type 304 stainless steel, satin finish.
   2. Construction: Seamless flanges, welded, self-closing stainless steel door with piano hinge, tumbler lock.
   3. Mounting: Surface mounted.
   4. Products: Subject to compliance with requirements, provide one of the following:
      a. B-270 by Bobrick
      b. ASI 0852
      c. Bradley 4781-15.

E. Framed Mirrors:
   1. Material: One piece, roll-formed stainless steel angle frame, 1/2" x 1/2" x 1/2," Type 304, satin finish.
   2. Mirror: 1/4" thick float glass mirror electrolytically copper plated; 15-year guarantee.
   3. Mounting: Theft resistant, concealed wall hangers.
   4. Products: Subject to compliance with requirements, provide one of the following:
      a. B-165 Series by Bobrick
      b. ASI 0620
      c. Bradley 781.

2.4 UNDERLAVATORY GUARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Buckaroos, Inc.
   2. Plumberex Specialty Products, Inc.
   3. Truebro by IPS Corporation.

B. Underlavatory Guard:
   1. Description: Insulating pipe covering for supply and drain piping assemblies that prevents direct contact with and burns from piping; allow service access without removing coverings.
   2. Material and Finish: Antimicrobial, molded plastic, white.
   3. Products: Subject to compliance with requirements, provide one of the following:
      a. Buckaroos, Inc.; Soft-Guard P-Trap Protection Covers.
      b. Plumberex Specialty Products, Inc.; TRAP GEAR.
      c. Truebro by IPS Corporation; Lav Guard 2.

2.5 CUSTODIAL ACCESSORIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. American Specialties, Inc.
   2. Bobrick Washroom Equipment, Inc.
   3. Bradley Corporation.

B. Shelf with Mop and Broom Holders:
   1. Material: 18 gage stainless steel, Satin finish.
   2. Construction: 8" deep with four mop holders, three rag hooks and wet rag rod.
   3. Mounting: Surface.
   4. Products: Subject to compliance with requirements, provide one of the following:
      a. B-224 x 36" by Bobrick
      b. ASI 1315-4
      c. Bradley 9984.

C. Ladder and Pail Hooks:
   1. Material: 12 gage, Type 304 stainless steel, satin finish.
   2. Construction: Angle, with stiffener and 90 degree retaining lip.
   3. Products: Subject to compliance with requirements, provide one of the following:
      a. B-232 by Bobrick.
      b. ASI 1307-3 (24").
      c. Bradley 9943.

2.6 FABRICATION

A. Form exposed surfaces from one sheet of stock, free of joints. Form surfaces flat without distortion. Maintain flat surfaces without scratches or dents.

B. Fabricate recessed units with seamless one piece flange on exposed face. Weld corners leaving on open miters.

C. Weld and grind smooth joints of fabricated components.

D. Provide steel anchor plates and anchor components for installation on building finishes. Hot-dip galvanize ferrous metal anchors and fastening devices.

E. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Check openings scheduled to receive recessed units for correct dimensions, plumbness of blocking or frames and preparation that would affect installation of accessories.

B. Verify spacing of plumbing fixtures and toilet compartments that affect installation of accessories.

C. Verify with Architect exact location of accessories.

3.2 PREPARATION

A. Protect adjacent or adjoining finished surfaces and work from damage during installation of accessories.

B. Deliver inserts and rough-in frames at project site at appropriate time for building in. Provide templates and rough-in measurements as required.

3.3 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to ASTM F446.

C. Drill holes to correct size and application that is concealed by items with 1/4" tolerance.

D. Mount recessed accessories into wall openings with sheet metal screws into metal frames.

E. Mount surface mounted accessories to backup material with toggle bolts, plumb and align.

F. Anchor grab bars to through-wall anchor plates.

G. Use tamperproof fasteners.

3.4 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written instructions.

3.5 LOCATION SCHEDULE

A. Grab Bars: One for each handicapped toilet compartment.

B. Framed Mirrors: One above each lavatory.

C. Feminine Napkin-Tampon Disposal: One for each two female toilet compartment.

D. Custodial Accessories: One set for each janitor's closet.

END OF SECTION

SECTION 10 73 26

WALKWAY COVER

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Manufactured extruded aluminum walkway cover system, including framing, reinforcing, structural anchors, integral gutters and drains, and attachments.

1.2 SUBMITTALS

A. Product Data: Technical data including material descriptions, fabrication methods, dimensions of individual components, finishes, and field installation instructions.

B. Shop Drawings: Submit plans, elevations, sections, details of construction, attachment to other work, and installation methods, section module of wind loadbearing members, calculations for stresses and deflections under design loading.

C. Samples: Submit 12 inches (305 mm) long section with finish of corrugated aluminum roof panel, gutters, and posts; submit samples of interlocking deck joint, roof deck expansion joint, welded column or beam corner, beam cap, and rain cap.

D. Delegated Design Submittal: Submit for 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.

1.3 INFORMATIONAL SUBMITTALS

A. Certificates and Reports:
   1. Welding certificates.
   2. Mill certificates.
   3. Research/Evaluation Reports: ICC-ES reports for post installed anchors.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Welding: Qualify procedures and personnel according to the following:
      a. AWS D1.2/D1.2 M Structural Welding Code - Aluminum.
      b. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

B. Manufacturer's Qualifications: Manufacturer having minimum five years documented experience in engineering and fabrication of similar work.

C. Installer Qualifications: Entity having minimum five years documented experience who is approved by manufacturer.

D. Source Limitations: Obtain walkway cover and components from a single manufacturer.

1.5 COORDINATION

A. Supply inserts and anchoring devices for building into concrete and instruct other trade of proper location and position.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver components packaged and wrapped to prevent damaged or deformation. Package walkway cover for protection during transportation and handling.

B. Unload, store, and erect walkway cover components to prevent bending, warping, twisting, and surface damage.

C. Set walkway cover horizontally on platforms or pallets, covered with weathertight and ventilated covering. Store to ensure dryness, with positive slope for drainage of water. Do not store metal canopy in contact with materials that stain, dent, or cause surface damage.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify location and elevation of footings relative to finished grade, columns, and adjacent construction contiguous with walkway cover by field measurements before fabrication and indicate measurements on shop drawings.
   1. Established Dimensions: Where field measurements cannot be made without delaying the work, establish dimensions and proceed with fabricating walkway cover without field measurements.

1.8 WARRANTY

A. Walkway Cover Finish: Written warranty signed by manufacturer in which manufacturer agrees to repair finish or replace walkway cover components that show evidence of deterioration of factory applied finishes within specified warranty period.
   1. Finish Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer to design metal canopy system.

B. Structural Performance: Metal canopy shall withstand the effects of gravity loads and the indicated loads and stresses within limits and under conditions indicated.
   1. Design Loads: Indicated on Structural drawings.
   2. Wind Loads: Indicated on Structural drawings.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change: 120 degrees F (67 degrees C), ambient; 180 degrees F (100 degrees C), material surfaces.

D. Electrical Devices: Devices UL listed with wiring bearing UL classification and conforming to the current NEC,

2.2 MATERIALS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Avadek Walkway Cover Systems.
   2. American Walkway Covers, LLC.
   3. Mapes Industries.
   4. US Sunguard.

B. Aluminum Panel: Extruded aluminum, alloy 6063-T6, 0.078 inch (22 mm) thick, nominal 2-3/4 inch by 6 inches (70 mm by 150 mm) channel with interlocking joints to form corrugated roof deck panels.

C. Gutter and Fascia: Extruded aluminum alloy 6063-T6 0.125 inch (3mm) thick, nominal 3 inch (75 mm).

D. Roof Beams: 4-inch by 6-inch (100 mm by 150 mm), 4-inch by 8-inch (100 mm by 200 mm), and 6 inch by 10-inch (250 mm) extruded aluminum channel beams providing structural support and conductance for rainwater.

E. Columns: 6-inch by 10 inch (150 mm by 250 mm) extruded aluminum tubular posts 0.125 inch (3 mm) thick.

F. Fasteners: Stainless steel, of type and size required for loading and installation indicated.

G. Bituminous Paint: Cold applied asphalt mastic complying with SSPC-Paint 12 but containing no asbestos fibers, or cold applied asphalt emulsion complying with ASTM D 1187.

H. Concrete Mix: Compressive Strength: 3,000 psi at 28 days, ASTM C 94 portland cement concrete.

2.3 FABRICATION

A. Configuration: Refer to Drawings.

B. Factory fabricate walkway cover components for field assembly. Include necessary attachment devices and accessories.
   1. End Closures: Welded at cover terminations.

C. Rain Drainage: Fabricate framing system to drain water from fascia gutter, to support columns, and provide discharge spouts for designated columns at ground level.

D. Apply protective coating to aluminum in contact with grout.

2.4 FINISH

A. Comply with NAAMM Metal Finishes Manual for Architectural and Metal Products for recommendations for applying and designating finishes.

B. Aluminum Finishes: Finish designations prefixed by AA comply with system established by the Aluminum Association for designating aluminum finishes.
   1. Exposed Anodized Finish:
      a. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.
   2. Apply a coat of bituminous paint to concealed aluminum surfaces in contact with cementitious or dissimilar materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions for compliance with requirements for installation tolerances, walkway cover supports, and conditions affecting performance of the work.
   1. Examine framing to verify that angles, channels, studs, and structural panel support members and anchorage have been installed within alignment tolerances required by manufacturer.
   2. Examine walkway cover deck panels to verify that joints are supported by framing or blocking and that installation is within flatness tolerances required by manufacturer.

B. Examine embedded supports for components and system to verify actual locations of penetrations relative to seam locations of walkway cover before installation.

C. Proceed with installation after correcting unsatisfactory conditions.

3.2 PREPARATION

A. Erect walkway cover after concrete and masonry work in vicinity is completed and washed down.

3.3 INSTALLATION

A. Set posts on 10 feet (3.1 m) maximum centers in concrete footings. Ensure drainage is constructed so standing water will not discharge at downspout post bottoms.

B. Erect walkway cover in accordance with manufacturer's instructions including related flashings, concealed gutters and drains, fasteners, hardware, sealants, and material necessary for complete weathertight installation.

C. Weld beams and columns either into one piece rigid bents or shop build as mechanical joint. Install structural ties in tops of beams for rigidity and to serve as closures between draining deck sections.

D. Interlock sections in structural unit with joint fabricated into rigid shape which is self-flashing. Fasten interlocking joints rigidly with fastenings 8 inches on center. Assemble roof deck on simple spans of 15 feet (5m) or more with camber sufficient to neutralize deflection caused by dead load of material and to provide positive drainage from center of deck. No protruding ribs on underside of deck are permissible.

E. Form expansion joints with no metal to metal contact between deck and beam or clamps.

F. Fill downspout columns with grout to discharge level to prevent standing water. Vibrate with small rod to fill voids. Install downspout deflectors after grouting.

G. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

3.4 ADJUSTING

A. Remove temporary protective coverings and strippable films as walkway cover is installed unless otherwise indicated in manufacturer's written installation instructions. On completion of installation, clean finished surfaces as recommended by manufacturer. Maintain in a clean condition during construction.

B. Repair damage or scratches using same paint as factory finish.

C. Replace walkway cover components damaged or deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

3.5 CLEANING

A. Wash exposed surfaces using mild domestic detergent in warm water applied with soft cloths. Remove dirt from corners and interior surfaces.

END OF SECTION

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SECTION 11 73 10

SUPPORT STATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Restroom support station.

1.2 ACTION SUBMITTALS

A. Product Data: Technical data including construction details, material descriptions, dimensions of individual components, and finishes for lifts.

B. Shop Drawings: Submit plans, elevations, sections, details, and required clearances.
   1. Include room layouts showing location of lift system installation.
   2. Indicate dimensions, weights, loads, and points of load to building structure.
   3. Include details of equipment assemblies, method of field assembly, components, and location and size of each field connection.
   4. Indicate structural supports to the underside of structure with sealed structural calculations for the support of the track and its attachment to ceiling structure.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: Submit data for manufacturer and Installer.

1.4 WARRANTY

A. Written warranty signed by manufacturer in which manufacturer agrees to repair or replace components of lifts that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: Comply with applicable provisions in the USDOJ's 2010 ADA Standards for Accessible Design, the ABA standards of the Federal agency having jurisdiction, and ICC A117.1.

2.2 SUPPORT STATION

A. Basis-of-Design: Provide Rifton; K710 support station or comparable product.

B. Support station must provide front-leaning support during toileting and hygiene care for children and adults with disabilities by pivoting user 90 degrees with assistance. Must fold against wall when not in use.

C. Capacity: 250 pounds.

2.3 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.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions for compliance with requirements for installation tolerances, critical dimensions, and conditions affecting performance of the work.

B. Prepare written report listing conditions detrimental to performance.

C. Proceed with installation after correcting unsatisfactory conditions.

3.2 INSTALLATION

A. Test safety devices and verify smoothness of required protective enclosures and other surfaces.

END OF SECTION

SECTION 12 36 63

SOLID SURFACING COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Solid surface material countertops.
   2. Solid surface material backsplashes.
   3. Solid surface material end splashes.

B. Related Requirements:
   1. Applicable Division 06 Sections for architectural woodwork and fabricated cabinets onto which countertops are installed.

1.2 COORDINATION

A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

1.3 ACTION SUBMITTALS

A. Product Data: For countertop materials.

B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.
   1. Show locations and details of joints.
   2. Show direction of directional pattern, if any.

C. Samples for Verification: For the following products:
   1. Countertop material, 4 inches (100 mm) square.
   2. One full-size solid surface material countertop, with front edge and backsplash, 8 by 10 inches (200 by 250 mm), of construction and in configuration specified.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

1.5 CLOSEOUT SUBMITTALS

A. 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.

1.6 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.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

B. Environmental Limitations: Do not deliver or install countertops until building is enclosed, utility roughing-in and wet work are complete and dry, and temporary HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Durasein Solid Surface; a brand of Relang International, LLC.
   2. E. I. du Pont de Nemours and Company.
   3. Formica Corporation.
   4. LX Hausys (formerly LG Hausys).
   5. Meganite Inc.
   6. Wilsonart LLC.

B. Source Limitations: Obtain solid surfacing countertops, backsplashes, and end splashes from the same source from the same manufacturer.
   1. Obtain adhesives from solid surfacing material manufacturer.

2.2 MATERIALS

A. Solid Surface Material: Homogeneous-filled plastic resin complying with ICPA SS-1.
   1. Type: Provide Standard type unless Special Purpose type is indicated.
   2. Colors and Patterns: As indicated in Interior Finish Schedule on Drawings.

B. Low Emitting Materials: Provide products complying with applicable regulations regarding toxic and hazardous materials that complies with VOC content limits and emissions and chemical component limits.
   1. Adhesives and Sealants: Comply with the specified content limits and emissions.

C. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.

D. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

E. Countertop Grommets for Cable Passage: 2-inch (51-mm) OD, molded-plastic grommets and matching plastic caps with slot for wire passage.
   1. Acceptable Manufacturer: Doug Mockett & Company, Inc.
   2. Color: As selected by Architect from manufacturer’s full range.

2.3 COUNTERTOP FABRICATION

A. Fabricate countertops according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."
   1. Grade: Premium.

B. Configuration:
   1. Front: Straight, 1 1/2-inch (38-mm) laminated, slightly eased at top, unless otherwise indicated on Drawings.
   2. Backsplash: Straight, slightly eased at corner.
   3. End Splash: Matching backsplash.

C. Countertops: 1/2-inch- (12.7-mm-) thick, solid surface material with front edge built up with same material.

D. Backsplashes: 1/2-inch- (12.7-mm-) thick, solid surface material.

E. Fabricate tops with shop-applied edges unless otherwise indicated. Comply with solid surface material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
   1. Fabricate with loose backsplashes for field assembly.

F. Joints: Fabricate countertops in sections for joining in field as follows:
   1. Countertops less than 12 ft (3.65 m): Fabricate without joints.
   2. Countertops longer than 12 ft (3.65 m): Fabricate countertops in sections for joining in field, with joints at locations indicated on approved Shop Drawings.
   3. Joint Locations: Not within 18 inches (450 mm) of a sink or cooktop and not where a countertop section less than 36 inches (900 mm) long would result, unless unavoidable.
   4. Joint Type: Splined and Bonded, 1/32 inch (0.8 mm) or less in width.
      a. Accurately cut kerfs in edges at joints for insertion of metal splines to maintain alignment of surfaces at joints.

b. Make width of cuts slightly more than thickness of splines to provide snug fit. Provide at least three splines in each joint.

G. Cutouts and Holes:

1. Undercounter Plumbing Fixtures: Make cutouts for fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.
   a. Provide vertical edges, slightly eased at juncture of cutout edges with top and bottom surfaces of countertop and projecting 3/16 inch (5 mm) into fixture opening.
   b. Provide vertical edges, rounded to 3/8-inch (10-mm) radius at juncture of cutout edges with top surface of countertop, slightly eased at bottom, and projecting 3/16 inch (5 mm) into fixture opening.
   c. Provide 3/4-inch (20-mm) full bullnose edges projecting 3/8 inch (10 mm) into fixture opening.
2. Counter-Mounted Plumbing Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.
3. Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, and similar items.
4. Counter-Mounted Cooktops: Prepare countertops in shop for field cutting openings for cooktops. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.

2.4 INSTALLATION MATERIALS

A. Bonding Adhesive: Product furnished or recommended by solid surface material manufacturer.

B. Sealant for Countertops: Comply with applicable requirements in Section 07 92 00 "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to receive solid surface material countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install countertops 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. Countertops Fastened Directly to Cabinets:
   1. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Predrill holes for screws as recommended by manufacturer.
   2. 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. Countertops Installed Over Subtops:
   1. Fasten subtops to cabinets by screwing through subtops into cornerblocks of base cabinets. Shim as needed to align subtops in a level plane.
   2. 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.

D. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.
   1. Install metal splines in kerfs in countertop edges at joints. Fill kerfs with adhesive before inserting splines and remove excess immediately after adjoining units are drawn into position.
   2. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned and joints are of specified width.

E. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.

F. Install aprons to backing and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears. Fasten by screwing through backing. Predrill holes for screws as recommended by manufacturer.

G. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.
   1. Seal edges of cutouts in particleboard subtops by saturating with varnish.

H. Countertop Grommets:
   1. Drill countertops in field for grommets, in locations as directed by Owner.

I. Apply sealant to gaps at walls; comply with Section 07 92 00 "Joint Sealants."

END OF SECTION

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SECTION 13 34 23.14

FABRICATED CLASSROOM BUILDINGS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Provide a factory made, wood framed, classroom building(s).

1.2 SUBMITTALS

A. Product Data:
   1. Paint Colors: Exterior and interior. Include paint manufacturer's description of different types of paint.
   2. Roofing: Include profile, gauge, color and fastener system and perimeter trim.
   3. Siding: Include profile, material, thickness, color, and fastener system.
   4. Trim: Interior and exterior. Include material, profile, fasteners, and finish.
   5. Underlayment: For Roof, walls, and floorings.
   6. Light Fixtures: Submit manufacturer's catalog information, including appearance and electrical characteristics.
   7. Windows, Doors, and Hardware: Provide catalog cuts showing materials, function, and appearance.
   8. Interior Ceilings and Walls: Material, thickness, and finish colors.
   9. Structural Systems: State which codes will be met and materials to be used.

B. Shop Drawings: Floor plans, elevations, details, foundation plan, and anchor details drawing.

C. Door and Door Hardware Schedules: Submit together with product data.

D. Manufacturer's Qualification Statement.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than 10 years of documented experience.

PART 2 - PRODUCTS

2.1 BUILDING

A. Basis-of-Design: Palomar Modular Buildings.

B. Building Codes and Occupancy: As indicated on Drawings. Building Type VB.

C. Wood Construction Requirements:
   1. Wood Construction Materials: Comply with the following standards.
      a. PS1 - Construction & Industry Plywood 2009.
      b. PS 20 - American Softwood Lumber Standards 2010.
   2. Wood Treatment where called for by in the IBC and other applicable Codes:
      a. Treated Lumber & Plywood: Comply with Requirements of AMPA U-1 - Use Category System for Wood Treatment determined by use categories, expected service conditions, and specific applications.
         1) Fire-Retardant Treated Wood, if used : Mark each piece of wood with producer's stamp indicating compliance with specified requirements.

D. Interior Wall Construction:
   1. 2 by 4 standard & better studs, 16 inches on center with 2 by 4 single bottom plate and double top plate.
   2. Acoustical Insulation: Restrooms and where indicated on Drawings.
   3. Full height FRP panels over 5/8 inch vinyl cover gypsum.

E. Exterior Wall Construction:
   1. Wood Studs: 2 by 6 at 16 inches on center with double top and single bottom plates.
   2. Insulation: R-11.
   3. Exterior Sheathing: 7/16" OSB.
   4. Moisture Control: Building wrap.
   5. Exterior Siding: 29 ga steel pre-finished, panel loc +
   6. Interior Finish: Full height FRP panels over 5/8 inch vinyl cover gypsum.

F. Roof Construction:
   1. Roof: 45 mill EPDM Class C.
   2. Decking: 5/8 inch OSB
   3. Rafters: 2 by 10 at 24 inches on center
   4. Insulation: R-30.

G. Ceiling: 2 feet by 4 feet acoustical panel ceiling with 15/16 inch grid.

H. Exterior Doors:
   1. 3-foot by 6'-8" painted 18 ga. insulated steel door per door leaf.
   2. 16 ga knock down frame.
   3. Door Hardware:
      a. Three 4.5-inch by 4.5-inch NRP hinges per door leaf. Stainless steel base metal.
      b. 1 rim Grade 1 exit device per door leaf. 626.
      c. 1 key removeable mullion per pair of doors.
      d. 1 closer per door leaf with stop function. 689.
      e. 1 set of weather gasketing and threshold per door. Mill finish
   4. Door Lite: 6 inches by 27 inches. Insulated. Tempered. Clear.

I. Interior Doors:
   1. 3-foot by 6'-8" prefinished solid core wood door.
   2. 18 ga knock down frame.
   3. Door Hardware:
      a. Three 4.5-inch by 4.5-inch hinges per door leaf. Steel base metal.
      b. 1 Lock per Door: 626 unless noted otherwise.
         1) Classrooms: Office function lockset.
         2) Multi-User Restrooms:
            a) Deadbolt with classroom function.
            b) Push and pull plates. 630.
         3) Single-User Restrooms: Privacy set with emergency override.
      c. 1 closer per door leaf for multi-user restrooms. 689.
      d. Door Silencers: 3 for single leaf doors, 2 for pairs of doors.

J. Windows: 3-foot by 4-foot insulated clear low-e single hung aluminum frames. 1 inch mini blinds.

K. Insulation: Vinyl faced fiberglass batt insulation.

L. Interior Room Light Fixtures. 2-foot by 4-foot LED. Occupancy sensor for each room.

M. Cooling and Heating Units: Wall mounted packaged HVAC with electric heat strip, 1 phase. Ducted air supply. 7 day programable thermostats. Adjustable diffusers.

N. Exhaust fans for restrooms.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions: Verify that portable building is complete and ready for occupancy. Code officials may want to see the anchor bolts before the bottom trim is installed.

3.2 PREPARATION

A. Clean wood portable building before preparing for transit.

B. Prepare building to assure damage free transit.

C. Lock and block (with 2x4's) all doors and windows for transit.

3.3 INSTALLATION

A. Follow manufacturers advise for removing building off truck, place building, and connecting utilities.

B. Install each item in accordance with component manufacturer's instructions.

3.4 PROTECTION

A. Protect installed wood portable building from subsequent construction operations.

END OF SECTION

SECTION 22 00 10

BASIC PLUMBING REQUIREMENTS

PART 1 GENERAL

1.1 DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions, Division 01 Specifications, and Section 22 00 10, apply to this Section.

1.2 SECTION INCLUDES

A. Basic plumbing requirements necessary to provide complete installation of all Division 22 work.

1.3 WORK INCLUDED

A. This section of work comprises furnishing of all materials, equipment, tools, scaffolding, rigging, hoisting, labor, and transportation necessary for the complete installation of the plumbing systems as shown on the plans and as specified herein.

B. Bidders shall determine the contents of a complete set of drawings and specifications and be aware that they may be bidding from a partial set of drawings, applicable only to the various separate contracts, subcontracts, or trades as may be issued for bidding purposes only. The contract documents and the complete scope of work for the project are illustrated on the combined Architectural, Structural, Mechanical, Heating, Ventilating, Air Conditioning, Plumbing, and Electrical, and each Bidder shall thoroughly acquaint himself with all the details of the complete set of drawings and specifications before submitting his bid.

C. All drawings and specifications form a part of the contract documents for each separate contract and shall be considered as bound therewith in the event partial sets of plans and specifications are issued for bidding only. The submission of bids shall be deemed evidence of the review and examination of all drawings, specifications, and addenda issued for this project as no allowances will be made because of unfamiliarity with any portion of the complete set of documents.

D. Plumbing Contractor is responsible for all final connections to specified plumbing fixtures and all owner furnished equipment requiring plumbing (drain, water, gas, condensate, air).

1.4 RELATED SECTIONS

A. The conditions of the Division 01 requirements and the contract requirements which include the General Conditions and the Supplementary Conditions apply to the work of this division.

1.5 CODES & REFERENCE STANDARDS

A. General
   1. Perform all Division 22 work in strict accordance with the requirements and recommendations stated in the codes and standards except when requirements

are modified by the contract documents.
2. Nothing in the Contract Documents shall be construed to permit work not conforming to these codes.
3. When two or more codes or standards are applicable to the same work, then the stricter code or standard shall govern.
4. The date of the code or standard that is in effect on the date of issue of the contract documents except when a particular publication date is specified.
5. The Contractor shall be held responsible for verifying all local codes and ordinances that may alter any part of the plans or specifications. The Contractor shall bear all costs for correcting the deficiencies.
6. Where local codes and ordinances are not in writing or on record but a local precedence has been set, the Owner shall pay for any additional cost incurred.

1.6 APPLICABLE CODES AND STANDARDS FOR ALL DIVISIONS 22 WORK

A. International Building Code

B. International Gas Code

C. International Plumbing Code

D. International Mechanical Code

E. International Energy Conservation Code

F. National Electrical Code

G. American Society of Heating, Refrigerating and Air Conditioning Engineers Standards.

H. Occupational Safety and Health Administration Standards:
1. OSHA Standard 2207 - Construction Industry Standards
2. OSHA 29 CFR Part 1926 - Regulation of Excavation
3. Texas Underground Facility Damage Prevention Act (H.B. 2295)
4. All other applicable standards

I. National Fire Protection Association:
1. NFPA 90A Installation of Air Conditioning and Ventilating Systems

J. Fire Sprinkler System:
1. NFPA 13
2. NFPA 14
3. NFPA 101 Section 8-3
4. All other applicable codes

K. National Appliance Energy Conservation Act of 1987

L. Texas State Board of Insurance Standards

M. Clean Air Act and Clean Air Act Amendments of 1990

N. State Codes:
1. Texas Department of Labor Boiler Rules and Regulations
2. All other applicable codes

O. Local Municipal Codes and Ordinances

P. Schedule of Abbreviations:
   1. Reference Standards are listed in Division 22 using the abbreviations listed below:
      a. AABC (NSTSB) - Associated Air Balance Council
      b. AASHTO - American Association of State Highway and Transportation Officials
      c. ADA - Americans with Disabilities Act
      d. AGA - American Gas Association
      e. ANSI - American National Standards Institute
      f. ASME - American Society of Mechanical Engineers
      g. ASPE - American Society of Plumbing Engineers
      h. ASTM - American Society for Testing and Materials
      i. AWE - American Welding Society
      j. AWWA - American Water Works Association
      k. CISPI - Cast Iron Soil Pipe Institute
      l. CS - Commercial Standard
      m. CSA - Canadian Standards Association
      n. DIPRA - Ductile Iron Pipe Research Association
      o. DOT - Department of Transportation
      p. DOC - Department of Commerce
      q. FCC - Federal Communications Commission
      r. FM - Factory Mutual
      s. FS - Federal Specification
      t. IBC - International Building Code
      u. ITL - Independent Testing Laboratories
      v. NEC - National Electric Code
      w. NFPA - National Fire Protection Association
      x. NSF - National Sanitation Foundation
      y. OSHA - Occupational Safety and Health Administration
      z. PDI - Plumbing and Drainage Institute
      aa. SMACNA - Sheet Metal and Air Conditioning National Association
      bb. Texas Department of Health
      cc. Texas Water Resource Commission
      dd. UL - Underwriters Laboratories

1.7 QUALITY ASSURANCE

A. Provide complete installations of all systems.

B. Furnish all items of equipment, material, and labor to complete the Contract even though each and every item necessary is not specifically mentioned or shown.

C. In case of any conflict between the specifications, plans, and ordinances, the ordinances shall govern.

D. All materials furnished under this Contract shall be new, free from defects of any kind, of the quality and design hereinafter specified, and shall conform to the standards of Underwriter`s Laboratories Inc., except for equipment which UL does not list or provide label service.

E. All plumbing equipment and fixtures shall be the same brand unless scheduled differently on plans.

1.8 CONTRACTOR`S RESPONSIBILITY

A. Erect barricades, protective fencing, and signs to prevent injury to personnel on-site.

B. Make permanent connection to utilities or existing lines. Determine depth and location, and bid accordingly.

C. Relocate and repair any existing lines cut by general construction work.

D. Pay all costs in connection with metering devices.

E. Plans do not show exact location and elevations of lines, nor do they show all offsets required.

F. Deviate from plans as required to conform to the general construction and provide proper grading.

G. Maintain all utility services during construction to existing portions of job that remain.

H. Procure and pay for all necessary permits or licenses to carry out the work.

I. Obtain and pay for all the necessary certificates of approval which must be delivered to the Architect before final acceptance of the work.

J. Periodically remove rubbish, clean or repair all surfaces marred by the work required under this contract.

K. Protect work from damage by other trades.

L. Make all tests required by law; pay all costs in connection with the testing.

M. Where job conditions require changes in indicated locations and arrangements, make such changes without extra cost to Owner.

N. Provide motor starters, controls, relays, all low-voltage wiring, conduit, and wiring related to plumbing and other equipment and devices to form a complete working system. See Division 26 00 00.

1.9 DEFINITIONS

A. Approval:
   1. It is understood that approval must be obtained from the Architect in writing before proceeding with the proposed work.
   2. Approval by the Architect of any changes, submitted by the Contractor will be considered as general only to aid the Contractor in expediting his work.

B. Contractor:
   1. The Contractor engaged to execute the work included in a particular section only, even though he may be technically described as a Subcontractor to the General Contractor.
   2. If the Contractor engaged to execute said work employs Sub-Contractors to perform various portions of the work included under this Section, he shall be held responsible for the execution of same, in full conformity with Contract Document

requirements.

3. The Contractor shall cooperate at all times and shall be responsible for the satisfactory cooperation of his Subcontractors with the other Contractors on the job so that all of the various phases of the work may be properly coordinated without unnecessary delays or damage to any parts of the work of any Contractor.

C. Provide:
   1. Defined as requiring the furnishing and installing of the item or facility indicated, complete in all respects, and ready for operation unless otherwise specifically noted.

1.10 WARRANTY

A. The Contractor shall warranty his work against defective materials and workmanship for a period of one year from date of acceptance of the job.

B. Neither the final payment nor any provisions in Contract Documents shall relieve the Contractor of the responsibility for faulty materials or workmanship.

C. He shall remedy any defects due thereto, and pay for any damage to other work resulting therefrom, which shall appear within a period of one year from date of substantial completion.

D. The Owner shall give notice of observed defects with reasonable promptness.

E. This Guarantee shall not be construed to include the normal maintenance of the various components of the system covered by these specifications.

1.11 SITE VISIT

A. Before submitting his proposal, each bidder shall examine all plans and specifications relating to the work, shall visit the site of the project, and become fully informed of the extent and character of the work required.

B. No consideration will be granted for any alleged misunderstanding of the materials to be furnished or the amount of work to be done, it being fully understood that the tender of a proposal carries with it the agreement to all items and conditions referred to herein, or indicated on the accompanying plans or required by nature of the site of which may be fairly implied as essential to the execution and completion of any and all parts of the work.

1.12 PROJECT RECORD DOCUMENTS

A. The Contractor shall keep a set of plans on the job, noting daily all changes made in connection with the final installation including exact dimensioned locations of all new and uncovered existing utility piping outside the building.

B. Upon submitting his request for final payment, he shall turn over to the Architect/Engineer, for subsequent transmittal to the Owner, a clean, neatly marked set of reproducible plans showing "as installed" work and an electronic file with changes of materials.

C. In addition to the above, the Contractor shall accumulate during the job`s progress the following data, in duplication (2 each), prepared in 3 ring binders of sufficient size, black in color, neat in appearance, and turned over to the Architect/Engineer for

checking and subsequent delivery to the Owner:

1. All warranties, guarantees, and manufacturer`s directions on equipment and material covered by the Contract.
2. Approved fixture brochures.
3. Copies of reviewed shop drawings.
4. Set of operating instructions. Operating instructions shall also include recommended maintenance.
5. Any and all other data and/or plans required during construction.
6. Repair parts lists of all major items and equipment including name, address, and telephone number of local supplier or agent.
7. The first page, or pages, shall have the names, addresses, and telephone numbers of the following:
   a. General Contractor and all sub-contractors.
   b. Major Equipment Suppliers.

1.13 TRAINING

A. Upon completion of the work and at a time designated by the Owner`s representative, provide a formal training session for the Owner`s operating personnel to include location, operation, and maintenance of all plumbing equipment and systems, some sections have further instructions.

B. Before proceeding with instruction, prepare a typed outline in triplicate listing the subjects that will be covered. Submit the outline for review by the Owner`s representative.

C. At the conclusion of the instruction, obtain the signatures of the attendees on each copy of the outline to signify that they have a proper understanding of the operation and maintenance of the system. Submit the signed outlines to the Owner`s representative and Engineer as a condition of final acceptance.

1.14 PLANS AND SPECIFICATIONS

A. The plans show diagrammatically the locations of the various lines, ducts, conduits, fixtures, and equipment and the method of connecting and controlling them.

B. It is not intended to show every connection in detail and all fittings required for a complete system.

C. The systems shall include but are not limited to the items shown on the plans.

D. Exact locations of these items shall be determined by reference to the general plans and measurements of the building and in cooperation with other Contractors, and in all cases, shall be subject to the approval of the Architect/Engineer.

E. The Architect/Engineer reserves the right to make any reasonable change in the location of any part of this work without additional cost to the Owner.

F. Contractor, subcontractor, vendors, and suppliers are required to waive subrogation against Owner and Engineer.

1.15 UTILITIES, LOCATIONS, AND ELEVATIONS

A. Locations and elevations of the various utilities within the scope of this work have been obtained from the City and/or other substantially reliable sources and are

offered separately from the Contract documents, as a general guide only, without guarantees as to accuracy.

B. The Contractor shall examine the site, shall verify to his own satisfaction the locations, elevations, and availability of all utilities and services required, and shall adequately inform himself as to their relation to the work; the submission of bids shall be deemed evidence thereof.

C. The Contractor shall coordinate all services with the Utility Companies during construction, coordinate changes made by Utility Companies to the design of project, and coordinate with the Owner, Architect/Engineer, and Utility the scheduling of any shutdowns or delays that may occur in providing service.

D. The Contractor shall verify location, conduct all necessary tests, inspections, coordinate with Owner`s representatives and utilities, and check for existing underground utilities and lines before ditching.

E. The Contractor shall be responsible for repair of any cut or damaged lines or utilities he uncovers. There are lines and utilities not shown on any plans.

F. Contractor is responsible for coordination of all existing and new utilities at site. Contractor is responsible for protecting and repairing any utilities damaged by installation of pipe. All existing and new landscaping/trees to remain and to be protected unless directed otherwise by Architect/Owner.

1.16 SUBSTITUTION OF PRODUCTS

A. Substitution of products specified herein will be considered only when a complete list of proposed alternative equipment is submitted to the Engineer in writing, supported by adequate technical and cost data. This includes a complete description of the proposed substitution, drawings, catalog cuts, performance data, test data, or any other data or information necessary for evaluation.

B. All proposed substitutions and data must be received by the Engineer no less than ten working days prior to the scheduled date for opening of bids.

C. The Engineer will consider all such submittals and the Architect will issue an addendum listing items that the Engineer considers acceptable. Only such items as specified or approved as acceptable will be installed on this project.

D. Manufacturers` names are listed herein and on the plans to establish a standard of quality and design. Where a manufacturer`s name is mentioned, products of other manufacturers will be acceptable, if, in the opinion of the Engineer, the substitute material is of equivalent quality or better than that of the material specified.

E. The Contractor`s Bid represents that the bid price is based solely upon the materials and equipment described in the Bid Documents (including addenda, if any) and that he contemplates no substitutions or extras.

F. Requests for substitution are understood to mean that the Contractor:
   1. Has personally investigated the proposed substitution and determined that it is equal or superior in all respects to that specified.
   2. Will provide the same guarantee for the substitution that he would for that specified.

3. Will, at no cost to the Owner, replace the substitute item with the specified product if the substitute item fails to perform satisfactorily.

G. After Award of the Contract, substitutions will be considered only under one or more of the following circumstances:
   1. The substitution is required for compliance with subsequent interpretations of code or insurance requirements.
   2. The specified product is unavailable through no fault of the Contractor.
   3. The manufacturer refuses to warranty the specified products as required.
   4. Subsequent information that the specified product is unable to perform properly or to fit in the designated space.
   5. In the Engineer`s sole judgment, the substitution would be in the Owner`s best interest.

H. Revisions to the plumbing system shall be under the supervision of the Engineer at a standard hourly rate charged by the Engineer and shall be paid by the Contractor originating the changes.

1.17 PROTECTION OF EQUIPMENT AND MATERIALS

A. The Contractor shall take such precautions as may be necessary to properly protect his apparatus from damage.

B. This shall include the creation of all required temporary shelters to adequately protect any apparatus above the floor of the construction and the covering of apparatus in the completed building with tarpaulins or other protective covering.

C. Failure to comply with the above to the satisfaction of the Owner`s inspector will be sufficient cause for the rejection of the equipment in question and its complete replacement by this Contractor.

D. All apparatus shall be cribbed up from the floor or ground by the Contractor and covered with tarpaulins or other protective covering where necessary or directed.

1.18 FINAL INSPECTION

A. It shall be the duty of this Contractor to make a careful inspection trip of the entire project, assuring himself that the work on the project is ready for final acceptance before calling upon the Architect/Engineer to make a final inspection.

B. To avoid delay of final acceptance of the work, the Contractor shall have all necessary bonds, warranties, receipts, affidavits, etc., called for in the various articles of these specifications, prepared and signed in advance, together with a letter of transmittal, listing each paper included, and shall deliver the same to the Architect/Engineer at or before the time of said final inspection. The Contractor is cautioned to check over each bond, receipt, etc., before preparing for submission to verify that the terms check with the requirements of the specifications.

1.19 CUTTING AND PATCHING

A. All Subcontractors shall notify the General Contractor sufficiently ahead of construction of any floors, walls, ceiling, roof, etc., of any openings that will be required for his work.

B. He shall see that all sleeves required for his work are set at proper times so as to avoid delay of the job.

C. All necessary cutting of walls, floors, partitions, ceilings, etc., as required for the proper installation of the work under this Contract shall be done at the Subcontractor`s expense in a neat and workmanlike manner, and as approved by the Architect/Engineer.

D. No joists, beams, girders, or columns shall be cut by any Contractor without first obtaining written permission of the Architect/Engineer.

E. Patching of openings and/or alterations shall be provided by the General Contractor.

F. All openings in firewalls and floors, such as thimbles, shall be completely sealed after installation for a completely airtight and watertight installation. Sealing material shall be non-combustible and UL approved. The installed sealing assembly shall not cause the fire rating of the penetrated structure to be decreased.

G. All openings in exterior walls shall be sealed watertight.

1.20 IDENTIFICATION

A. Refer to Section 22 05 54.

1.21 MANUFACTURER`S INSTRUCTIONS

A. All equipment and devices shall be installed in accordance with these plans and specifications, manufacturer`s instructions, and applicable codes.

B. Where specifications call for installation of a product to be in accordance with manufacturer`s instructions and/or where manufacturer`s instructions are required for installation of a product, it shall be the Contractor`s responsibility to obtain the necessary applicable manufacturer`s instructions and install the product in accordance with the manufacturer`s instructions.

C. It shall be the Contractor`s responsibility to install all equipment, materials, and devices shown on the plans and as called out in these specifications even if manufacturer`s instructions are absolutely unattainable.

1.22 RELATED WORK

A. The various specification sections for this division may or may not include related work listings.

B. All related work shall be coordinated and provided by the Contractor regardless of whether specifically identified or not.

1.23 ELECTRICAL WIRING AND EQUIPMENT FOR PLUMBING SYSTEMS

A. All wiring, conduit, boxes, equipment (controls, thermostats, relays, contactors, motor starters, heaters, switches), and any other control devices or equipment required to form a complete and properly operating system, shall be the responsibility of this Contractor.

B. The Electrical Contractor shall only provide line voltage (including hook-up) to all plumbing equipment.

C. All controls and devices shall be low voltage unless otherwise noted or shown on the plans. Where line voltage controls or devices are noted, the Contractor shall provide complete wiring diagrams (approved by the Engineer) to the Electrical Contractor prior to final hook-up.

D. The Plumbing and Electrical plans are based on the equipment and devices scheduled as shown on the plans or as called for in the specifications. Should any plumbing equipment or device be changed or approved from those which are shown or noted, all electrical and/or plumbing changes shall be made at the expense of the trade or Contractor initiating the change with no expense to the Owner, Architect, Engineer, or their representatives.

E. All wiring provided by this Contractor shall be installed in a workmanlike manner using tie wraps, labels, anchors and etc. Loose wiring is not acceptable.

F. All conduit and boxes required in all walls for control purposes (thermostats, switches, etc.) shall be provided by electrical contractor.

G. All conduit required in attic, clear spaces, or on roof shall be by electrical Contractor.

1.24 DEMOLITION AND REMODEL

A. It shall be the responsibility of this Contractor to see that all demolition and remodeling work involving his trade (including but not limited to plumbing piping, condensate lines, plumbing equipment, etc.) is accomplished in a manner and completeness to provide the appearance of new construction work.

B. Abandoned plumbing fixtures shall be removed and disposed of off-site in a legal manner.

C. Any usable equipment and/or structure damaged during demolition and remodel work shall be replaced.

D. All abandoned and/or otherwise unused piping shall be securely capped using materials of the same composition as the original piping.

E. No exposed piping and/or other materials will be permitted in the finished job.

F. Any abandoned piping which penetrates the slab in an exposed area shall be sealed and securely capped below the slab.

1.25 OPERATION PRIOR TO COMPLETION

A. When any piece of plumbing equipment is operable and the Contractor needs to operate the equipment, he may do so providing that he properly supervises the operation.

B. The warranty period shall, however, not commence until such time as the equipment is operated for the beneficial use of the Owner.

C. Regardless of whether or not the equipment has or has not been operated, the Contractor shall properly clean the equipment, install clean filter media, properly adjust and complete all punch list items before final acceptance by the Owner.

D. The date of acceptance and the start of the warranty may not be the same date.

1.26 SAFETY GUARDS

A. Contractor shall furnish and install all safety guards required. All belt driven equipment, projecting shafts, and other rotating parts shall be enclosed or adequately guarded.

1.27 FLAME SPREAD PROPERTIES OF MATERIALS

A. All materials and adhesives used for plumbing and insulation shall conform to NFPA and UL life and flame spread properties of materials.

B. The composite classifications shall not exceed 25 for a flame spread rating and 50 for a smoke developed rating as listed for the basic material, the finishes, adhesives, etc., specified for each system and shall be such when completely assembled.

1.28 ASBESTOS

A. No asbestos or asbestos containing materials shall be permitted in this project.

1.29 LEAD MATERIALS

A. No lead or lead containing materials shall be allowed in any domestic or potable water supply piping, valves, fixtures, components, equipment, or any other item.

1.30 REFRIGERANTS

A. Chlorofluorocarbons (CFCs) shall not be allowed in any equipment on this project.

B. Comply with ASHRAE Std 15 and ASHRAE Std 34.

1.31 REFRIGERANT RECOVERY AND RECYCLE

A. Refrigerants shall not be released to the environment.

B. Contractor shall provide recovery and recycle equipment that has been certified by the Electrical Testing Laboratories or Underwriters Laboratories.

C. Contractor shall also provide properly trained and certified (in accordance with EPA) personnel for refrigerant work during installation, demolition, start-up, servicing, etc.

1.32 ACCESS CLEARANCE

A. Proper access to all installed equipment shall be provided. This Contractor shall label all points of access immediately upon installation with a marker pen.

B. A minimum of 3 feet shall be maintained in front of all access points.

C. If another trade violates this space, this Contractor shall immediately notify the General Contractor to correct this condition.

D. When equipment is installed above lay-in ceiling this Contractor shall coordinate with the Ceiling Contractor to provide access without removing part of T-bar ceiling.

E. No speakers, lights, fire alarm equipment, etc. shall be installed in lay-in ceiling tiles where access is to be gained.

PART 2 PRODUCTS

2.1 NOT APPLICABLE

PART 3 EXECUTION

3.1 TESTING

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 sequence and operation throughout the range of operation regardless of the season the Contractor shall test all plumbing equipment.

B. Perform a smoke test on all sanitary sewers and camera all lines and provide owner with a videotape.

C. Perform gas piping pressure test to comply with HB 1611 and all required City or governing body tests.

D. Make adjustments as required to ensure proper functioning of all systems.

E. Special tests on individual systems are specified under individual sections.

3.2 AS BUILT DRAWINGS

A. Upon substantial completion, Contractor shall submit as-built drawings showing all deviations between contract drawings and actual installed conditions.

B. Show location of all valves in gas and water piping. Submit to Owner.

END OF SECTION

SECTION 22 00 90

PLUMBING SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 SUMMARY

A. This section supplements Division 01 Submittal Procedures and contains additional requirements applicable to Division 22 submittals.

1.2 SECTION INCLUDES

A. This section includes, but is not limited to:
   1. Plumbing submittal procedures
   2. List of required Division 22 submittals to the engineer
   3. This section applies only to the Division 22 specifications. Submittals required by other specification divisions are not included here, even though the same subcontractor may be providing work under other divisions.

1.3 RELATED SECTION

A. Division 01 - Submittal Procedures

1.4 DEFINITIONS

A. Product Data: Illustrations, standard schedules, performance charts, instructions, and brochures furnished by the contractor, subcontractor, manufacturer, or supplier to illustrate materials or equipment or to illustrate some portion of the work. Provide a summary of scheduled items with all data in schedules.

B. Shop Drawings: Drawings, diagrams, schedules, and other data specifically prepared for the work by the contractor, subcontractor, manufacturer, or supplier to illustrate some portion of the work.

C. Equipment/Material Submittal Package: A compilation of the product data, shop drawings, and other items as required by the specifications, submitted near the start of the work. Typically, the specifications require the initial submittal package to be submitted within a certain number of days after the work starts.

D. Quality Assurance Submittal: Items submitted before and during the execution of a particular portion of the work for the purpose of guarding against defects and deficiencies.

E. Quality Control Submittal: Items submitted at the completion of a particular portion of the work for the purpose of evaluating completed activities and elements of the work for conformance with contract requirements (e.g. start-up reports).

F. Closeout Submittals: Items submitted at or near the completion of the contract.

1.5 SUBMITTALS

A. The materials, workmanship, design, and arrangement of all work installed under this contract shall be subject to the review of the architect, engineer, and owner.

B. Manufacturers: Manufacturers submitted shall be as per the acceptable manufacturers listed in each specification section or referenced schedule. For additional manufacturers requiring approval, reference the Substitution of Products article in Section 22 00 10.

C. Required Submittals: Refer to the Submittals article of each individual Division 22 specification section for the required items to be submitted.

D. Contractor's Coordination Submittals: The contractor may require his subcontractors to provide drawings, setting diagrams, and similar information to help coordinate the project, but such data shall remain between the contractor and his subcontractors and will not be reviewed by the engineer.

E. Electronic Submittals: E-mail or other electronic forms of submittals from the contractor are required. The procedures described in this section shall be as follows:
   1. The contractor shall supply one electronic copy of the submittal.
   2. The electronic files will either be e-mailed to the architect or posted to a project management and information exchange website, depending on the architect's requirements. The architect and contractor can distribute copies of the files as desired.
   3. The engineer will retain an electronic copy of the submittal and all responses.

F. Coordination Correspondence: The contractor may desire to verify the acceptability of a particular item prior to assembling the initial submittal package. The contractor may send material directly to the engineer for comments and feedback. This communication will be treated as normal coordination correspondence and will not be tracked or documented as a formal submittal. The engineer may or may not respond to such correspondence. If the engineer agrees, in writing, to the use of a particular item, then that same material shall be included in the initial submittal package along with a copy of the correspondence.

G. Unapproved Products: If materials or equipment are installed before being reviewed and approved by the engineer, the contractor shall be liable for the removal and replacement of such unapproved materials and equipment, at no additional expense to the owner. Additionally, if the removal and replacement of unapproved materials or equipment necessitates the removal and replacement of other related materials or equipment, then the contractor shall be liable for the removal and replacement of the related materials and equipment at no additional expense to the owner.

H. Product Data:
   1. Where the content of manufacturer submittal literature includes data not pertinent to the submittal, clearly indicate which portions of the contents are being submitted for review. Catalogs, pamphlets, or other documents submitted to describe items on which review is being requested shall be specific and identifications in catalogs, pamphlets, etc., of items submitted shall be clearly made in a contrasting ink or highlighting. Data of a general nature shall not be acceptable.

I. Shop Drawings:
   1. Scale and measurements: Make shop drawings accurately to a scale sufficiently large to show all pertinent aspects of the item.
   2. Electronic shop drawing submittals are required.

3. Shop drawings must include domestic water entry rooms with backflow prevention and all water heater rooms.

1.6 QUALITY ASSURANCE/CONTROL SUBMITTALS

A. Quality assurance and quality control submittals may be in the form of documentation or may be in the form of completed physical work that is offered for review by the engineer, architect, or owner.

B. If documentation is the subject, then submit in a manner similar to the initial submittal package.

C. If completed physical work is the subject, then the work shall not be concealed, nor shall subsequent work be performed, until the engineer's representative has reviewed the work. If the work is concealed, or if subsequent work is performed, before the engineer's representative has reviewed the work, then the contractor shall be liable for removal and replacement at no additional expense to the owner.

D. Sequencing:
1. Within 30 calendar days after the contractor has received the owner's notice to proceed, provide the complete submittal package.
2. After the engineer has reviewed the submittal package, make necessary revisions to the submittals as directed by the engineer and resubmit.
3. After the submittal has been reviewed by the engineer, proceed to purchase materials and perform the work.

E. Scheduling:
1. Failure to submit items that meet the requirements of the contract documents in ample time for review shall not entitle the contractor to an extension of contract time, and no claim for extension by reason of such default shall be allowed. The contractor may be held liable for delays so occasioned.

PART 2 PRODUCTS

2.1 NOT APPLICABLE

PART 3 EXECUTION

3.1 SUBMITTALS

A. Make submittals of product data, shop drawings, samples, quality assurance submittals, quality control submittals, and other items in accordance with the requirements of this section, applicable sections in Division 22, and additional requirements of each individual Division 22 specification section.

B. Grouping of Submittals:
1. The submittal package shall be coordinated and included in a single submission. Multiple submissions are not acceptable except where prior written approval has been obtained from the engineer. Partial submittals may be rejected, without being reviewed, as not complying with the provisions of the contract.
2. In the case that multiple submissions are approved, it is the responsibility of the contractor to maintain and update a submittal checklist. The contractor shall ensure that all applicable submittal sections are submitted to the Engineer. If a submittal section is not submitted, it will be considered rejected until reviewed by

the Engineer.

3. If submittal sections are submitted as individual submittal files, the submittal sections will be grouped and returned as one file with one set of submittal responses.

C. Electronic Submittal Organization:
   1. Electronic submittals are to be submitted as a single PDF file. Within the PDF file, each section shall be bookmarked.
   2. Provide an electronic submittal cover sheet that lists at least the following:
      a. Project name
      b. Date
      c. Name and address of architect
      d. Name and address of engineer
      e. Name, address, and telephone number of prime contractor
      f. Name, address, and telephone number of HVAC contractor
      g. Name, address, and telephone number of HVAC supplier
   3. Provide an electronic index sheet listing all items submitted.
   4. The contractor shall call to the attention of the engineer, clouded in the submittal and noted after the index sheet, any instance in which the submittals are known to differ from the requirements of the contract documents.
   5. Organize all required items by specification section. The material for each specification section shall be organized as follows:
      a. Provide an electronic section cover sheet that lists the same information as the submittal cover sheet, plus the specification number and title and the name, address, and telephone number of the vendor or vendor's representative, if applicable.
      b. Refer to the individual Division 22 specification sections for any required organization of the submittal material within each submittal section.
      c. Bookmarked sections shall be arranged by specification section number in numerical order.
      d. Submit in accordance with these procedures and procedures described in Division 01 Submittal Procedures.
      e. Submittals not organized as described here may be rejected, without being reviewed, as not complying with the provisions of the contract.

D. Response to engineer's review:
   1. Review comments:
      a. Review comments of the engineer will either be shown on the returned sets to the contractor or shown on a document attached to the sets. If the comments are on an attached document, then the engineer will place a note on the submittal referring to the attached comments. In such cases, the engineer's signature will appear only on the attached document. If the attached, signed document becomes physically separated from the submittal, then the submittal will no longer be considered as being a reviewed submittal.
   2. Complete rejection:
      a. If the submittal is not complete or does not meet the requirements of this specification section, then the engineer may reject the entire submittal and return the submittal without further review or comment. In such cases, the entire submittal shall be completely revised and resubmitted. The resubmittal shall be given a new submittal number and shall be documented and processed as a separate submittal from the original.

3. Held for completion:
   a. If the submittal is not complete but is only missing some minor item, the engineer may, at the engineer's sole discretion, hold the submittal rather than rejecting and returning the submittal. In such cases, the engineer will notify the architect and contractor that the submittal is being held for completion. The contractor will be given a predetermined amount of time to provide the missing item. Upon receipt of the missing item, the engineer will insert the missing item into the submittal package and proceed with the review process.
4. Partial rejection:
   a. The engineer may reject only certain portions of the submittal. In such cases, only those rejected portions or items need to be revised and resubmitted.
5. Provide as corrected:
   a. The engineer may note a required change to a submitted item, but may not consider the change serious enough to require a resubmittal. In such cases, the engineer will note that the item is to be provided as noted or corrected. In such cases, the contractor may proceed to provide the item. However, if subsequent observations reveal that the noted change was not made, then the contractor shall be liable for removal and replacement of the item at no additional cost to the owner.
6. Reviewed without comment:
   a. The contractor may proceed to provide all materials and equipment.

E. Close-out Submittals:
   1. Provide close-out submittals in accordance with the requirements of Division 1.

Section	Submit on the following	1	2	3	4	Arch Sub #
22 05 24	**Valves - General**					
	Full port					
	Bronzed body					
	Ball valves					
22 05 30	**Pipe and Pipe Fittings - General**					
	Hangers					
	Dissimilar Metals Union					
	Unions					
	Escutcheons					
	Sleeves					
	Hanger rods					
	Concrete anchors					
	Beam Clamps					
	Fire Penetration Products					
22 05 54	**Plumbing Identification**					
	Valve tags and chains					
	Valve chart					

Section	Submit on the following	1	2	3	4	Arch Sub #
	Piping markers					
	18 gauge copper wire for underground gas piping					
	Equipment labels					
	Nametag fasteners					
	Underground warning tape					
22 07 20	**Piping Insulation**					
	Closed cell only in concrete masonry walls					
	2” wrap for concealed roof drain piping					
	2” wrap at roof drain deck pan					
	2” rigid on exposed roof drains or					
	2” wrap with PVC jacketing on exposed roof drains					
	Domestic hot and cold water pipe insulation					
	(1” for hot water and 1” for lines in exterior walls)					
	Flange, fitting, valve Insulation					
	Insulation metal shield					
	Sealant, adhesive, finish					
22 11 17	**Domestic Water Piping and Appurtenances**					
	Type K - underslab					
	Type L - underground/above slab					
	CPVC piping					
	PEX-A piping					
	Pipe Fittings					
	a. Up to 1-1/2”- 95-1/2% tin, 4% copper, 1/2% silver					
	b. 2” and up - SILFOS 15% silver, 80% copper, 5% phosphorus					
	c. Pressfit fittings					
	CPVC fittings					
	PEX-A with cold expansion fittings					
	PEX manifolds					
	Valves - same as valve general					
	Water hammer arrestors					

Section	Submit on the following	1	2	3	4	Arch Sub #
	Freeze protection heat trace					
22 13 17	**Soil, Waste and Sanitary Drain Piping and Appurtenances**					
	Schedule 40 PVC pipe and fittings					
	Schedule 40 cast iron pipe and fittings					
	No hub and bell spigot					
	CPVC/cast iron on first 20’ of dishwasher discharge					
	Cleanouts					
	Closet Flanges					
	Trap Guards					
	Trap primers					
	Pressure differential (automatic)					
	Electronic					
	Automatic flush valve					
	Plumbing Void Systems					
	Sand backfill embedment for C.I. Pipe					
	Pea gravel embedment for PVC pipe					
	Copper DWV on exposed kitchen indirect waste					
22 13 18	**Condensate Piping**					
	Copper type M or DWV					
	Schedule 40 PVC painted exterior w/ 4’-0” oc hangers					
	Schedule 40 CPVC painted exterior w/ 4’-0” oc hangers					
	Insulation thickness and thermal conductivity (K)					
	Hangers - see 22 05 30					
	Insulation - See piping insulation					
	Fittings, unions					
22 14 01	**Roof Drainage and Appurtenances**					
	Primary roof drains					
	Emergency roof drains					
	Schedule 40 PVC pipe and fittings					

Section	Submit on the following	1	2	3	4	Arch Sub #
	Schedule 40 cast iron pipe and fittings					
	Hangers - see 22 05 30					
	Schedule 40 perforated PVC pipe					
	Black Swan adhesive					
	Downspout Nozzles					
	Insulation - See piping insulation					
	Plumbing Void Systems					
	Sand embedment for cast iron pipe					
	Pea gravel embedment for PVC pipe					
22 15 14	**Compressed Air Piping (Shops)**					
	Reciprocating air compressor					
	Screw Air compressor					
	Compressed air piping and fittings					
	Filters					
	Regulators					
	Quick connections					
	Air reels					
	Refrigerated air dryers					
	Aftercoolers					
	Valves - see Valves General					
	Hangers - see 22 05 30					
22 16 01	**Natural Gas Piping and Appurtenances**					
	Schedule 40 black steel pipe and fittings					
	Gas regulators					
	Paint for roof and up wall installations					
	Cut off valves, unions, inspection ports					
	Polyethylene gas piping below grade					
	Roof supports					
22 16 03	**Propane Gas Piping and Fittings**					
	Black steel schedule 40 pipe and fittings					
	Gas regulators					

Section	Submit on the following	1	2	3	4	Arch Sub #
	Paint for roof and up wall installations					
	Polyethylene gas piping below grade					
	Cut off valves, unions, inspection ports					
	Roof supports					
22 33 34	**Access Doors**					
	Stainless steel for kitchens and locker/shower areas					
	Primer steel access doors for general use					
	Verify sizes per specification					
22 40 01	**Plumbing Fixtures and Carriers**					
	Water heaters					
	Gas-BTUH, tank size, electrical					
	Electric - KW size, electrical, tank size					
	Expansion tanks					
	Circulating pumps					
	Water closets - wall or floor mount					
	Urinals - wall mount					
	Lavatories - wall mount or counter mount					
	Floor drains and sinks					
	Mop sinks with stainless steel backsplash					
	Sinks-standard, ADA, TAS					
	Faucets-standard, ADA, TAS, sensor type					
	Electric water coolers-standard, ADA, TAS					
	Plaster traps					
	Oil and sand separators with alarm panel					
	Oil separators with alarm panel					
	Grease interceptors					
	Hose bibbs - exterior, interior, roof					
	Acid dilution basin					
	Carriers					

Section	Submit on the following	1	2	3	4	Arch Sub #
	Sump pumps - GPM, total head, electrical					
	Lift stations - GPM, total head, electrical					
	Commercial washer, dryer					
	Whirlpools					
	Showers - ADA, one, two, three, column					
	Thermostatic mixing valves					
	Wash fountains - 120 volt					
	Shop drawings for all water heater rooms and domestic water entry with RPZ backflow preventer, and booster pumps					
22 66 54	**Chemical Waste and Vent Piping**					
	CPVC acid waste piping and fittings					
	Schedule 40 acid waste pipe- Orion, Ipex, Fuseal, George Fischer, Zurn					
	Dilution Basins					
	Limestone					
	Acid floor drain					
	Inspectors Port					
	Hangers - See 22 05 30					

1 - Reviewed
2 - Furnish as corrected in comments, resubmit not required
3 - Revise and Resubmit based on comments
4 - Rejected based on comments

END OF SECTION

SECTION 22 05 20

GAUGES, METERS, AND THERMOMETERS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions, Division 01 Specifications, and Section 22 00 10, apply to this Section.

1.2 SECTION INCLUDES

A. Thermometers

B. Pressure gauges

C. Pete`s plugs

1.3 RELATED SECTIONS

A. Section 22 00 10 - Basic Plumbing Requirements

B. Section 22 05 30 - Pipe and Pipe Fittings - General

C. Section 22 33 34 - Access Doors

D. Section 22 40 01 - Plumbing Fixtures and Fixture Carriers

1.4 SUBMITTALS

A. Provide submittal data on all items specified in this section in accordance with Specification Section 22 00 10, General Conditions, and Division 01.

PART 2 PRODUCTS

2.1 THERMOMETERS

A. Type:
   1. 9" adjustable angle thermometer

B. Construction:
   1. Temperature range:
      a. Fahrenheit degrees as approved by the Engineer.
   2. Window:
      a. Unbreakable Plexiglas.
      b. Furnish with separable socket.
   3. Manufacturer/Model:
      a. Trerice BX91403 ½
      b. MILJOCO SX935

2.2 PRESSURE GAUGES

A. Type:
   1. 4" dial type pressure gauge

B. Manufacturer/Model:
   1. Trerice 500X
   2. MILJOCO P4509LX

C. Construction:
   1. Pressure range:
      a. As approved by the Engineer.
   2. Cast aluminum case
   3. Double strength clear glass window
   4. Stainless steel movement
   5. Phosphor bronze tube
   6. Brass socket
   7. Furnish with a Trerice No. 880 lever handle gauge cock.

D. Accuracy: 1/2 of 1% of scale range.

2.3 PETE`S PLUGS

A. Provide two sets of suitable pressure and temperature gauges for use with the plugs.

PART 3 EXECUTION

3.1 INSTALLATION

A. Furnish and install thermometers, pressure gauges, and Pete`s plugs where indicated on plans in accordance with manufacturer’s instructions.

B. Install thermometers at each pump for domestic hot water systems.

C. Install pressure gages across each pump over one horsepower.

END OF SECTION

SECTION 22 05 24

VALVES - GENERAL

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions, Division 01 Specifications, and Section 22 00 10, apply to this Section.

1.2 SECTION INCLUDES

A. General requirements for valves

1.3 RELATED SECTIONS

A. Section 22 00 10 - Basic Plumbing Requirements

B. Section 22 05 20 - Gauges, Meters, and Thermometers

C. Section 22 05 30 - Pipe and Pipe Fittings - General

D. Section 22 11 17 - Domestic Water Piping and Appurtenances

E. Section 22 16 01 - Natural Gas Piping and Appurtenances

1.4 REFERENCES

A. ASTM 763 - Standard Specification for Copper Alloy Sand Castings for Valve Applications

B. ASTM 61 - Standard Specification For Steam or Valve Bronze Castings

C. ASTM C27450 - Standard Specification for Brass Rod, Bar & Shapes

D. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges Pipe Fittings

E. ASTM A105/A105M - Standard Specification for Carbon Steel Forgings for Piping Applications

F. ASTM - American Society of Testing Materials

G. ASTM A216/A216M - Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High Temperature Service

H. ASTM B813 - Standard Specification for Liquid & Paste Fluxes for Soldering of Copper and Copper Alloy Tube

I. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings

J. ASTM B88 - Standard Specification for Seamless Copper Water Tube

K. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings

L. CSA - Canadian Standards Association

M. PDI - Plumbing & Drainage Institute

1.5 QUALITY ASSURANCE

A. Manufacturer to stamp valve to show that shell and seat tests have been successfully completed.

1.6 SUBMITTALS

A. Provide submittal data on all items specified in this section in accordance with Specification Section 22 00 10, General Conditions, and Division 01.

PART 2 PRODUCTS

2.1 MATERIAL SPECIFICATIONS

A. Bronze - 150 psi maximum: ASTM B62

B. Bronze - 300 psi maximum: ASTM B61

C. Cast Iron: ASTM A126, Class B

D. Cast Carbon Steel: ASTM A216/A216M, Grade WCB

E. Forged Carbon Steel: ASTM A105/A105M, Grade II

F. Brass - Lead free, dezincification resistant arsenical brass, 125 psi maximum, ASTM 763 or ASTM B283/B283M.

2.2 CONSTRUCTION

A. Provide valves designed for repacking under pressure when fully opened.

B. Equip with packing suitable for intended service.

C. Furnish with gland followers.

D. Provide valves rated greater than the design temperature and pressure for the intended system.

E. All domestic cold water and hot water valves 2" and less shall be full port ball valves with stainless steel ball.

F. All domestic cold water and hot water valves 2-1/2" and larger to gate valves.

2.3 MANUFACTURERS

A. Apollo

B. Crane

C. Grinnell

D. Jenkins

E. Jomar, T-100NGDZ

F. Kennedy

G. Milwaukee Valve Company

H. Nibco

I. Stockham

J. Walworth

K. Watts

L. Hammond

M. Kitz

PART 3 EXECUTION

3.1 INSTALLATION

A. Install valves and stops inaccessible locations.

B. Provide where shown or as required to make system complete and readily maintained.

C. Provide access doors for all inaccessible valves.

D. Provide as-built drawings locating all valves in gas and water lines.

END OF SECTION

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SECTION 22 05 30

PIPE AND PIPE FITTINGS - GENERAL

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions, Division 01 Specifications, and Section 22 00 10, apply to this Section.

1.2 SECTION INCLUDES

A. Pipe

B. Pipe fittings

1.3 RELATED SECTIONS

A. Section 22 00 10 - Basic Plumbing Requirements

B. Section 22 05 24 - Valves - General

C. Section 22 07 20 - Piping Insulation

D. Section 22 11 17 - Domestic Water Piping and Appurtenances

E. Section 22 13 17 - Soil, Waste, and Sanitary Drain Piping, Vent Piping, and Appurtenances

F. Section 22 13 18 - Condensate Piping

G. Section 22 14 01 - Roof Drainage Piping and Appurtenances

H. Section 22 15 14 - Compressed Air Piping (Shops)

I. Section 22 16 01 - Natural Gas Piping and Appurtenances

J. Section 22 40 01 - Plumbing Fixtures and Fixture Carriers

K. Section 22 66 54 - Chemical Waste and Vent Piping

1.4 REFERENCES

A. ASME - American Society of Mechanical Engineers

B. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings

C. ASTM D2665 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials

E. UL - Underwriters Laboratory

F. NFPA 90A & NFPA 90B - Installation of Air Conditioning & Ventilation Systems and Installation of Warm Air Heating and Air Conditioning Systems

G. CISPI-310 - Cast Iron Soil Pipe Institute

H. CSA - Canadian Standards Association

1.5 QUALITY ASSURANCE

A. Valves:
   1. All valves to be from a single manufacturer.

B. The welder, employed on this project, shall have passed qualification tests as prescribed by the National Pipe Welding Bureau, or other reputable testing laboratory using qualification procedures as recommended by the ASME Boiler Construction Code or the American Welding Society Standards.

1.6 SUBMITTALS

A. Provide submittal data on all items specified in this section in accordance with Specification Section 22 00 10, General Conditions, and Division 01.

B. Submit product data indicating dimensions, general assembly, and use.

PART 2 PRODUCTS

2.1 PIPE AND FITTINGS

A. The type of pipe and fittings necessary for each system are specified in the section on that system.

2.2 DISSIMILAR MATERIALS

A. Use approved adapters such as Di-Electric Unions manufactured for making piping connections between dissimilar materials such as copper and brass or copper and steel.

2.3 ESCUTCHEONS

A. Usage:
   1. All exposed lines passing through floors, walls, and ceilings.

B. Material:
   1. Chrome plated steel

C. Flange size:
   1. As necessary to cover penetrated openings.

D. Plate size:
   1. As necessary to fit pipe or insulation and securely lock in place.

E. Manufacturer/Model:
   1. Engineered Brass Company, Type CF

2.4 SLEEVES

A. Application:
   1. Provide sleeves for all pipes and conduits which pass through a concrete slab, masonry wall/concrete wall, sheetrock wall (fire rated or not fire rated), roof, or other portion of the building structure.

B. Above Grade and/or dry locations:
   1. Material:
      a. 20 or 22-gauge galvanized steel.
   2. Size:
      a. As necessary to allow free passage of the insulated pipe.

C. Below Grade and/or moist locations:
   1. Material:
      a. ASTM D2665 Schedule 40 PVC. When PVC not allowed by code, use schedule 40 galvanized steel.
      b. Return Air Plenum:
         1) Schedule 40 galvanized steel.

D. Passing through fire-rated enclosures:
   1. Material:
      a. Galvanized or black steel pipe.
      b. Non-combustible.
      c. PVC will not be allowed.

E. Penetration Seal: (All Sleeved Penetration Locations- fire rated or non-fire rated)
   1. Seal penetration with 3M Fire Barrier Sealant CP 25WB+ or one-component ceramic fiber-based putty fill, void, or cavity material, UL rated material classified for use in through-penetration firestop systems nos. 124, 125, 150, and 151.
   2. Flame Spread/Smoke Contribution:
      a. 0/0 in accordance with ASTM E84.

2.5 VALVES, UNIONS, STOP COCKS, ETC.

A. Applications:
   1. Ball Valves:
      a. Provide accessible valves at each group of plumbing fixtures and at each piece of equipment on all piping systems for isolation of fixtures and equipment. All valves shall be full port valves.

B. All Other Valves, Unions, Stop Cocks, Etc.:
   1. Provide at each group of plumbing fixtures and at each individual fixture, at each piece of equipment, at all inlet and outlet connections for hot and cold water and gas.
   2. Provide Di-Electric Unions at connection of dissimilar pipe materials to prevent electrolysis.

C. Type:
   1. Suitable for 125 lbs. working pressure.

2.6 PIPE SUPPORTS

A. Hangers:
   1. 2" and Smaller Piping:
      a. May be split cast ring type with fastening device in walls and chases.
   2. Copper Piping:
      a. Copper plated ferrous hangers.
   3. All Other Above Ceiling Locations:
      a. Adjustable clevis type. Hangers to accommodate circumference of pipe and saddles.

B. Hanger Rods:
   1. Type:
      a. Minimum 3/8 inch diameter with machine threads.

C. Minimum Steel Hanger Rod Diameter for Individually Suspended Horizontal Pipes:
   1. 2" and smaller diameter pipe:
      a. 3/8"
   2. 2-1/2" to 3 - 1/2" diameter pipe:
      a. 1/2"
   3. 4" to 5" diameter pipe:
      a. 5/8"
   4. 6" diameter pipe or larger:
      a. 3/4"

D. Hanger Manufacturers:
   1. Anvil
   2. Elcen
   3. ERICO
   4. F&S Manufacturing
   5. Fee & Mason
   6. PHD

E. In wall pipe supports:
   1. Metal strut, manufactured pipe clamps

F. In wall pipe support manufacturer:
   1. Holdrite or Equivalent

G. Refer to Specification Sections 22 13 17 and 22 14 01 for void system requirements.

PART 3 EXECUTION

3.1 PIPE INSTALLATION

A. Install piping in a neat and workmanlike manner.

B. Install each of the piping systems to provide for expansion and contraction.

C. Solder all joints when the system is not under strain.

D. Expansion Offsets:
   1. Copper Piping:
      a. Use developed length Copper Tube Handbook 411-R as published by Copper Development Association, Inc.
   2. Steel Piping:
      a. Use developed per Carrier System Design Manual, Part 3 Piping Design.

E. Furnish necessary spring pieces and offsets as required.

F. Conceal all of the piping systems in chases, above ceilings, in walls, and in finished areas.

G. Run Exposed piping only in machinery spaces and unfinished areas as specified or as shown on the plans.

H. Install all necessary fittings and offsets to hold the piping close to walls and ceilings.

I. Where these lines run exposed, obtain a clearance from the Engineer in writing before making the installation.

J. Install piping in the most advantageous manner possible with respect to headroom, valve access, openings, equipment clearances, and clearances for other work.

K. Give particular attention to piping in the vicinity of equipment.

L. Preserve the maximum access to various equipment parts for maintenance.

M. Do not cut or weaken any structural member.

N. Cut all pipes accurately to measurement determined at the site.

O. After cutting pipe, ream it to remove burrs.

P. Install piping neatly, free from unnecessary traps and pockets. Work into place without springing or forcing.

Q. Use fittings to make all changes in direction.

R. Field bending and mitering are prohibited.

S. Make all connections to equipment using flanged joints or unions.

T. Make reducing connections with reducing fittings only.

U. Do not allow piping to pass through or over designated electrical rooms or technology spaces.

V. Compression fittings are not allowed.

3.2 VALVES, UNIONS, STOP COCKS, ETC.

A. Locate all valves so that their bonnets may be easily removed.

B. Move all flange valves shown in horizontal positions so that valve stem is inclined one bolt hole above the horizontal position.

C. Make up all screwed pattern valves placed in horizontal lines so that their valve stem is inclined at an angle of 30 degrees above the horizontal position.

D. All valve stems must be true and straight at the time the system is tested for final acceptance.

E. Pack all valves and leave perfectly tight at the completion of the work.

F. Provide access doors as required for these valves.

G. Furnish locations of all access doors to the Architect/Engineer.

3.3 PIPING JOINTS

A. Screwed Pipe Joints:
   1. Provide full cut pipe threads.
   2. Assemble joints with an approved compound applied to only the male threads.
   3. Leave a maximum of three pipe threads exposed where the joint is assembled.

B. Welded Pipe Joints:
   1. Fuse weld by using a metallic arc welding process.
   2. Conform to the current recommendations of the American Welding Society for all welding operations.

C. Mechanical Coupling Joints for Copper Systems:
   1. Grooved-End-Tube Couplings: Ductile iron conforming to ASTM A536, Grade 65-45-12, coated with copper colored alkyd enamel. Housings cast with offsetting, angle-pattern bolt pads to provide rigidity. Coupling Gaskets: Grade “P” Fluoroelastomer compound with red and blue color code designed for operating temperatures from 0 deg F to +180 deg F.
      a. Center-leg gasket with pipe stop to ensure proper groove engagement, alignment, and pipe insertion depth.
      b. Installation Ready direct-push-installation.
      c. Reference shall always be made to the latest published Victaulic Selection Guide for Gaskets for proper gasket selection for the intended service.
      d. Basis of design Victaulic Style 607 or engineer approved equal.
   2. Fittings: Fittings shall be manufactured to copper tubing sizes, with grooves designed to accept grooved end couplings of the same manufacturer. Fittings shall be wrought copper, conforming to ASTM B75/B75M alloy C12200 or ASTM B-152 alloy C11000 and ANSI B16.22, or bronze sand-casting ANSI B16.18 and UNS-C89836. Victaulic Copper Connection Fittings.

D. Solder Joints:
   1. Assemble with square cut pipe using a pipe cutter.
   2. Hacksaw-cut pipe ends will not be acceptable.
   3. Ream open pipe end to full size.
   4. Burnish both the pipe and fitting absolutely clean.
   5. Apply brazing flux to both the pipe and the fittings.
   6. The use of corrosive acid flux will not be permitted.
   7. Charge the pipe and fittings with nitrogen gas during the brazing.

E. Hubless Cast Iron Soil Pipe Joints:
   1. Make with an approved neoprene gasket and stainless steel retaining sleeve.

2. Mark no-hub gaskets with the manufacturer`s name, ASTM C564, the word "No-Hub", nominal diameter, and the CI symbol of the Cast Iron Soil Institute indicating it meets the standard.
3. Mark stainless steel couplings for no-hub "All Stainless", name of manufacturer, words "No-Hub", nominal diameter, and the CI symbol indicating it conforms to CISPI 310.
4. Install the hubless cast iron soil pipe systems in accordance with CISPI Pamphlet 100 - Installation Suggestions for CI No-Hub Pipe and Fittings.
5. Provide identifying markers for stainless steel couplings and neoprene gaskets to indicate compliance with CISPI 310.

F. Positive-Seal One Piece Elastomeric Compression-Type Gasket:
1. May be used for joining hub and spigot cast iron soil pipe as an alternate for lead or oakum joints or for drainage and waste system above and below ground.
2. Form the joint by inserting an approved gasket in the hub.
3. Lubricate the inside of the gasket and push the spigot end of the pipe into the gasket until seated, thus effecting a positive seal.
4. Use neoprene compression gaskets for cast iron soil pipe, marked as such, with ASTM C564 and the CI symbol of Cast Iron Soil Pipe Institute to indicate the gasket meets the standard.

G. PVC Pipe Joints:
1. May be solvent cemented using the proper cement recommended for the particular materials.
2. Cut all pipe square and clean both pipe and fittings of all soil, dirt, oil, and grease.
3. Make solvent joints in accordance with the applicable ASTM Standards.
4. Allow joints to dry before testing.
5. If any leak occurs during the water test, then replace the defective joint.
6. Comply with requirements of the NSF Standard 14 for all solvent cements and primers and label to identify the laboratory certifying compliance for the particular cement and primer being used.
7. Plastic pipe and fittings for sewer and water pressure lines may also be joined by use of elastomeric (O-ring gasket) joints when the respective standards for the materials so specify. No-Hub fittings are not allowed on PVC sanitary sewer and storm drain piping under slab or underground.
8. Do not use pipes with cracked bells.
9. PVC pipe and pipe fittings are not allowed in any return air plenum serving mechanical systems. Use cast iron piping above slab for these installations.

3.4 SLEEVES

A. Above Grade and/or Dry Locations:
1. Walls:
   a. Mount flush on both sides.
2. Floors:
   a. Mount 2 inches above finished floor in pipe chases.

B. Below Grade and/or Moist Locations:
1. Install suitable flange in the center of wall or floor to form a waterproof passage.
2. Fill the void space around the pipe with jute twine or Oakum caulk or an asphalt based compound to insure a waterproof penetration.

C. Passing Through Fire-Rated Enclosure:
   1. Fill the void space around the pipe in accordance with NFPA requirements.
   2. Do not allow the sleeve installation to lower the fire rating of the assembly.

3.5 SECURING AND SUPPORTING OF PIPE

A. Support all pipe from the building structure by means of approved hangers and supports while maintaining required grade and pitch, preventing vibration, and providing for expansion and contraction.

B. Secure all hangers to approved inserts wherever possible.

C. Set hanger inserts in place when the concrete is poured.

D. If Joists Are Used for Attachment:
   1. 2" diameter or smaller:
      a. May be attached to the bottom of joists.
   2. Greater than 2" diameter:
      a. Must be attached to the top cord of the joists.
   3. Do not support any piping and trapeze hangers from joist bridging on roof and floor deck.

E. If Structural Steel Framing Is Used for Attachment:
   1. Use approved beam clamps.
   2. Where required, install channels to span between framing members.
   3. Do not attach hangers to the roof deck or cross bracing.

F. Hanger Spacing:
   1. Schedule 40 PVC Piping:
      a. All Sizes:
         1) 4`-0"
   2. Ferrous (Schedule 40) Piping:
      a. 1/2" diameter pipe:
         1) 6`-0" or less
      b. 3/4" diameter pipe:
         1) 8`-0" or less
      c. 1-1/4" diameter pipe:
         1) 10’-0” or less
      d. Vertical:
         1) Every Floor Level Minimum
   3. Copper (Water Tube) Piping:
      a. Smaller Than 1¼”:
         1) 6`-0"
      b. 1 ½” and Larger:
         1) 10`-0"
      c. Vertical:
         1) 10`-0"
   4. Cast Iron Piping:
      a. All pipe sizes:
         1) One hanger per length of pipe and not exceeding 5`-0" O.C.
      b. Vertical:
         1) Every Floor Level Minimum

G. Vertical Lines:
   1. Adequately support at their bases, either by a suitable hanger placed in the horizontal line near the riser or by a base fitting set on a pedestal or foundation.
   2. Support from each floor slab by means of an approved clamp-type support which bears on the slab or beam.

H. Change of Direction:
   1. Install supports within two feet of change of direction.
   2. Brackets of approved type may be used along the walls.
   3. Install hangers within 2 feet of each change in vertical or horizontal direction, pipe tees, and on each side of valves, strainers, etc.
   4. Multiple horizontal pipes, smaller than 12" diameter pipe, may be supported on trapeze hangers. Space trapeze hangers in accordance with the schedule for pipe spacing based upon the smallest size pipe.
   5. Properly size the trapeze members for the piping load they are to support. The number of pipes on the trapeze must be approved by the Engineer to prevent overloading of the building structure.
   6. Where pipes are insulated, oversize the hanger accordingly to accommodate the outside diameter of the insulation. Provide half-round 16 gauge galvanized steel shields, not less than 12" long and rolled to fit the insulation diameter, between the insulation and the hanger.
   7. When pipe is guided at top and bottom, cover the entire pipe circumference with metal shields.
   8. Adhere metal shield to the insulation so that the metal will not slide with respect to the insulation.
   9. Wood struts shall not be used to support piping in walls.

I. Refer to Specification Sections 22 13 17 and 22 14 01 for Plumbing Void Systems requirements.

3.6 EXCAVATION AND BACKFILLING

A. Excavation:
   1. Call utility companies before digging.
   2. Call Notifications Center before digging.
   3. Excavate trenches for underground piping to the required depths with bell holes being provided as necessary to ensure uniform bearing. Dig all bell holes after the trench has been graded.
   4. Refill excavation below the required grade of piping with fine granular material to the pipe grade.
   5. Where rock is encountered, excavate to a grade 3 inches below the lowermost part of the pipe and refill with fine granular materials to the pipe grade.
   6. Sheath, brace, pump or bail the trenches as required to protect workmen and structures and to permit execution of the work. A trench greater than 5 feet deep will not be permitted unless the sides are cut back at 45 degrees to 5 feet or less. If this cannot be accomplished, hire a Registered Engineer to design shoring.
   7. Install all underground piping below the frost line and in no case less than 18 inches below the surface.

B. Void System Under Piping:

1. Refer to Specification Sections 22 13 17 and 22 14 01 for Plumbing Void Systems requirements.

C. Sand Embedment:
1. Refer to Specification Sections 22 13 17 and 22 14 01 for Sand Embedment requirements for cast iron piping below slab.

D. Pea Gravel Embedment
1. Refer to Specification Sections 22 13 17 and 22 14 01 for Pea Gravel Embedment for schedule 40 PVC piping below slab.

3.7 EQUIPMENT PLUMBING CONNECTIONS

A. Make all final connections to all pieces of equipment which require natural gas, water, drain, waste, or vent connections.

B. Provide all required shut-off cocks, valves, drain valves, and traps.

3.8 TESTING AND INSPECTION

A. Perform all tests as specified in Division 22 or as required by the Engineer or by the Local, Federal, and State Bureaus having jurisdiction and under their supervision during the progress and upon completion of work.

B. Include costs of all required tests in your bid.

C. Provide all apparatus, temporary pipeline, and all other requirements necessary for such tests.

D. Take all due precautions to prevent damage to the building or its contents incurred by such tests as the Contractor will be required to repay and make good any damage so caused at his own expense.

E. Immediately repair any leaks, defects, or deficiencies discovered as a result of the tests. Repeat until test requirements are in full compliance.

3.9 IDENTIFICATION OF PIPING AND EQUIPMENT

A. Mark all piping to show the service and direction of flow.

B. Place markers at each branch of tees, at equipment connections, and change of direction and at 20-foot intervals. Minimum of one (1) marker in each room.

C. Install valve tags on all valves.

D. Frame under glass cover and hang a typewritten list including the valve number, type of service, and location of each valve in the boiler mechanical room.

E. Mark all valve numbers corresponding to this system of identification on the as-built drawings which will be delivered to the Owner upon completion of the work.

END OF SECTION

SECTION 22 05 54

PLUMBING IDENTIFICATION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions, Division 01 Specifications, and Section 22 00 10, apply to this Section.

1.2 SECTION INCLUDES

A. Identification required for plumbing systems.

B. Code required identification not shown on plans nor specified herein shall be provided.

1.3 RELATED SECTIONS

A. Section 22 00 10 - Basic Plumbing Requirements

B. Section 22 05 30 - Pipe and Pipe Fittings - General

1.4 SUBMITTALS

A. Provide submittal data on all items specified in this section in accordance with Specification Section 22 00 10, General Conditions, and Division 01.

B. Submit wording of nameplates with submittals.

C. Submit list of all products incorporated in this section.

1.5 REFERENCES

A. Comply with ANSI A13.1

B. USAS Code B31.8

C. NTSB-PSS-73-1

D. AGA

E. API

1.6 DESCRIPTION OF WORK

A. Provide signs for the following equipment identification:
   1. Water Heaters
   2. Piping
   3. Pumps
   4. Starters
   5. Valves

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Seton

B. Brady

C. Marking Services, Inc.

2.2 EQUIPMENT LABELS

A. Type:
   1. Engraving-Stock, melamine plastic laminate, 3 layer.
      a. Thickness:
         1) Less than 25 square inches: 1/16 inch
         2) 25 square inches or more: 1/8 inch

B. Color:
   1. Black

C. Conform to FS L-P-287

2.3 LETTERING

A. Style:
   1. Engraved standard print, unless otherwise indicated.

B. Size:
   1. 3/16 inch to 1/4 inch

C. Color:
   1. White letters, black background

2.4 SIGN INFORMATION

A. Plumbing Equipment:
   1. Unit mark from Drawings/Owner
   2. Voltage - Phase
   3. Manufacturer and Model Number

2.5 NAMEPLATE FASTENERS

A. Securely attach nameplates to equipment with non-corroding stainless steel screws.

B. Non-corroding pop rivets are acceptable.

C. Stick-ons or adhesives will not be allowed.

2.6 PIPING AND CONTROL DIAGRAM SIGNS

A. Material:
   1. 1/4 inch acrylic cover and backing screwed together with brass screw/bolts.
   2. Size:
      a. Minimum:

1) 12" x 17"
b. Maximum:
1) 24" x 36"

B. Provide a diagram in each mechanical room similar to the diagrams shown on the plans, and/or as required for the area served.

C. Provide pipe markers with the following features.
1. Letters from 1/2" to 3-1/2":
a. Size letters to afford readability from the appropriate viewing position.
2. Repeated and reversed words for viewing from 360º around pipe.
3. Self-clinging, coiled markers that snap into place around pipe and do not require any other securement.
4. Integral directional arrows.

D. Letters on Field:
1. Identify the specific material conveyed, e.g., "Domestic Cold Water", "Domestic Hot Water", etc.

E. Model:
1. Less than 3/4":
a. Tags, same as Paragraph. Piping System Devices, color codes for hazard.
2. 3/4" up to 6":
a. Seton Setmark SNA snap-on.
3. Over 6":
a. Seton Setmark STR strap-on, with stainless steel spring straps.
4. Use Seton Ultra-Mark for outdoor use.

F. Piping System Devices (Valves, Thermometers, Pressure Gages, etc., and Pipe Less Than 3/4"):
1. Identify with the following:
a. Tags:
1) Not less than 1-1/2 inch brass or aluminum tags, round, square, or octagonal.
b. Stamp tags with minimum 1/2" high descriptive characters, 1/2" high numbers with black enamel-filled indentations.

G. Attachment:
1. Stainless steel or solid brass jack chain; Seton JA16, or stainless steel or brass "S" hooks

H. Underground Warning Tapes:
1. Provide materials that meet the codes or have the approvals listed below:
a. Office of Pipeline Safety Regulation, USAS Code B31.8.
b. GSA Public Building Service Guide Specification.
c. National Transportation Safety Board Report NTSB-PSS-73-1.
d. AGA Report 72-D-56.
e. API Report API RP 1109.
2. Material:
a. Plastic, continuous tape, color-coded, marked for hazard.
b. For Non-metallic Piping System:
1) Aluminum foil core encased in plastic.
c. Metallic Piping:

1) Plastic tape.

3. Color:
   a. Colored (not printed color) plastic, coded for material conveyed by piping.
4. Width:
   a. As scheduled for piping system burial depth.
5. Legend:
   a. "Caution "System Name" Line Buried Below".
6. Tape Colors:

Utility	**Color**
Natural Gas, Oil, Dangerous Materials	Hi-Visibility Safety Yellow
Communications	Safety Alert Orange
Water Systems	Safety Precaution Blue
Sewer Systems	Safety Green

7. Model:
   a. Metallic Piping System: Seton Polyethylene Tape.
   b. Non-Metallic Piping System: Seton Metallic Detection Tape.

I. Underground Gas Piping:
   1. Attach No. 18 gauge copper tracer wire to the piping and terminate above grade at each end.

J. Pipeline Markers for Pipe Beneath Pavement and Slabs:
   1. Minimum 2" round, square, or octagonal, same as specified in Subparagraph: Piping System Devices.
   2. Attachment:
      a. 1-1/2" screw, bolted to tag as anchor.
      b. Anchor Setting Compound: Epoxy or epoxy grout, compatible with the pavement.

PART 3 EXECUTION

3.1 GENERAL

A. Contractor shall verify room numbers with Owner/Engineer before nameplates are fabricated.

B. The following shall be permanently and clearly identified:
   1. Each valve and pump.

3.2 INSTALLATION

A. Install signs on non-removable panels. Attach to equipment with pop rivets or stainless steel screws.

B. Mount in an easily visible location.

C. All labeling identification shall conform to final room numbers. Coordinate with General Contractor, Architect , and Owner to secure construction room numbers.

D. Provide all additional signage required by local authority at no cost to the Owner.

E. Complete installation in accordance with ANSI A13.1 and manufacturer`s installation instructions and with the Drawings. Fasten each unit securely in place with stainless steel screws.

F. Equipment Labeling:
   1. Install on scheduled items of equipment, including the following:
      a. Water heaters
      b. Pumps
      c. Control panels and major control components
      d. Other items of equipment
      e. Include Mark Number and descriptive name from Drawing and Specification schedules
      f. Attach with corrosion resistant, stainless steel screws or pop rivets
      g. Install 1/2" diameter adhesive marker (color to be approved by Architect), and apply to T-bar below any mechanical equipment, valves, and fire dampers above lay-in ceilings.
   2. Spacing:
      a. Where pipe passes through walls, floors, and other barriers.
      b. In Tunnel Vaults and Equipment Rooms:
         1) Maximum spacing, 10 feet; closer where piping is congested, and where piping continuity is obscured from view.
      c. Piping in Tunnels:
         1) Maximum spacing 100 feet
      d. Other Places:
         1) Maximum spacing 50 feet

G. Piping System Color Coding:
   1. Designate for painter the following:
      a. Types of piping services
      b. Direction of flow
      c. Other information required for proper identification.

H. Surfaces to be Painted:
   1. Bare piping
   2. Insulation covering of insulated piping

I. Paint according to the following schedule:

System	**Pastel Color**
Exposed Domestic Cold Water	Blue
Waste and Vent	None
Exposed Gas Piping	Black

J. Piping System Devices (Valves, Thermometers, Pressure Gages, etc.):
   1. Identify with the following information:
      a. System
      b. Device number
      c. Device Function
   2. Device Chart:
      a. Key devices to device chart
      b. Give complete description of device function and system.

K. Key devices to drawings as follows:
   1. Floor plans
   2. Schematic drawings of piping systems

L. Underground Warning Tapes:
1. Tape Widths:

Piping Burial Depth	Tape Width
10"	2"
20"	3"
27"	6"
30"	9"
40"	12"
50" or more	18"

M. Recommended Tape Bury Depth:
1. Minimum Depth:
   a. 6".
2. Distance Between Pipe and Tape:
   a. Minimum 12".
3. Maximum Depth:
   a. 12".

N. Tie tape to pipe where pipe leaves the ground.

O. Pipeline Markers for Pipe Beneath Pavement and Slabs.
1. Location:
   a. Accuracy:
      1) Plus or minus 6" from piping centerline.
   b. Flat Edge Pavement and Slabs:
      1) Set within 6" of pavement or slab edge.
   c. Concrete Curbs:
      1) Set in top of curb.
   d. Spacing:
      1) Each change in direction, each edge of pavement or slab, maximum spacing of 100`.

P. Legend:
1. Same as tags plus an engraved or stamped line; set marker with line parallel to buried line.

Q. Attachment:
1. Drill hole for anchor bolt, full depth of bolt plus 1/2"; set full tag and bolt in epoxy, flush with pavement or slab.

END OF SECTION

SECTION 22 07 20

PIPING INSULATION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions, Division 01 Specifications, and Section 22 00 10, apply to this Section.

1.2 SECTION INCLUDES

A. Fiberglass insulation
   1. Applications:
      a. Above ground domestic cold water
      b. Roof drains
      c. Horizontal portions of waste lines above grade which receive condensate from air handling units
      d. Condensate drain lines
      e. Domestic hot water piping
      f. Hot water storage tanks
      g. Storm shelter water supply tanks

B. Closed Cell Insulation
   1. Closed cell insulation for piping in concrete masonry unit walls only.

1.3 RELATED SECTIONS

A. Section 22 00 10 - Basic Plumbing Requirements

B. Section 22 11 17 - Domestic Water Piping and Appurtenances

C. Section 22 13 17 - Soil, Waste and Sanitary Drain Piping, Vent Piping and Appurtenances

D. Section 22 14 01 - Roof Drainage Piping and Appurtenances

1.4 SUBMITTALS

A. Product Data:
   1. Provide submittal data on all equipment specified in this section in accordance with Section 22 00 10, General Conditions, and Division 01.
   2. Submit product data indicating typical catalog of information.
   3. Submit product data sheets indicating dimensions, general assembly, and ratings.
   4. Submit manufacturer`s installation instructions and method of application.

1.5 REFERENCES

A. Refer to Section 22 00 10 for complete names of references identified in this section.
   1. ASTM E84 - Fire and Smoke Ratings
   2. ASTM C547 - Standard Specifications for Mineral Fiber Pipe Insulation

3. ASTM C585 - Standard Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System)
4. ASTM C795 - Standard Specifications for Thermal Insulation for Use in Contact with Austenitic Stainless Steel
5. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation
6. NFPA 255 - Surface Burning Characteristics of Building Materials
7. UL 723 - Composite Surface Burning Characteristics

1.6 DEFINITIONS

A. Concealed:
   1. Hidden from sight as in trenches, chases, furred spaces, walls, pipe shafts, or hung ceilings.

B. Exposed:
   1. Not "concealed" as defined above. Normally open and visible to building occupants (such as gymnasiums).

1.7 QUALITY ASSURANCE

A. Fire Hazard Rating:
   1. All insulation used on the project 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, or UL 723. Insulation used in plenums must be listed and labeled as such.
   2. These ratings must be tested on the composite of insulation, jacket or facing, and adhesive.
   3. Components such as adhesives, mastics, and cements must meet the same individual ratings as minimum requirements.

B. Quality Controls:
   1. All insulation shall be the product of reputable manufacturers.
   2. All insulation shall be applied by mechanics skilled in the use of various materials, and in the employ of a concern regularly engaged in the insulating business. Submit qualifications of insulator with insulation submittals.
   3. The materials shall be applied in accordance with the special materials as required by these specifications and by the manufacturer's standards.
   4. Poor workmanship or appearance will be cause for rejection.

C. Insulations shall not contain formaldehyde, asbestos, lead, mercury, mercury compounds, or polybrominated diphenyl ether fire retardants.

D. Fiberglass insulations shall have a minimum of 50 percent recycled glass content; certified and UL Validated.

E. Fiberglass insulations shall have a bio-based, formaldehyde-free binder and be UL GREENGUARD Gold certified.

PART 2 PRODUCTS

2.1 GENERAL

A. Pipe covering insulation shall be manufactured for the sizes required for the particular system and shall be suitable for installation on piping systems defined.

2.2 PIPE INSULATION

A. Fiberglass Insulation Manufacturers:
   1. Johns Manville
   2. Knauf Insulation
   3. Owens/Corning
   4. Manson Insulation

B. Thickness:
   1. Domestic Cold Water Piping:
      a. 1 ¼ inch pipe diameter or smaller: ½ inch thick
      b. 1 ½ inch pipe diameter or larger: 1 inch thick
   2. Condensate Lines:
      a. 1 ¼ inch pipe diameter or smaller: ½ inch thick
      b. 1 ½ inch pipe diameter or larger: 1 inch thick
   3. Waste Lines Which Receive Condensate:
      a. 1 ¼ inch pipe diameter or smaller: ½ inch thick
      b. 1 ½ inch pipe diameter or larger: 1 inch thick
   4. Roof Drain Piping: 2inch
   5. Domestic Hot Water Piping (Up to 140°F):
      a. 1 ¼ inch pipe diameter or smaller: 1 inch thick
      b. 1 ½ inch pipe diameter or larger: 1 ½ inch thick
   6. Outdoor Piping: 2 inch

C. Construction for fiberglass insulation (Above ground and crawlspace):
   1. Fiberglass preformed pipe covering insulation complying with ASTM C547, Type I (850 degrees F) or Type IV (1000 degrees F); ASTM C585, ASTM C411, ASTM C795, and UL/ULC Classified. Fiberglass bonded with a bio-based thermosetting resin.
   2. Provide insulation with factory applied, white ASJ SSL, vapor retarder jacket complying with ASTM C1136. Thermal conductivity ASTM C 335 (k-value) at 75 degrees F mean temperature shall be 0.23 Btu x in. /h x sq. ft. x degrees F, or less. Service temperature range of 0 degrees F minimum to 1000 degrees F maximum.
   3. Flame spread/Smoke-developed Rating (ASTM E84) of 25/50. Must be ULEnvironment GREENGUARD Gold certified and UL Validated Formaldehyde-free.

D. Closed Cell Insulation Manufacturers (for concrete masonry wall installations only):
   1. Armacell
   2. Aeroflex

E. Construction for Closed Cell Insulation (for concrete masonry wall installations only):
   1. Type: EPDM Closed-cell flexible elastomeric foam pipe insulation

a. Performance Criteria: Resistant to ultraviolet and biological degradation as demonstrated by ASTM G7 and ASTM G90.
b. Temperature Range: -90ºF to 220ºF
c. Water Vapor Permeability (Dry Cup): Less than 0.03 per inch when measured by ASTM E96/E96M.
d. Thermal Conductivity: 0.25 BTU-IN/HR-F2-ºF or less at 75ºF mean temperature

2.3 FLANGE, VALVE, AND FITTING INSULATION

A. PVC Fitting Covers/Jacket Manufacturers:
1. Proto LoSmoke PVC
2. Zeston PVC

B. Metal Fitting Cover/Jacket Manufacturers:
1. RPR Products
2. Ideal Products

C. Exposed Piping:
1. Provide molded or mitered covers with full thickness matching adjacent covering.
2. Finish with white glass, reinforced white vapor barrier coating, or white .020-inch thick PVC jacketing with self-seal lap.

D. 2½ Inch Diameter and Larger Concealed Piping:
1. Insulate fittings and valves with molded or mitered fitting covers.
2. Finish with white vapor barrier coating reinforced with white 10" x 10" reinforced mesh.

E. 2 Inch Diameter and Smaller Concealed Piping:
1. Insulate fittings and valves with mineral wool and insulating cement to a thickness equal to or greater than adjoining straight pipe.
2. Molded or mitered fittings finished with white vapor barrier coating reinforced with reinforced mesh may be provided.

F. Underground Piping (hot water only):
1. Provide mitered covers with full thickness matching adjacent covering.
2. Field fabricated miter joints are not acceptable.
3. No insulation is required on underground domestic cold water piping.

G. Outdoor Piping:
1. Metal jacketing shall be 0.016" minimum aluminum or stainless steel with moisture barrier, secured in accordance with jacket manufacturer`s recommendations.
2. Use preformed fitting covers matching jacket used on straight pipe, with all joints sealed with metal jacketing sealant.

2.4 SEALANT, ADHESIVE, AND FINISH

A. Sealant:
1. Manufacturers:
a. Foster 95-44
b. Childers CP-76
c. Vimasco Corporation
d. Mon-Eco Industries

2. Usage:
    a. Valve Covers
    b. Anchors
    c. Hangers
    d. Metal Jacketing
    e. Flashing Penetrations

B. Adhesive:
1. Manufacturers:
    a. Foster 85-20/85-60
    b. Childers CP-127
    c. Vimasco Corporation
    d. Mon-Eco Industries
2. Usage:
    a. Longitudinal laps of the vapor barrier jacket
    b. Butt joint covers.

C. Weather Barrier Mastic
1. Manufacturers:
    a. Foster 46-50
    b. Childers CP-10
    c. Vimasco Corporation
    d. Mon-Eco Industries
2. Usage:
    a. Used on above ambient piping/duct to protect insulation from weather.
    b. Use in conjunction with reinforcing mesh.

D. Vapor Barrier Coating:
1. Manufacturers:
    a. Foster 30-33 Vapor Out
    b. Childers CP-33 Chil Out
    c. Vimasco Corporation
    d. Mon-Eco Industries
2. Usage:
    a. Glass fabric reinforcement.
    b. Vapor stops.
    c. Completing factory installed vapor retarders.

E. Reinforcing Mesh
1. Manufacturers:
    a. Foster Mast Afab
    b. Childers Chil-glass #10
    c. Vimasco Corporation
    d. Mon-Eco Industries
2. Usage:
    a. Glass fabric reinforcement

2.5 INSULATION SHIELD

A. Field-fabricated:
1. Material:

a. High-density fiberglass insulation
2. Construction:
a. Insulation to support the bearing area at hangers and supports with a shield of galvanized metal extending not less than 4 inches on either side of the support bearing area, covering at least half of the pipe circumference. When pipe is guided at top and bottom, metal shields should cover the whole pipe circumference. Adhere metal shield to insulation so that metal will not slide with respect to insulation.
3. Schedule:
a. 3" and smaller pipe diameter:
1) 12-inch insulated section, 18 gauge metal shield
b. Greater than 3" pipe diameter:
1) 12-inch insulated section, 16 gauge metal shield

B. Factory-made:
1. Manufacturer:
a. Pipe Shields, Inc. or equal.
2. Type:
a. Proper shield for service and pipe span.
3. Construction:
a. Extend insulation at least 1 inch beyond metal.

C. Insulation shall not compress at hanger.

PART 3 EXECUTION

3.1 SITE INSPECTION

A. Before starting work under this section, carefully inspect the site and installed work of other trades and verify that such work is complete to the point where installation of materials and accessories under this section can begin.

B. Verify that all materials and accessories can be installed in accordance with project drawings and specifications and material manufacturers` recommendations.

C. Verify, by inspecting product labeling, submittal data, and/or certifications which may accompany the shipments, that all materials and accessories to be installed on the project comply with applicable specifications and standards and meet specified thermal and physical properties.

3.2 PROPERTIES

A. Ensure that all pipe and fitting surfaces over which insulation is to be installed are clean and dry. Remove materials that will adversely affect insulation application.

B. Ensure that insulation is clean, dry, and in good mechanical condition with all factory-applied vapor or weather barriers intact and undamaged. Wet, dirty, or damaged insulation shall not be acceptable for installation.

C. Ensure that pressure testing of piping and fittings has been completed prior to installing insulation.

3.3 INSTALLATION

A. General:
1. To ensure that it will achieve its highest possible performance and serve its intended purpose, install all insulation materials and accessories in accordance with manufacturer's published instructions (latest edition) and industry practices detailed by the North American Commercial and Industrial Insulation Standards Manual (latest edition). Install insulation on piping subsequent to installation of heat tracing, painting, and acceptance tests.
2. Install insulation on piping subsequent to installation of heat tracing, painting, and acceptance tests.
3. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with single cut piece to complete run. Do not use cut pieces or scraps abutting each other. Butt insulation joints firmly to ensure complete, tight fit over all piping surfaces.
4. Maintain the integrity of factory-applied vapor barrier jacketing on all pipe insulation, protecting it against puncture, tears, or other damage. All staples used on cold pipe insulation shall be coated with suitable vapor barrier coating to maintain vapor barrier integrity.
5. All cold water, hot water, and condensate drains routed in concrete masonry units shall be insulated using closed cell insulation as noted in this specification.

3.4 PIPE

A. Insulation size shall match pipe size.

B. Insulation to be continuous through wall and ceiling penetrations.

C. Apply insulation to clean, dry pipes.

D. Butt insulation joints firmly together and apply butt strip. All pipe insulation terminations shall be tapered and sealed.

E. Butt pipe insulation against hanger inserts. Seal jacketing according to type used.

F. Seal longitudinal laps and butt strips with sealant in addition to the self-sealing laps.

G. Seal joints with adhesive and staple at 2" O.C. with outwardly clenching staples.

H. Seal all joints with vapor barrier coating.

3.5 VALVES, FLANGES, AND FITTINGS

A. Insulate all valves, flanges, and fittings with covers secured with Velcro with equivalent thickness and composition installation on straight pipes.

B. Finish with 1/4 inch layer of Foster 30-33 or Childers CP-33 reinforced with reinforcing mesh.

C. Factory made covers equal to Proto Corporation or Zeston are acceptable.

3.6 CONTROL VALVE COVERS

A. Fabricate special covers, complete with troweled-on vapor seal, shaped to accommodate the valve stem. Insulation thickness shall be same thickness as

adjoining pipe.

B. Seal covers to valve insulation properly with adhesive so that the seal may be broken with a knife blade without damage to either part. Arrange so that cover can be removed and replaced as necessary for operation of the valve.

C. Finish valve cover with glass cloth and two coats of vapor barrier coating.

D. Factory made covers are acceptable. Provide submittal.

3.7 ROOF DRAIN PIPING

A. Seal vapor tight to prevent any moisture from entering into the insulation.

B. Roof drains for canopies do not require insulation.

C. Roof drains that are exposed shall be insulated as described in the paragraph on exposed piping.

D. Roof drain laterals which serve primary roof drains shall be insulated.

E. No insulation is required on concealed secondary roof drain piping.

F. Insulate all roof drain bodies (primary and secondary), first 3-feet of vertical pipe on secondary laterals, and primary roof drain piping to a point seven feet downstream of the first elbow.

3.8 WASTE LINES WHICH RECEIVE CONDENSATE

A. Insulate from the drain receptor (i.e. floor sink, hub drain) all the way to where the drain line changes to a vertical stack.

3.9 REPAIRS AND REPLACEMENT

A. Replace any insulation that gets wet, whether now dry or not.

B. Repair any damage caused by condensation due to improper insulating.

3.10 ALL EXPOSED PIPING

A. All exposed piping insulation to be pre-formed pipe insulation with white PVC jacket and white PVC fittings (no exceptions). All exposed roof drain primary and secondary downspouts, water piping, condensate piping, and any other piping that requires insulation shall be insulated down to the floor level using the pre-formed pipe insulation and PVC jackets and fittings.

3.11 OUTDOOR PIPING

A. Metal jacket shall be applied per manufacturer`s recommendations. Longitudinal joints shall be applied so they will shed water completely and be sealed completely with 1/8” bead of metal jacketing sealant under each lap. Circumferential joints shall be closed using preformed butt strips in accordance with manufacturer`s recommendations.

3.12 SHIELDS

A. Metal jacketing shall be 0.016-inch minimum aluminum or stainless steel with moisture barrier, secured in accordance with jacket manufacturer`s recommendations. Use bands and seals of the same material. Use preformed fitting covers matching jacket used on straight pipe, with all joints weather sealed with 1/8” bead of metal jacketing sealant under each lap.

3.13 SHIELDS AND HANGERS

A. Piping hangers or anchors are not to be in direct contact with pipe. Hangers are to be on the outside of the insulation with pipe shields at each hanger.

B. At the location of hangers or supports for pipes run above ground and finished with a vapor seal insulation, provide rigid sections of cork, high density fiberglass, Foamglas, calcium silicate, or high density polyurethane, the same thickness as adjacent insulating material to adequately support the pipe without compression of the insulating material and cover with a vapor seal that is bonded to the adjacent insulation as described for fittings in the lines. Wood inserts shall not be allowed. Hangers and supports for piping insulation to receive a vapor barrier shall be installed exterior to the insulation.

C. Material Changes:
   1. Wherever there is a change in materials on lines that are vapor sealed, apply a suitable adhesive that is compatible with both materials, tapes, etc., as required to maintain the vapor barrier.

D. Apply insulation around the hanger ring or anchor and pipe and carry vapor barrier upward and outward along the hanger rod or anchor members to a point not less than 12 inches from the adjacent pipe.

E. Take care to avoid puncturing the vapor seal.

F. Finish insulation as specified for flanges, and seal over adjacent vapor barrier jacket.

3.14 FIELD QUALITY ASSURANCE

A. Upon completion of all insulation work covered by this specification, visually inspect the work and verify that it has been correctly installed. This may be done while work is in progress, to assure compliance with requirements herein to cover and protect insulation materials during installation.

3.15 PROTECTION

A. Replace damaged insulation which cannot be satisfactorily repaired, including insulation with vapor barrier damage and moisture-saturated insulation.

B. The insulation contractor shall advise the general and/or the mechanical/plumbing contractor as to requirements for protection of the insulation work during the remainder of the construction period, to avoid damage and deterioration of the finished insulation work.

END OF SECTION

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SECTION 22 08 00

COMMISSIONING OF PLUMBING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

B. Division 01 Section "Building Systems Commissioning".

1.2 SUMMARY

A. This section includes commissioning process requirements for Plumbing systems, assemblies, and equipment.

B. Related Section:
   1. Division 01 Section "Building Systems Commissioning" for general commissioning process requirements.

1.3 DESCRIPTION

A. Refer to Division 01 Section “Building Systems Commissioning” for the description of commissioning.

1.4 DEFINITIONS

A. Refer to Division 01 Section “Building Systems Commissioning” for definitions.

1.5 SUBMITTALS

A. Refer to Division 01 Section “Building Systems Commissioning” for CxA’s role.

B. Refer to Division 01 Section “Submittals” for specific requirements. In addition, provide the following:
   1. Certificates of readiness
   2. Certificates of completion of installation, prestart, and startup activities.
   3. O&M manuals
   4. Test reports

1.6 QUALITY ASSURANCE

A. Test Equipment Calibration Requirements: Contractors will comply with test manufacturer’s calibration procedures and intervals. Recalibrate test instruments immediately after instruments have been repaired resulting from being dropped or damaged. Affix calibration tags to test instruments. Furnish calibration records to CxA upon request.

1.7 COORDINATION

A. Refer to Division 01 Section “Building Systems Commissioning” for requirements pertaining to coordination during the commissioning process.

PART 2 PRODUCTS

2.1 TEST EQUIPMENT

A. All standard testing equipment required to perform startup, initial checkout, and functional performance testing shall be provided by the Contractor for the equipment being tested. For example, the plumbing contractor of Division 22 shall ultimately be responsible for all standard testing equipment for the plumbing systems and controls systems in Division 22. A sufficient quantity of two-way radios shall be provided by each contractor.

B. Special equipment, tools, and instruments (specific to a piece of equipment and only available from vendor) required for testing shall be included in the base bid price to the Owner and left on site, except for stand-alone data logging equipment that may be used by the CxA.

C. Proprietary test equipment and software required by any equipment manufacturer for programming and/or start-up, whether specified or not, shall be provided by the manufacturer of the equipment. Manufacturer shall provide the test equipment, demonstrate its use, and assist in the commissioning process as needed. Proprietary test equipment (and software) shall become the property of the Owner upon completion of the commissioning process.

D. Data logging equipment and software required to test equipment will be provided by the CxA, but shall not become the property of the Owner.

E. 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 0.5ºF and a resolution of + or - 0.1ºF. 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.

PART 3 EXECUTION

3.1 GENERAL DOCUMENTATION REQUIREMENTS

A. With assistance from the installing contractors, the CxA will prepare Functional Testing Forms for all commissioned components, equipment, and systems

B. Red-lined Drawings:
   1. The contractor will verify all equipment, systems, instrumentation, wiring, and components are shown correctly on red-lined drawings.
   2. Preliminary red-lined drawings must be made available to the Commissioning Team for use prior to the start of Functional Performance Testing.
   3. Changes, as a result of Functional Testing, must be incorporated into the final as-built drawings, which will be created from the red-lined drawings.

4. The contracted party, as defined in the Contract Documents will create the as-built drawings.

C. Operation and Maintenance Data:
1. Contractor will provide a copy of O&M literature within 45 days of each submittal acceptance for use during the commissioning process for all commissioned equipment and systems.
2. The CxA will review the O&M literature once for conformance to project requirements.
3. The CxA will receive a copy of the final approved O&M literature once corrections have been made by the Contractor.

D. Systems manual requirements:
1. The Systems Manual is intended to be a useful information resource containing all of the information related to the systems, assemblies, and Commissioning Process in one place with indexes and cross-references.
2. The GC shall include final approved versions of the following information for the Systems Manual:
   a. As-Built System Schematics
   b. Verified Record Drawings
   c. Test Results (not otherwise included in Cx Record)
   d. Periodic Maintenance Information for computer maintenance management system
   e. Recommendations for recalibration frequency of sensors and actuators
   f. A list of contractors, subcontractors, suppliers, architects, and engineers involved in the project along with their contact information
   g. Training Records, Information on training provided, attendees list, and any ongoing training
3. This information shall be organized and arranged by building system, such as fire alarm, chilled water, heating hot water, etc.
4. Information should be provided in an electronic version to the extent possible. Legible, scanned images are acceptable for non-electronic documentation to facilitate this deliverable.

3.2 CONTRACTOR`S RESPONSIBILITIES

A. Perform commissioning tests at the direction of the CxA.

B. Attend construction phase controls coordination meetings.

C. Participate in Plumbing systems, assemblies, equipment, and component maintenance orientation and inspection as directed by the CxA.

D. Provide information requested by the CxA for final commissioning documentation.

E. Include requirements for submittal data, operation and maintenance data, and training in each purchase order or sub-contract written.

F. Prepare preliminary schedule for Plumbing system orientations and inspections, operation and maintenance manual submissions, training sessions, equipment start-up, and task completion for owner.

G. Update schedule as required throughout the construction period.

H. Perform and clearly document all completed startup and system operational checkout procedures, providing a copy to the CxA.

I. Assist the CxA in all verification and functional performance tests.

J. Provide measuring instruments and logging devices to record test data, and provide data acquisition equipment to record data for the complete range of testing for the required test period.

K. Gather operation and maintenance literature on all equipment, and assemble in binders as required by the specifications. Submit to CxA 45 days after submittal acceptance.

L. Participate in, and schedule vendors and contractors to participate in the training sessions.

M. Provide written notification to the CM/GC and CxA that the following work has been completed in accordance with the contract documents, and that the equipment, systems, and sub-system are operating as required.
   1. Service Water Heating Systems and components such as hot water heaters, circulation pumps, and controls.

N. The equipment supplier shall document the performance of his equipment.

O. Provide a complete set of red-lined drawings to the CxA prior to the start of Functional Performance Testing.

P. Provide training of the Owner’s operating staff using expert qualified personnel, as specified.

Q. Equipment Suppliers
   1. Provide all requested submittal data, including detailed start-up procedures and specific responsibilities of the Owner, to keep warranties in force.
   2. Assist in equipment testing per agreements with contractors.
   3. Provide information requested by CxA regarding equipment sequence of operation and testing procedures.

R. Refer to Division 01 Section “Building Systems Commissioning” for additional Contractor responsibilities.

3.3 OWNER’S RESPONSIBILITIES

A. Refer to Division 01 Section “Building Systems Commissioning” for Owner’s Responsibilities.

3.4 DESIGN PROFESSIONAL`S RESPONSIBILITIES

A. Refer to Division 01 Section “Building Systems Commissioning” for Design Professional’s Responsibilities.

3.5 CXA`S RESPONSIBILITIES

A. Refer to Division 01 Section “Building Systems Commissioning” for CxA’s Responsibilities.

3.6 TESTING PREPARATION

A. Certify in writing to the CxA that Plumbing systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to the Contract Documents.

B. Certify in writing to the CxA that Plumbing 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. Certify in writing that testing procedures have been completed and that testing reports have been submitted, discrepancies corrected, and corrective work approved.

D. Place 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).

E. Check safety cutouts, alarms, and interlocks with smoke control and life-safety systems during each mode of operation.

F. Testing Instrumentation: Install measuring instruments and logging devices to record test data as directed by the CxA.

3.7 GENERAL TESTING REQUIREMENTS

A. Provide technicians, instrumentation, and tools to perform commissioning test at the direction of the CxA.

B. Scope of Plumbing testing shall include the service water heating system.

C. Test all operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and verify proper response of building automation system controllers and sensors.

D. Tests will be performed using design conditions whenever possible.

E. Simulated conditions may need to be imposed using an artificial load when it is not practical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by the CxA and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.

F. The CxA may direct that set points be altered when simulating conditions is not practical.

G. The CxA may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are not practical.

H. If tests cannot be completed because of a deficiency outside the scope of the Plumbing system, document the deficiency and report it to the Owner. After deficiencies are resolved, reschedule tests.

I. If the testing plan indicates specific seasonal testing, complete appropriate initial performance tests and documentation and schedule seasonal tests.

3.8 PLUMBING SYSTEMS, SUBSYSTEMS, AND EQUIPMENT TESTING PROCEDURES

A. Functional Performance Tests: The CxA may modify these procedures during the Construction Phase once all systems are known and all required documentation has been provided.

B. Plumbing Instrumentation and Control System Testing: Assist the CxA with preparation of testing plans.

3.9 DEFICIENCIES/NON-CONFORMANCE, COST OF RETESTING, FAILURE DUE TO MANUFACTURER DEFECT

A. Refer to Division 01 Section “Building Systems Commissioning” for requirements pertaining to deficiencies/non-conformance, cost of retesting, or failure due to manufacturer defect.

3.10 APPROVAL

A. Refer to Division 01 Section “Building Systems Commissioning” for approval procedures.

3.11 DEFERRED TESTING

A. Refer to Division 01 Section “Building Systems Commissioning” for requirements pertaining to deferred testing.

3.12 OPERATION AND MAINTENANCE MANUALS

A. The Operation and Maintenance Manuals shall conform to Contract Documents requirements as stated in Division 01.

B. Refer to Division 01 Section “Building Systems Commissioning” for the AE and CxA roles in the Operation and Maintenance Manual contribution, review, and approval process.

END OF SECTION

SECTION 22 11 17

DOMESTIC WATER PIPING AND APPURTENANCES COPPER

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions, Division 01 Specifications, and Section 22 00 10, apply to this Section.

1.2 SECTION INCLUDES

A. Domestic hot water piping.

B. Domestic cold water piping.

1.3 RELATED SECTIONS

A. Section 22 00 10 - Basic Plumbing Requirements

B. Section 22 05 24 - Valves - General

C. Section 22 05 30 - Pipe and Pipe Fittings - General

D. Section 22 33 34 - Access Doors

E. Section 22 40 01 - Plumbing Fixtures and Fixture Carriers

1.4 REFERENCES

A. ASTM 763 - Standard Specification for Copper Alloy Sand Castings for Valve Applications

B. ASTM 61 - Standard Specification for Steam or Valve Bronze Castings

C. ASTM C27450 - Standard Specification for Brass Rod, Bar & Shapes

D. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges & Pipe Fittings

E. ASTM A105/A105M - Standard Specification for Carbon Steel Forgings for Piping Applications

F. ASTM - American Society of Testing Materials

G. ASTM B813 - Standard Specification for Liquid & Paste Fluxes for Soldering of Copper & Copper Alloy Tube

H. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings

I. ASTM B88 - Standard Specification for Seamless Copper Water Tube

J. PDI - Plumbing & Drainage Institute

K. ANSI/NSF 61

1.5 SUBMITTALS

A. Provide submittal data on all items specified in this section in accordance with Specification Section 22 00 10, General Conditions, and Division 01.

B. Submit product data sheets.

PART 2 PRODUCTS

2.1 UNDERGROUND PIPING

A. Type:
1. 2 Inch Diameter and Smaller:
a. Type "L" soft drawn commercially pure copper
2. 2½ Inch Diameter:
a. Type "L" hard drawn commercially pure copper
3. 3 Inch Diameter or Larger:
a. Type "L" hard drawn commercially pure copper

B. All copper meets ASTM B88 Standards.

2.2 UNDER SLAB PIPING

A. Type:
1. 2 Inch Diameter and Smaller:
a. Type "K" soft drawn commercially pure copper
2. 2½ Inch Diameter and Larger:
a. Type "K" hard drawn commercially pure copper

B. No joints will be permitted in piping runs beneath concrete slabs. All joints shall be made in accessible areas above the slab (behind access doors in walls, in mechanical closets, etc.).

C. All copper meets ASTM B88 Standards.

2.3 INTERIOR PIPING

A. Type:
1. Type "L" hard drawn commercially pure copper.

B. All copper meets ASTM B88 Standards.

2.4 PIPE FITTINGS

A. Copper Piping:
1. Unions:
a. 150 lb. standard, 300 lb. water-oil-gas service copper with ground joints.

B. Dissimilar Metal:
1. Di-Electric Unions

2.5 PIPE JOINTS

A. Copper Piping:
   1. Type: Solder fittings
      a. Solid string, hard solder
      b. Wire, hard solder
      c. Cored solder will not be allowed
   2. Type: Grooved
      a. Coupling Gaskets: Grade “P” Fluoroelastomer compound with red and blue color code designed for operating temperatures from 0 deg F to +180 deg F.
      b. Center-leg gasket with pipe stop to ensure proper groove engagement, alignment, and pipe insertion depth.
      c. Installation Ready direct-push-installation
      d. Reference shall always be made to the latest published Victaulic Selection Guide for Gaskets for proper gasket selection for the intended service.
      e. Basis of design Victaulic Style 607 or engineer approved equal
   3. Type: Press-connect fittings
      a. Copper and copper alloy fittings with EPDM elastomeric sealing element.
      b. Unpressed fittings shall leak and not hold pressure.
      c. Press connect fittings may not be used on elbow at main water entry under slab. Use Silfos sweat fittings on all elbows on main water entry.
   4. Approved Manufacturers:
      a. Viega ProPress
      b. Nibco
      c. Mueller Industries Streamline PRS
      d. Apollo
      e. Merit Brass
   5. Material:
      a. Solder (1½” and Smaller):
         1) 95-1/2% tin, 4% copper, and 1/2% silver
      b. Solder (2” and Larger):
         1) “SILFOS15”, 15% silver, 80% copper, 5% phosphorous
      c. Flux:
         1) Non-corrosive, lead-free paste
   6. Use a cast brass adapter when connecting copper pipe to screwed brass pipe.
   7. Brand:
      a. Silvabrite or similar brand

B. Conform to ASTM B813 and ASTM B828.

2.6 VALVES

A. Type:
   1. Check Valves:
      a. 125 lb. bronze check valve with "Buna-N" disc.
   2. Ball Valves:
      a. 150 psi, bronze 1/4 turn ball valve with full port, stainless steel ball.
      b. 300 psi, bronze 1/4 turn ball valve with full port, stainless steel ball. ASTM 61
      c. 125 psi, lead-free dezincification resistant arsenical brass ¼ turn ball valve with full port, stainless steel ball C46500 or CW 511L, ASTM 763, or C46750.

3. Temperature and Pressure Relief Valves:
   a. ASME rated valve
4. Copper Grooved Butterfly Valves:
   a. Valves 2-1/2" - 6", 300 psi (2065 kPa) maximum pressure rating, with copper tubing sized grooved ends. Cast bronze body to UNS C87850. (Alloy code shall be cast or stamped into the valve body.) Elastomer encapsulated ductile iron disc, ASTM A536, Grade 65-45-12, with integrally cast stem. Bubble tight, dead-end, or bi-directional service, with memory stop for throttling, metering, or balancing service. Valve may be automated with electric, pneumatic, or hydraulic operators. Basis of design Victaulic Series 608 or engineer approved equal.
5. Balancing Valves:
   a. All domestic cold water and hot water balancing valves 2” down will be s NSF Certified in accordance with ANSI/NSF 61 for cold +73ºF/+23ºC and hot +180ºF/+82ºC potable water service and ANSI/NSF 372. Valves ½” to 3/47” will have removable flow cartridge that limits flow within +/-5% of flow range. Basis of design Victaulic 76X or 78BL or engineer approved equal.
6. Gate Valves:
   a. 125 lb. rising stem, double-disc bronze gate valves larger than 3 inches.
7. Water Main Valves:
   a. 150 lb. AWWA valve.
   b. 300 lb. bronze sealed spring cage, strainer
8. Cast Iron: ASTM A126, Class B
9. Cast Carbon Steel: ASTM A126, Grade WCB
10. Forged Carbon Steel: ASTM A105/A105M, Grade II
11. Backflow Preventers: Refer to Section 22 40 01 - Plumbing Fixtures and Fixture Carriers.

B. Manufacturers:
   1. Apollo
   2. Crane
   3. Grinnell
   4. Jenkins
   5. Jomar, T-100NGDZ
   6. Kennedy
   7. Milwaukee Valve Company
   8. Nibco
   9. Stockham
   10. Walworth
   11. Watts
   12. Hammond
   13. Kitz
   14. Victaulic

C. Provide valves where required to adequately control and isolate the various domestic water piping systems.

D. Provide valves at the connection point of all equipment.

E. Provide Di-Electric Unions at connection of dissimilar metal.

2.7 CONSTRUCTION

A. Provide valves designed for repacking under pressure when fully opened.

B. Equip with packing suitable for intended service.

C. Furnish with gland followers.

D. Provide valves rated greater than the design temperature and pressure for the intended system.

E. All domestic cold water and hot water valves 2" and less shall be full port ball valves.

2.8 WATER HAMMER ARRESTORS

A. Water Hammer Protective Devices:
   1. Usage:
      a. Provide on hot and cold water supply lines. Locate between last two flush/solenoid valves on supply lines or per manufacturer's recommendations.
      b. In single toilets locate within 3 feet of fixture or per manufacturer's recommendation.
   2. Type:
      a. As recommended by the manufacturer for the particular application.
      b. Locate arrestor on shop drawings with size.
   3. Manufacturer/Model:
      a. Wade "Shokstop"
      b. Sioux Chief "Hydra-Rester"
      c. PPP "SC Series"
      d. Mifab "MWH Series"
   4. Air chambers are not allowed.

2.9 FREEZE PROTECTION HEAT TRACE AND DOMESTIC HOT WATER LAYOUT FORICC (IECC)-2015

A. Freeze Protection Heat Trace Tape:
   1. Usage:
      a. Provide on hot and cold water supply lines where freezing of the piping is a concern.
   2. Type:
      a. Self-regulating heating cable, 5 watt per liner foot. Provide control panel and all necessary controls and wiring.
   3. Manufacturer/Model:
      a. Raychem XL-Trace

B. Domestic Hot Water Layout for ICC (IECC)-2015:
   1. Usage:
      a. At all sinks/lavatories associated with water closets and/or urinals and handwashing lavatories in kitchens require the domestic hot water circulation loop will be routed down in wall to within two feet of the faucet, routed horizontally for multiple sinks/lavatories, then routed back up to above ceiling in order to meet the 2015 International Energy Conservation Code.

PART 3 EXECUTION

3.1 INSTALLATION

A. All products to comply with ANSI/NSF 61.

B. Install in accordance with the plans and Section 22 05 30.

C. Drainage:
   1. Minimum Slope:
      a. 1/8 inch per 10 feet.
   2. Where constant pitch cannot be maintained for long runs, establish intermediate low points and rise to higher level.
   3. Slope branches to drain toward mains or risers.
   4. Terminate low points of risers with drain valve piped to nearest hub or floor drain unless otherwise indicated.

D. Water Hammer Arrestors:
   1. Install in accordance with PDI-WH 201.

E. Pipe ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove.

F. The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service as specified.

G. See the latest copy of the manufacturer's Field Assembly and Installation Instruction Pocket Handbook (I-100).

3.2 VALVES

A. All valves, trap primers, etc. that are located behind access doors shall be located directly behind door and within 24" of plane of door.

3.3 INSTALLATION

A. ProPress elbow is not acceptable on water supply elbows at location of main water stub up. Use SilFos sweated fittings on all water supply elbows larger than 2". 2" water supply line can be soft drawn copper with no elbow.

B. Install valves and stops in accessible locations.

C. Provide where shown or as required to make system complete and readily maintained.

D. Plumbing contractor to provide strainers, spools (for future pressure reduction valve), associated cut-off valves, reduced pressure zone, and flood control valve at all building main water entry backflow preventer assemblies. Also, route drain from the backflow preventer (RPZ) to the exterior of the building.

E. Isolation valves shall be located:
   1. Restroom Gang - Above lay-in ceilings adjacent to gang restrooms. When hard ceilings are present provide 18"x18" (minimum) ceiling access panel to access valves.

2. Individual (private) Restrooms - Above lay-in ceilings adjacent to restroom. When hard ceilings are present provide 18”x18” (minimum) ceiling access panel to access valve.
3. Individual Fixtures - Above lay-in ceilings adjacent to restroom. When hard ceilings are present provide 18”x18” (minimum) ceiling access panel to access valve
4. Isolation valves on the domestic cold water shall be provided in corridors to allow isolation of buildings wings, sections, and areas.
5. Provide cut-off valve on main water entry upstream of strainer and backflow preventer (if backflow preventer is inside building).
6. Each exterior wall hydrant and each roof hydrant shall be provided with an accessible cut-off valve.

F. Press fitting manufacturer shall provide a duplicate set of all tools required to maintain and/ or modify press fittings. Required tools are to be given to the owner. One set of tools shall be provided for each campus.

3.4 FIELD QUALITY CONTROL

A. Properly test water distribution systems with 80 PSI hydrostatic pressure test.

B. Do not install trap primers, flush valves, or other pressure sensitive devices until all tests are completed.

C. Repair all leaks in pipes, fittings, and accessories during this test period.

D. Repeat 80 PSI hydrostatic test until no leaks are found for an entire 8-hour period.

E. Make joints in accordance with ASTM B828.

F. A factory trained field representative (direct employee) shall provide on-site training for contractor’s field personnel in the proper use of grooving tools, application of groove, and installation of grooved piping products.

3.5 STERILIZATION

A. Solution:
   1. Strength:
      a. Minimum 50 parts per million
   2. Agents:
      a. Liquid Chlorine:
         1) Conform to U.S. Army Specification #4-1
      b. Calcium Hydrochloride:
         1) Federal Specification O-C-114
      c. Chlorinated Lime:
         1) Federal Specification O-C-114

B. Procedure:
   1. Perform sterilization after testing has been satisfactorily completed.
   2. Pump solution into a 1/4 inch opening provided in the water main next to the water meter.
   3. Conduct the sterilization process under the direction of the local health department.

4. After sterilization, flush the system with clean water until the residual chlorine content is less than 3 ppm.
5. After flushing, the local health department will test and verify the cleanliness of the system.

3.6 PLUMBING SCHEDULE

A. Minimum Size:
   1. Water Closets (flush valve):
      a. 1-1/4" cold water
   2. Urinals:
      a. 3/4" cold water
   3. Sinks:
      a. 1/2" cold water, 1/2" hot water
   4. Mop & Service Sinks:
      a. 1/2" cold water, 1/2" hot water
   5. Hose Bibbs:
      a. 3/4" cold water
   6. Drinking Fountains:
      a. 1/2" cold water
   7. Lavatories:
      a. 1/2" cold water, 1/2" hot water

3.7 EMCS FLOW SENSOR

A. EMCS contractor to furnish flow sensor (full water main size) and the plumbing contractor to install inside the building downstream of the backflow preventer (RPZ) or downstream of the initial water main stub up inside the building if the backflow prevention device is located in the yard. EMCS contractor to make all necessary connections for EMCS interface.

END OF SECTION

SECTION 22 13 17

SOIL, WASTE AND SANITARY DRAIN PIPING, VENT PIPING, AND APPURTENANCES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions, Division 01 Specifications, and Section 22 00 10, apply to this Section.

1.2 SECTION INCLUDES

A. Drain and vent piping within the building and underground laterals.

B. Pea gravel embedment for schedule 40 PVC piping below slab.

1.3 RELATED SECTIONS

A. Section 22 00 10 - Basic Plumbing Requirements

B. Section 22 11 17 - Domestic Water Piping and Appurtenances

C. Section 22 13 18 - Condensate Piping

D. Section 22 33 34 - Access Doors

E. Section 22 40 01 - Plumbing Fixtures and Fixture Carriers

F. Section 22 66 54 - Chemical Waste and Vent Piping

1.4 REFERENCES

A. Refer to Section 22 00 10 for complete names of references identified in this section.
   1. Commercial Standard CS-188-59
   2. ASTM D2665 - Standard Specifications for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings

1.5 SUBMITTALS

A. Provide submittal data on all items specified in this section in accordance with Specification Section 22 00 10, General Conditions, and Division 01.

B. Submit product data on pipe, pipe fittings, trap primers, covers, cleanouts, etc.

PART 2 PRODUCTS

2.1 DRAIN PIPE AND FITTINGS

A. Material: (Pipe material for above and below slab for ducted return mechanical system)
   1. Schedule 40 PVC pipe and fittings conform to ASTM D2665.
   2. “Foam Core PVC” not allowed.

2.2 VENT PIPE AND FITTINGS

A. Material: (Pipe material for above and below slab for ducted return mechanical system)
   1. Schedule 40 PVC pipe and fittings conform to ASTM D2665.

2.3 CLEANOUTS

A. Size:
   1. Identical with the line size up to a maximum diameter of 4 inches.

B. Type:
   1. Compatible with the surrounding floor/wall.

C. Manufacturers:
   1. Jay R. Smith
   2. Josam
   3. Mifab
   4. Sioux Chief
   5. Wade W-6000
   6. Zurn

2.4 PLUGS

A. Wade 8590, Tapped brass cleanout plug only. PVC plugs not allowed.

B. Applications:
   1. Each change in direction of soil lines
   2. End of each continuous waste line
   3. Foot of each riser within the building
   4. 50 ft. intervals in interior horizontal lines

C. Construction: Secure covers with vandal-proof screws

D. Finished Floors:
   1. Covers: Chromium-plated, flush mounted, cast bronze with scoriated top surface.

E. Walls/Painted Surfaces:
   1. Covers:
      a. Furnish stainless steel covers.

F. Exterior Locations:
   1. Traffic Areas:
      a. Covers: Flush mounted, cast bronze covers with scoriated top surface
   2. Non-Traffic Areas:
      a. Encase in a 14" x 14" x 6" concrete pad
      b. Manufacturer/Model:
         1) Wade W-8500 series

2.5 CLOSET FLANGE

A. Size: 4” to match sanitary sewer piping.

B. Type:

1. PVC or cast iron to match sanitary sewer piping.
2. PVC flanges to be provided with stainless steel ring for reinforcement.
3. Offset toilet flanges are not allowed.

C. Manufacturer:
1. Oatley or equal

2.6 TRAP PRIMERS - AUTOMATIC

A. Type:
1. Fully automatic valve with diaphragm operated piston.

B. Size:
1. Inlet:
a. 1/2 inch
2. Outlet:
a. 1/2 inch

C. Features:
1. Activated by a pressure drop.
2. No adjustment required.
3. Equipped with distribution unit for 1 to 4 traps.
4. Can be located anywhere in an active cold water line of 1½ inch or less that is directly serving one or more flush valves.
5. Provide copper tubing (type K) from trap primer to protected trap.

D. Application:
1. Provide automatic trap primers at all floor drains and floor sinks on entire project that are within 20 feet of a water closet supply line.
2. Provide a minimum of one union on each side of each trap primer, unless a means of detaching the trap primer is provided integrally in the trap primer, in which one union is permissible.

E. Manufacturer/Model:
1. Precision Plumbing Products, Inc. PO-500.

F. Furnished with AG-500 air gap fitting with alignment legs.

2.7 TRAP PRIMERS - ELECTRONIC

A. Type:
1. Fully electronic trap primer valve.

B. Size:
1. Sized per manufacturer according to the number of trap primer tie-ins required.

C. Features:
1. Atmospheric vacuum breaker
2. Pre-set 24-hour adjustable timer
3. Manual override switch
4. 120 volt electrical
5. 3/4 inch FNPT connection
6. Calibrated manifold for equal flow (total as required)
7. Flush mount cabinet

D. Application:
   1. Provide electronic trap primer systems as noted on the drawings. Coordinate with the electrical contractor.
   2. Allow one foot of elevation for every 20 foot of trap primer supply line.
   3. Provide a minimum of one union on each side of each trap primer system, unless a means of detaching the trap primer is provided integrally in the trap primer, in which one union is permissible.

E. Manufacturers:
   1. Precision Plumbing Products, Inc. Model PT (coordinate the number of outlets required).
   2. Furnished with flush mount cabinet with Model D-1416 access door.

2.8 TRAP PRIMERS - FLUSH VALVE AUTOMATIC

A. Type:
   1. Fully automatic flush valve primer

B. Size:
   1. Inlet
      a. 1/2 inch
   2. Outlet
      a. 1/2 inch

C. Features:
   1. Activated by flush valve operation
   2. No adjustment required
   3. Equipped with distribution for one trap
   4. Provide copper tubing from flush valve trap primer to protected trap.
   5. Include vacuum breaker with flush valve primer assembly.

D. Application:
   1. Provide flush valve automatic trap primers at all floor drains and floor sinks on entire project that are within 20 feet of a water closet supply line.

E. Manufacturer/Model:
   1. Precision Plumbing Products, Inc. FVP-1VB
   2. Flush valve manufacturer (if applicable).

2.9 3/8 INCH PEA CLEAN PEA GRAVEL FOR SCHEDULE 40 PVC PIPING BELOW SLAB

A. Provide 3/8” clean pea gravel aggregate as backfill for all schedule 40 PVC piping below slab. Provide a minimum of 6 inches of pea gravel cover over pipe and under pipe. Compact to 85% to 95%.

2.10 EXPOSED INDIRECT WASTE LINES IN KITCHENS AND CONCESSIONS

A. All exposed indirect waste lines in kitchens and concessions to be DWV copper material. All joints to be soldered and turned down with elbow above floor sink or hub drain (discharge below elbow to be cut at 45-degree angle).

PART 3 EXECUTION

3.1 INSTALLATION

A. Location:
   1. Install a 12-gauge copper tracer wire on all underground sewers outside of building.

B. Slope:
   1. Desired: 1/4 inch per foot
   2. Minimum:
      a. 1/8 inch per foot for diameter of 4 inch and larger if approved by local authority and it is impractical to use 1/4 inch per foot.

C. Drain Pipe and Fittings:
   1. Reduction fittings:
      a. Use to connect two pipes of different diameter.
   2. Directional changes:
      a. Use 45-degree wyes, long sweep quarter bends, and sixth, eighth, and sixteenth bends. Sanitary tees may be used on vertical stacks. Use long sweeps at all locations sanitary tees are used.
      b. Embed pipe on sand cushion approximately 2 pipe diameters below (minimum 4”) and at least one diameter on each side and top in trench.
      c. No hub couplings of any type cannot be used underground.

D. In kitchens install schedule 40 cast iron pipe and fittings from dishwasher, braising pans, and steamer discharges to grease interceptor inlet. All fittings picking up PVC branches along the way must be schedule 40 cast iron, as well.

E. Crawlspace Location:
   1. All pipe to be suspended from structure with hangers.

F. Traps:
   1. Provide at each fixture unless a trap is built into the fixture.
   2. Provide a deep seal trap and trap primers at each floor drain and hub drain.
   3. Place traps so that the discharge from any fixture will pass through only one trap before reaching a building drain.
   4. Place each trap as near to the fixture as possible. Do not exceed the distances stated in the governing codes up to a maximum of 8 feet.

G. Trap Guards:
   1. Install per manufacturer’s recommendations.

H. Trap Primers:
   1. Provide trap primers at all floor drains, floor sinks and hub drains on entire project.
   2. Provide unions on each side of trap primer for service.
   3. Manufacturer shall provide field start-up and review of installation on trap primers.
   4. Use PEX tubing

I. Hub Drains:

1. Install with the top of the hub 1/2 inch above the finished floor, unless otherwise shown on the drawings.

J. Cleanouts:
1. See table below for cleanout requirements whether shown on plans or not.
2. Install so that they open in a direction opposite to the pipe flow or at a right angle.
3. At all wall cleanouts, install tapped brass cleanout plug behind wall escutcheons.
4. Install vertically above the flow line of the pipe for "wye" branch and end-of-line cleanouts.
5. Place cleanouts above the floors in pipe chases so that they will be accessible through doors or bring through a wall and provide with flush covers.
6. Set cleanouts flush in floor slabs.
7. Place cleanouts in accessible locations. Exact locations of each shall be approved by the Architect before installation. Locate all cleanouts within 2-feet of access door or cover.
8. Location of all cleanouts shall be shown on the shop drawings.

INTERIOR AND EXTERIOR CLEANOUTS		
LOCATION	**DESCRIPTION**	**ACCESSORIES**
Interior horizontal drain lines.	Every 100’-0” (O.C.)	All cleanouts in walkways and floors to have scoriated non-slip cover.
Change in direction of the building drain.	At the change in direction greater than 45 degrees. If multiple changes in direction occur in a maximum of 40 feet only one cleanout is required (at the first change in direction	
Base of stack.	A cleanout shall be provided at the base of each waste or soil stack.	Provide with access door or escutcheon. No more than 2 inches from cleanout.
Junction of building drain and building sewer.	Provide a two-way cleanout exterior of building at junction of building drain and sewer.	Two-way cleanout to be installed per detail with concrete cover.
Concealed piping cleanouts.	Cleanouts on concealed piping or under a floor less than 24 inches in height must extend up through the finished wall or floor.	Provide with scoriated non-slip cover.

9. All cleanouts must be the same size as the piping they serve. On all lines larger than 4 inches, the cleanout shall not be less than 4 inches.
10. Cleanouts up to 4 inches in diameter must have 18-inch clearance. All cleanouts larger than 4 inches must have 36-inch clearance.
11. Access shall be provided at all cleanouts.
12. All cleanouts shall have long radius sweeps at change in direction to allow the insertion of the plumbing snake for cleaning purposes. Short radius fittings will not be allowed.
13. Provide wall cleanout after last plumbing fixture and in the ADA stall. Wall cleanout to be installed 12” above the flood rim of the ADA water closet.

K. Plugs:
1. Install temporary plugs in all open sanitary drain pipes during construction to prevent any foreign objects from entering the pipe.
2. All floor drains to have plugs until substantial completion.

L. Vent Piping:
1. Connections:
   a. Connect two or more vents together and extend as one vent through the roof, where practical.
   b. Make vent and waste connections to stacks by using 45-degree wyes, long sweep quarter bends, sixth, eighth, or sixteenth bends. Sanitary tees may be used on the vertical stacks.
2. Flashing:
   a. Use minimum 10-inch square, 4-pound lead flashing.
   b. Flange the flashing to the lead sleeve.
   c. Extend the flashing up and around the vent pipe.
   d. Turn the flashing down inside the pipe at least 2 inches to make an absolutely watertight joint.
   e. For single-ply rooftop systems, flash according to the roofing specifications.
3. Location:
   a. Do not locate any vent within 15 feet of an outside air intake.
4. Mop Sinks:
   a. Mop sinks to be installed after substantial completion.
5. Termination:
   a. 12 inch above roof deck or 2 inch above parapet, whichever is greater.

3.2 TESTING

A. Temporarily plug sanitary drain piping.

B. Fill the pipes with water.

C. Test the system in sections so that no section has a pressure less than 10 feet of water.

D. If the level of water has been decreased by leakage after a 24-hour period, then locate and repair all leaks.

E. Repeat the test until there is no perceptible decrease in the water level over a 24-hour period.

F. Sewer Pressurization Test:

1. Provide smoke pressure test after plumbing top out/before sheetrock is installed and again at substantial completion.
2. All smoke test on the sanitary sewer system is to be performed before ceiling tiles are installed, no exception.
3. After all water tests are complete, perform smoke test to ensure there are no air leaks in building. Fill all p-traps with water and temporarily cap all vents prior to testing.
4. Procedure for Plumbing Sewer Pressurization Test Using a Visual Smoke Indicator:
    a. Contact your local city water department, some cities may provide and supervise a smoke test for your facility.
    b. Prior to the test, notify the local fire and police departments that you are conducting a smoke test of the facility.
    c. Prior to the test, turn off the fire alarms. The smoke will activate the alarm. After the test is complete the building will have to be ventilated to clear smoke and then the alarm can be reactivated.
    d. You are required to have a blower with adjustable pressure control and liquid smoke or white smoke bombs.
    e. Inflatable ball stops are required to block off the sewer line at the building manhole that connects to the city sewer main line.
    f. All sewer vents on the facility have to be sealed to properly conduct the test. (Duct tape over the openings is acceptable.)
    g. Ladders, portable lights, two-way radio communication, and standard hand tools are required for access above ceilings, floor drains, etc.
    h. A minimum of three helpers are required to conduct the test.
    i. Prior to the test, identify rooms or problem areas that should be observed first. Plumbing drawings are required to identify the locations of vents, traps, restrooms, etc.
    j. This test will pressurize the sewer piping (approximately 1.25” S.P.) and identify any deficiencies.
    k. If there are questions, contact EMA Engineering & Consulting: Phone 903-581-2677.
5. Provide TV video of all main sanitary sewers in building and to city main. Notify Owner’s representative when video is to be made 48 hours prior to work.

G. Job Photographs:
1. Contractor is to provide digital photographs of all pipe showing sand embedment prior to covering trenches.

3.3 PLUMBING BRANCH SCHEDULES

A. Minimum size:
1. Water Closets (tank type):
    a. 3" waste, 2" vent
2. Water Closets (flush valve):
    a. 3" waste, 2" vent
3. Urinals:
    a. 2" waste, 1-1/2" vent
4. Sinks:
    a. 2" waste, 1-1/2" vent
5. Mops & Service Sinks:
    a. 3" waste, 1-1/2" vent

6. Floor Drains:
   a. 3" waste, 1-1/2" vent
7. Drinking Fountains:
   a. 2" waste, 1-1/2" vent
8. Lavatories:
   a. 2" waste, 1-1/2" vent

END OF SECTION

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SECTION 22 13 18

CONDENSATE PIPING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions, Division 01 Specifications, and Section 22 00 10, apply to this Section.

1.2 SECTION INCLUDES

A. Condensate piping for cooling units.

1.3 RELATED SECTIONS

A. Section 22 00 10 - Basic Plumbing Requirements

B. Section 22 05 30 - Pipe and Pipe Fittings - General

C. Section 22 07 20 - Piping Insulation

D. Section 22 13 17 - Soil, Waste, and Sanitary Drain Piping, Vent Piping, and Appurtenances

E. Section 22 33 34 - Access Doors

1.4 REFERENCES

A. ASTM B88 - Seamless Copper Tube for Water, Gas & Sanitation

B. ASTM B306 - Standard Specification for Copper Drainage Tube (DWV)

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials

1.5 DEFINITIONS

A. Draw-through Unit:
   1. A unit in which the cooling coil operates under a negative static pressure.

B. Blow-through Unit:
   1. A unit in which the cooling coil operates under a positive static pressure.

1.6 SUBMITTALS

A. Product Data:
   1. Provide submittal data on all equipment specified in this section in accordance with Section 22 00 10, General Conditions, and Division 01.
   2. Submit product data indicating typical catalog of information.
   3. Submit product data sheets indicating dimensions, general assembly, and ratings.

PART 2 PRODUCTS

2.1 GENERAL

A. Provide condensate lines for all cooling units even if not shown on the plans.

B. Provide a secondary condensate drain pan and secondary condensate piping for all horizontal air handlers above ceiling, even if not shown on plans.

C. Minimum size:
   1. 1", but no smaller than the coil nipple.

2.2 PIPING

A. Type:
   1. Hard drawn type DWV or type M copper.
   2. Other type as noted on plans.
   3. Conform to ASTM B306 or ASTM B88.

2.3 FITTINGS

A. Type: Cast Copper Alloy Solder Joint Drainage Fitting-DWV
   1. Conform to ASME B16.23
   2. Provide dielectric insulating couplings between ferrous and copper piping systems.

2.4 INSULATION

A. All condensate lines shall be insulated per Section 22 07 20.

2.5 CONNECTIONS

A. Type:
   1. Solid string hard solder
   2. Wire hard solder
   3. Cored solder will not be allowed.

B. Material:
   1. Solder:
      a. 95% tin and 5% antimony
   2. Flux:
      a. Non-corrosive paste type

C. Use a cast adapter when connecting soldered copper piping to screwed brass pipe.

2.6 ROOF PIPE SUPPORTS

A. Manufacturers:
   1. MAPA MS-5
   2. Miro Industries Model 3 RAH (3-inch or less)
   3. Pipe Hangers and Devices (PHP) Model PP10
   4. Portable Pipe Hangers (PHP) Model PP10
   5. ERICO RPS 360407

B. All roof supports to be equal to MAPA Products Model MS-5, adjustable height, select size designed for size of pipe supported. MS-5 for 4” and smaller.
   1. Install ½” rubber walk pad under each pipe support.

C. MAPA MWP ½” thick rubber walk pad.
   1. Coordinate exact locations of supports with roofing contractor.

D. Roof supports to support all gas piping a minimum of 6" above roof.
   1. Coordinate exact locations of supports with roofing contractor.
   2. Install ½” rubber walk pad under each pipe support.

E. Spacing of Supports (Horizontal):
   1. ½” 6 feet or less
   2. ¾” or 1” 8 feet or less
   3. 1¼” or larger 10 feet or less
   4. Install supports within 2 feet of every change of direction.

2.7 ACCESSORIES

A. Traps:
   1. Draw-through units:
      a. Required on all units, unless noted otherwise on plans.
   2. Blow-through units:
      a. As recommended by the unit manufacturer or as shown on the plans.

B. Clean-outs

C. Unions

D. Neutralization kits for all condensing furnaces and condensing water heaters.
   1. Equal to JJM Boiler Works, Inc.

PART 3 EXECUTION

3.1 INSTALLATION

A. Traps:
   1. Install in each line serving a draw-through unit. Coordinate size and configuration with air conditioning unit manufacturer.

B. Cleanouts:
   1. Install cleanouts as shown on plans.
   2. Install cleanouts at changes in direction (greater than 45º).
   3. Provide insulation caps on cleanouts for easy removal and reinstall.

C. Unions:
   1. Install unions on both sides of the trap.

D. Minimum Drain Line Slope:
   1. 1/8 inch per foot
   2. Insulate all condensate lines inside buildings.

E. Size and install Neutralization kits per manufacturer’s recommendations.

F. At all rooftop units on the roof, contractor to connect to the side outlet on the rooftop unit condensate drain pan and then route condensate drain down through roof in roof penetration per the roofing consultant's roof penetration detail. The bottom outlet on the rooftop unit condensate drain pan is unacceptable. The P-trap must be accessible on the roof.

G. Testing:
   1. Pressure test all sections of the condensate drainage system at a 10-foot head pressure for a 24-hour period. Repeat test until no leaks exist.

END OF SECTION

SECTION 22 14 01

ROOF DRAINAGE AND APPURTENANCES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions, Division 01 Specifications, and Section 22 00 10, apply to this Section.

1.2 SECTION INCLUDES

A. Roof drains

B. Drain piping within the building

C. Pea gravel embedment for schedule 40 PVC piping below slab.

1.3 RELATED SECTIONS

A. Section 22 00 10 - Basic Plumbing Requirements

B. Section 22 05 30 - Pipe and Pipe Fittings - General

1.4 REFERENCES

A. ASTM D2665 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings

1.5 SUBMITTALS

A. Product Data:
   1. Provide submittal data on all items specified in this section in accordance with Section 22 00 10, General Conditions, and Division 01.
   2. Submit product data sheets.

PART 2 PRODUCTS

2.1 PIPE AND FITTINGS

A. Material:(Pipe material for above and below slab for ducted return mechanical system)
   1. Material: Schedule 40 PVC pipe and pipe fittings conform to ASTM D2665.
   2. “Foam Core PVC” not allowed.

B. Primary Roof Drains
   1. Type:
      a. Cast Iron
      b. Straight down outlet
      c. Side outlet
      d. Select type based on application and clearance
   2. Construction:

a. Equip with low dome strainer
b. Provide cast iron mushroom dome.
c. Provide inside screw connections with underdeck clamping rings
d. Use corrosion resistant bolts
e. Coordinate roof attachment with Architect for proper installation.

3. Manufacturer/Model:
   a. Straight Down Outlet:
      1) Wade W-3000
      2) Watts RD-300
      3) Mifab R1200
      4) Josam 21500
      5) J.R. Smith 1010
      6) Zurn Z100F
   b. Side Outlet:
      1) Wade W-3030
      2) Watts RD-100-SD
      3) Mifab R1200-90
      4) Josam 21500-66
      5) J.R. Smith 1020
      6) Zurn Z100F-90

C. Secondary Roof Drains (also known as emergency roof drains and overflow roof drains)
   1. Type:
      a. Cast Iron
   2. Features:
      a. Flashing ring and gravel stop
      b. Adjustable plastic standpipe
   3. Height:
      a. 2 inches above top of roof grade at a point 10 feet out from roof drain.
      b. Cast iron mushroom dome
   4. Manufacturer/Model:
      a. Wade W-3004-SD
      b. Watts RD-300-W
      c. Mifab R1204-W
      d. Josam 21500-16
      e. Jay R. Smith 1080
      f. Zurn Z100F-W2

D. Storm Shelter Roof Drains
   1. Roof Penetration Housings, LLC:
      a. Primary Roof Drain- CRD series
      b. Secondary Roof Drain-COFRD series

E. Insulation
   1. Provide insulation per Section 22 07 20.

F. Downspout Nozzles
   1. Material:
      a. Cast Bronze
      b. Provide bird screen on sizes 6 inches and larger.

2. Manufacturers:
   a. J. R. Smith
   b. Mifab
   c. Wade
   d. Watts
   e. Josam
   f. Zurn

G. Roof Drain Ty-Seal and No-Hub Fitting Adhesive
1. Manufacturer:
   a. Black Swan No-Hub Sealant

2.2 3/8 INCH PEA CLEAN PEA GRAVEL FOR SCHEDULE 40 PVC PIPING BELOW SLAB

A. Provide 3/8” clean pea gravel aggregate as backfill for all schedule 40 PVC piping below slab. Provide a minimum of 6 inches of pea gravel cover over pipe and under pipe. Compact to 85% to 95%.

PART 3 EXECUTION

3.1 INSTALLATION

A. Minimum Slope:
1. 1/8 inch per foot unless otherwise shown

B. Drain Pipe and Fittings:
1. Use reduction fittings to connect pipes of different diameter
2. Use 45-degree wyes, long-sweep quarter bends, and sixth, eighth, and sixteenth bends to change directions.
3. Use long sweeps at the base of risers.
4. Provide cleanouts at every 100’ of piping and every change of direction.

C. Downspout nozzles:
1. To be installed no higher than 18” above adjacent grade to bottom of nozzle. Contractor to be sure to coordinate rough-in for all projects with stem walls and low brick ledges so that the pipe and elbow is roughed in before grade beam/stem wall is poured.

D. Cleanouts
1. Provide cleanouts as required by applicable code and/or authority having jurisdiction.

E. Painting
1. Paint any visible pipe in all drains or downspout nozzles flat black.

F. Roof Drains:
1. Secure flashing and roof material to drain with an underdeck clamp ring.

G. Water dams and standpipes on emergency roof drains shall be installed and adjusted so top of water dam/standpipe is no more than 2 inches higher than the roof inlet to the associated primary roof drain. Coordinate this with the roofing contractor.

H. Field Quality Control
1. Test new drainage system before backfilling and connecting to storm sewers.

2. Maintain greater than 15 feet of hydrostatic head for 2 hours without a leak.
3. Any leaks detected shall be repaired and the system shall be retested until no leaks are found.
4. Check and record heights of all emergency roof drains above roof grade and 10 feet from roof drain.
5. Submit test report and record of heights with close-out documents for Owner.
6. Refer to Section 22 00 10 for backfilling and excavation.

I. Apply “Black Swan Sealant” to Ty-Seal, roof drain pipe, and/or No-Hub coupling before installing roof drain pipe to roof drain. Only apply at initial roof drain pipe to roof drain connection.

END OF SECTION

SECTION 22 33 34

ACCESS DOORS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions, Division 01 Specifications, and Section 22 00 10, apply to this Section.

1.2 SECTION INCLUDES

A. Access doors

1.3 RELATED SECTIONS

A. Section 22 00 10 - Basic Plumbing Requirements

B. Section 22 05 24 - Valves - General

C. Section 22 11 17 - Domestic Water Piping and Appurtenances

D. Section 22 13 17 - Soil, Waste and Sanitary Drain Piping, Vent Piping and Appurtenances

E. Section 22 13 18 - Condensate Piping

F. Section 22 16 01 - Natural Gas Piping and Appurtenances

G. Section 22 40 01 - Plumbing Fixtures and Fixture Carriers

H. Section 22 66 54 - Chemical Waste and Vent Piping

1.4 SUBMITTALS

A. Provide submittal data on all items specified in this section in accordance with Specification Section 22 00 10, General Conditions, and Division 01.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acudor

B. Elmdor

C. Mifab

2.2 ACCESS DOORS

A. Locations requiring access doors:
   1. Concealed valves
   2. Traps
   3. Trap primers

4. Controls
5. Cleanouts
6. Equipment above hard ceilings.
7. Other equipment requiring accessibility for operation and maintenance.

B. Type:
1. Hinged flush-type steel framed door with straps and exposed narrow border.

C. Minimum size:
1. 18" x 18" unless otherwise indicated.
2. 24” x 24” for equipment above hard ceilings.
3. Conform to architectural panel pattern for acoustical ceilings.
4. Confirm size with Building Inspector and Engineer.

D. Construction:
1. Hinges:
a. Concealed continuous type.
2. Locking Device:
a. Flush cam type, screwdriver operated.

E. Fire Rating:
1. Same or better fire rating than the surrounding area.

F. Access doors located in kitchens, restrooms, or areas where water is present shall be stainless steel.

2.3 FACTORY PAINTING

A. Apply prime coat of rust inhibiting paint, unless located in wet area.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer`s instructions and recommendations.

B. In suspended acoustical ceilings, provide a beaded pin or other approved means for identification and easy removal where necessary.

C. Access doors shall only be installed in areas/locations that are readily accessible.

D. Doors shall be installed in such a manner that door will open 180 degrees.

E. Access doors in walls, serving cut-off valves, trap primers, and cleanouts shall be coordinated with the architect/engineer. Top of access doors to be below bottom of wall mount lavatory apron. Access doors will not be allowed in walls above this height unless coordinated with the architect/engineer.

END OF SECTION

SECTION 22 40 01

PLUMBING FIXTURES AND FIXTURE CARRIERS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions, Division 01 Specifications, and Section 22 00 10, apply to this Section.

1.2 SECTION INCLUDES

A. Water Heaters

B. Thermometers

C. Pressure Gages

D. Pete’s Plugs

E. Expansion Tanks

F. Circulating Pumps

G. ADA Accessories

H. Water Closets

I. Urinals

J. Mop sinks

K. Lavatories

L. Wash Fountains

M. Electric Drinking Fountains

N. Sinks

O. Fixture carriers

P. Thermostatic Mixing Valves

Q. Back Flow Preventers

R. Emergency Fixtures

S. Utility and Washer Boxes

T. Floor Drains and Floor Sinks

U. Floor Drains and Floor Sinks for ALTRO Floor

V. Whirlpools

W. Commercial Washers and Dryers

X. Ice Makers

Y. Interceptors (Refer to Section 22 13 19)

1.3 RELATED SECTIONS

A. Section 22 00 10 - Basic Plumbing Requirements

B. Section 22 05 30 - Pipe and Pipe Fittings - General

C. Section 22 11 17 - Domestic Water Piping and Appurtenances

D. Section 22 13 17 - Soil, Waste, and Sanitary Drain Piping, Vent Piping, and Appurtenances

E. Section 22 33 34 - Access Doors

F. Section 22 66 54 - Chemical Waste and Vent Piping

G. Section 26 09 18 - Laboratory Utility Shut-Off System

1.4 REFERENCES

A. ASHRAE 90-75 - American Society of Heating, Refrigerating & Air Conditioning Engineers, Inc. (Energy Conservation Standard in New Buildings)

B. PDI-WH 201 - Plumbing & Drainage Institute (Water Hammer Arresters)

C. ANSI Z21.22 - American National Standards Institute (Relief Valves & Automatic Gas Shutoff Devices)

D. ANSI Z358.1 - American National Standards Institute (Emergency Eyewashes and Shower Equipment)

E. AGA - American Gas Association

F. ADA - Americans With Disabilities Act

G. TAS - Texas Accessibility Standards

H. ASSE 1069 - Performance Requirements for Automatic Temperature Control Mixing Valves

I. ASSE 1070 - Water Temperature Limiting Devices

J. ASSE 1071 - Performance Requirements for Mixing Valves for Emergency Showers

1.5 SUBMITTALS

A. Submit shop drawings and product data under provisions of Section 22 00 10, General Conditions, and Division 01.

B. Indicate on submittal construction materials, finishes, sizes, quantities, and related hardware.

C. Product Data:

1. Plumbing fixtures
2. Carriers
3. Fixture trim

D. Certification:
1. Submit certification that complete system complies with test requirements of municipality, State, and other public authorities having jurisdiction over system.

E. Provide closeout documents as required in Division 01, Section 22 00 10.

1.6 QUALITY ASSURANCE

A. Provide faucets, fittings, supply stops, and similar devices of one manufacturer.

B. Verify that the voltage is the same as scheduled on the electrical drawings. If not, change at no cost to the Owner.

C. Regulatory Requirements:
1. Comply with requirements in the following order of precedence:
a. Codes, laws, ordinances, rules, regulations, or orders of any public authority having jurisdiction over installation, inspection, and testing, including local codes.
b. Provisions specified in this section.
c. Local Plumbing Code.

1.7 HANDLING

A. Deliver fixtures crated and in undamaged condition.

B. Replace damaged fixtures with new fixtures.

PART 2 PRODUCTS

2.1 GENERAL

A. All plumbing fixtures shall be new and as shown on the plans.

B. Furnish plumbing fixtures with carriers shown and all necessary trimming.

C. All porcelain enameled cast iron to be acid resistant.

D. All supplies shall be IPS brass with stops.

E. All exposed finished metal parts shall be chromium plated.

F. Rough bodied parts shall be heavily nickel plated.

G. Galvanized nipples will not be permitted.

H. Traps for lavatories, sinks, etc. shall be 17 gauge three-piece chrome plated cast brass with cleanout and IPS tailpiece and chrome plated sleeve.

I. All escutcheons on supplies and waste shall be heavy cast brass set-screw type.

J. Furnish faucets and supply stops with renewable seats.

K. All storage tanks and/or tank type water heaters to be installed with heat traps either in the vertical piping at the water heater connection or in the water heater inlet/outlet connection port.

2.2 WATER HEATERS

A. Type:
1. Commercial Grade Electric:
a. ASME Code Section IV (more than 58 KW)
b. Minimum Working Pressure:
1) 160 psi
2. Commercial Grade Gas:
a. ASME Code Section IV (more than 200,000 BTU input)
b. AGA Seal of Certification
c. Minimum Working Pressure:
1) 150 psi

B. Tank Construction:
1. Insulation:
a. Heavy density fiberglass insulation trimmed with a baked enamel steel jacket.
2. Cleanout:
a. Boiler type hand-hole
3. Temperature and Relief Valve:
a. Comply with ANSI Z21.22
b. Discharge line from valve to be same size as valve outlet
4. Coatings:
a. 316 stainless steel tank construction.

C. Low NOx Requirements:
1. All water heaters/boilers shall meet the TNRCC and TCEQ standards for low NOx as follows:
a. ≤ 75 MBTU 55 PPM
b. > 75 ≤ 400 MBTU 55 PPM
c. > 400 MBTU 30 PPM
2. Boilers/water heaters not meeting these standards will be rejected.

D. Approved Manufacturers:
1. A.O. Smith
2. Bradford White
3. Heat Transfer Products
4. Larrs
5. Lochinvar
6. Rheem
7. State

E. Warranties:
1. Commercial Grade Electric:
a. 3-year warranty on storage tank
b. 1-year warranty on parts
2. Commercial Grade Gas:
a. 5-year warranty on heat exchanger

b. 1-year warranty on parts

F. Provide a 4-inch thick concrete housekeeping pad and drain pan for all floor mount water heaters.

G. Neutralization kits on condensate drain line for all high efficient (90% AFUE or greater) water heaters, equal to JJM Boiler Works, Inc.

H. Each room containing a boiler (greater than 200,000 BTUH or 120 gallons of storage) from which carbon monoxide can be produced shall be provided with a carbon monoxide detector.

2.3 CARBON MONOXIDE DETECTOR

A. Approved Manufacturers:
1. Marcurco - CM-6 / CM-12
2. Equivalent

B. Provide and install carbon monoxide detector with a manual reset in each boiler (greater than 200,000 BTUH or 120 gallons of storage) room.

C. The carbon monoxide detector and all heater(s)/boiler(s) in common room shall be interlocked to disable the burners when the measured level of CO rises above 50 ppm.

D. The carbon monoxide detector shall disable the burners upon loss of power to the detector.

E. The carbon monoxide detector shall be calibrated in accordance with the manufacturer’s recommendations or every eighteen months after installation of the detector. A record of calibration shall be posted at or near the boiler and be readily accessible to an inspector.

F. Mount, install, and wire per manufacturers recommendations.

2.4 EXPANSION TANK

A. Approved Manufacturers:
1. Thrush-Amtrol Model Therm-X-Trol
2. Watts - DETA Series
3. Bell & Gossett PTA Series
4. Watts-PLT

B. Provide and install expansion tank at each water heater installation per manufacturer`s requirements. All expansion tanks shall bear ASME seal that serves boilers (greater than 200,000 BTUH or 120 gallons of storage).

2.5 CIRCULATING PUMPS

A. Approved Manufacturers:
1. Armstrong
2. Bell & Gossett PL Series
3. Grundfos
4. Astro

B. Pumps are to be 100% bronze construction (Lead-Free).

2.6 THERMOMETERS

A. Type:
   1. 9" adjustable angle thermometer

B. Construction:
   1. Temperature range:
      a. Fahrenheit degrees as approved by the Engineer.
   2. Window:
      a. Unbreakable Plexiglas.
      b. Furnish with separable socket.
   3. Manufacturer/Model:
      a. Trerice BX91403 ½
      b. MILJOCO SX935

2.7 VACUUM RELIEF VALVES

A. Type:
   1. Male NPT, low profile, and lead-free.

B. Manufacturer/Model:
   1. Watts LFN36
   2. Mifab
   3. Cash Acme

C. Construction:
   1. Low profile
   2. All lead-free brass body
   3. Protective cap
   4. Testes and rated to ANSI Z21.22
   5. CSA certified
   6. Maximum temperature 250 degrees F.

2.8 PRESSURE GAUGES

A. Type:
   1. 4" dial type pressure gauge

B. Manufacturer/Model:
   1. Trerice 500X
   2. MILJOCO P4509LX
   3. Range is minimum 1 ½ times working pressure of T & P Valve.

C. Construction:
   1. Pressure range:
      a. As approved by the Engineer.
   2. Cast aluminum case
   3. Double strength clear glass window
   4. Stainless steel movement
   5. Phosphor bronze tube
   6. Brass socket
   7. Furnish with a Trerice No. 880 lever handle gauge cock.

D. Accuracy: 1/2 of 1% of scale range.

2.9 PETE`S PLUGS

A. Provide two sets of suitable pressure and temperature gauges for use with the plugs.

2.10 ADA ACCESSORIES

A. P-Trap and water supplies with stop guards
   1. Usage: Each ADA lavatory
   2. Size: Verify with fixture
   3. Manufacturer/Model:
      a. Truebro Lav-Guard 102 or 105 (verify usage)
      b. Plumberex Pro Extreme #X4333 and X4114 (verify usage)

2.11 WATER CLOSETS, URINALS, AND LAVATORIES

A. Approved Manufacturers:
   1. American Standard
   2. Kohler
   3. Sloan
   4. Zurn

2.12 CARRIERS FOR WATER CLOSETS, URINALS, LAVATORIES, AND ELECTRIC WATER COOLERS

A. Water Closets:
   1. Wade 300 Series
   2. Watts
   3. Mifab
   4. Zurn
   5. Josam

B. Urinals:
   1. Wade 400 Series
   2. Watts
   3. JR Smith
   4. Mifab
   5. Zurn
   6. Josam

C. Lavatories:
   1. Wade 520 Series
   2. Watts
   3. JR Smith
   4. Mifab
   5. Zurn
   6. Josam

D. Electric Water Coolers:
   1. Wade 400
   2. Watts
   3. J.R. Smith
   4. Mifab
   5. Zurn
   6. Josam

2.13 WATER HYDRANTS

A. Approved Manufacturers:
1. Woodford
2. Wade
3. MAPA
4. Mifab
5. Josam
6. JR Smith
7. Zurn
8. Prier Products

B. All frost proof water hydrants mounted in building or roof shall be designed to not require an independent drain line unless specifically stated on construction drawings.

2.14 FAUCETS

A. Approved Manufacturers:
1. American Standard
2. Sloan
3. Chicago
4. Delta
5. Symmons
6. Moen
7. T & S Brass
8. Zurn AquaSpec
9. Speakman
10. Elkay
11. Just

2.15 SINKS

A. Approved Manufacturers:
1. Elkay
2. Just

2.16 ELECTRIC WATER COOLERS

A. Approved Manufacturers:
1. Elkay
2. Halsey-Taylor
3. Oasis
4. Acorn
5. Murdock

B. All electric water coolers shall have vandal resistant bubbler and pushbutton activation mechanism.

C. All electric water coolers shall have mechanical control valves to provide operation and water flow in the event of loss of electrical power.

2.17 MOP SINKS

A. Approved Manufacturers:

1. Fiat
2. Stern Williams
3. Acorn
4. Creative Industries Terrazzo Products, Inc.

2.18 SHOWERS

A. Approved Manufacturers:
   1. Acorn
   2. Bradley

2.19 WASH FOUNTAINS

A. Approved Manufacturers:
   1. Acorn
   2. Bradley
   3. Willoughby
   4. Sloan

2.20 FLOOR DRAINS/FLOOR SINKS

A. Approved Manufacturers:
   1. J.R. Smith
   2. Josam
   3. Mifab
   4. Sioux Chief
   5. Wade
   6. Watts
   7. Zurn

2.21 KITCHEN FLOOR DRAINS AND FLOOR SINKS

A. Kitchen floor drains to be 10"x10" constructed of AISI 304 stainless steel with a vertical outlet. Floor drains to be furnished with a floor drain top, ACO adjustable feet, light duty heel safe grates, silt basket, and stainless steel ACO p-trap.

B. Kitchen floor sinks to be 10”x10” constructed of AISI 304 stainless steel with a vertical outlet. Floor sinks to be furnished with a floor sink top, ACO adjustable feet, light duty heel safe half grate. Silt basket, and stainless steel ACO p-trap.

2.22 FLUSH VALVES

A. Approved Manufacturers:
   1. Manual:
      a. Sloan #111 Series Water Closets, #186 Series Urinals
         1) Zurn #Z6000, WSI Water Closets, #Z-6003-WSI Urinals
      b. Provide offset vacuum breaker tube for conflicts with grab bars, as needed, in ADA/TAS water closet stalls.

2.23 THERMOSTATIC MIXING VALVES

A. Approved Manufacturers:
   1. Acorn Controls
   2. Apollo
   3. Bradley

4. Conbraco
5. Leonard
6. Powers
7. Symmons
8. Watts
9. Lawler

B. Thermostatic mixing valves for showers shall comply with ASSE 1069.

C. Thermostatic mixing valves for lavatories and sinks shall comply with ASSE 1070. Provide inlet check stops and inlet y-strainers.

D. Thermostatic mixing valves for emergency fixtures shall comply with ASSE 1071.

2.24 BACKFLOW PREVENTERS

A. Reduced Pressure Zone
1. Bronze or FDA approved epoxy coated cast iron body.
2. Maximum Working Pressure: 175 psi
3. Provide full line size strainer before reduced pressure zone assembly.
4. Provide air gap assembly.

B. Vacuum Breakers (Atmospheric)
1. Bronze bodied
2. Non-spilling type
3. Rated for 150psi maximum operating pressure
4. Elastomers - Nitrile
5. Poppet - Acetal/Polypropylene

C. Vacuum Breakers (Pressure)
1. Bronze bodied
2. Elastomers - Nitrile
3. Union End Ball Valves
4. Rated for 150 psi maximum operating pressure

D. Approved Manufacturers:
1. Apollo
2. Conbraco
3. Watts
4. Zurn
5. Ames

2.25 EMERGENCY FIXTURES

A. Comply with ANSI Z358.1

B. Approved Manufacturers:
1. Acorn Safety
2. Bradley
3. Guardian Equipment
4. Haws
5. Encon Safety Products
6. Water Saver

2.26 SCIENCE/BIOLOGY/CHEMISTRY LABS

A. Plumbing Contractor to provide acid p-trap, supplies with stops, thermostatic mixing valve (equal to Leonard 270LF), and all final connections. All sinks and faucets furnished by others, installed by Plumbing Contractor.

2.27 INTERCEPTORS

A. Refer to Section 22 13 19.

2.28 STORM SHELTER WATER SUPPLY TANKS

A. Lochinvar FVG - glass-lined storage tank (non-ASME)

B. A.O. Smith TJV - NSF-approved glass lining (non-ASME)

C. Lochinvar FVG - glass-lined storage tank (ASME)

D. A. O. Smith TJV - NSF-approved glass lining (ASME)

2.29 UTILITY AND WASHER BOXES

A. Oatey

B. Guy Gray

PART 3 EXECUTION

3.1 PREPARATION

A. All equipment surfaces coming in contact with walls, floors, or surfaces of other fixtures shall be ground truly flat and shall be bedded with fine dental plaster.

B. Install an approved vacuum breaker or backflow preventer on each water supply line serving a plumbing fixture which has a water supply below the rim of the fixture. Vacuum breakers shall be designed to prevent any possible backflow through them. Where these are installed in chrome plated lines, they shall be chrome plated to match.

C. Provide and install a check valve on the cold water supply serving each and every water heater on project.

D. Temperature and pressure relief line to be piped full-sized and in copper to exterior of building, or as noted on plans.

E. Set water heater storage temperature to 140°F.

3.2 INSTALLATION

A. Plumbing contractor is required to provide a mock up for coordination purposes of flush valve and grab bar rough-in locations for water closets in the ADA/TAS stall at each age level in the facility.

B. Furnish and completely install all fixtures shown on plans and as specified.

C. Properly anchor all fixtures, lines, or equipment to construction.

D. Clean all plumbing fixtures before final inspection and acceptance by the Architect.

E. Install all fixtures to proper heights as shown on the plans and in the codes. Refer to Texas Accessibility Standards. Coordinate height with plans. If different from engineering plans, contact the Architect for the correct height. Do not install until written approval is issued by the Architect. If fixture cannot be installed to proper height given, contact Architect for direction. No cost changes will be allowed for changes to piping to correct the problem.

F. Install Handi Lav-Guard Kits per manufacturer on ADA lavatories.

G. Provide and install thermostatic mixing valves at all ADA lavatories, sinks, wash stations, and lavatory systems. Set tempered water supply to 90 to 95 degrees F(tempered), unless noted otherwise by owner.

H. Provide and install thermostatic mixing valves at all emergency showers/eyewashes to 85 degrees F (tepid), unless noted otherwise by owner.

I. Electrical Contractor to provide 120V to Science Lab/Prep. Room solenoid valves. Electrical Contractor to make final 120V tie-in to solenoid valves.

J. Install water heater expansion tank on cold water entering the water heater or storage tank.

K. All tankless water heaters to be installed per manufacturer’s recommendations. All multiple tankless water heater arrangements must be provided with manufacturer’s shop drawings showing all components, piping arrangement, and controllers.

L. Horizontal Y-Strainers shall be located:
   1. On domestic water main entry into the building provide a horizontal Y-strainer downstream of the building isolation valve and upstream of the backflow preventer.
   2. Where infrared controlled lavatories or hand sinks are provided downstream of the supply stops exposed under the fixture.
   3. In gang or private (individual) restrooms directly downstream of the isolation valves behind the access panel.

M. Provide backflow preventer (reduced pressure zone) at all ice makers/machines, coffee/drink dispensers, and soap dispensers at mop sinks, and where shown on architectural and plumbing drawings. Discharge from R.P.Z. to be drained to nearest floor sink/drain/mop sink.

N. Provide framing support attached to building structure for all roof hose bibs. Install per manufacturer's recommendations.

O. Install vacuum relief valves on the cold water supply line at an elevation no less than 12” above top of storage tank/water heater.

P. Plumbing contractor to provide strainers, spools (for future pressure reduction valve), associated cut-off valves, reduced pressure zone, and flood control valve at all building main water entry backflow preventer assemblies. Also, route drain from the backflow preventer (RPZ) to the exterior of the building.

3.3 FIELD QUALITY CONTROL

A. Inspect all faucets, flush valves, stop valves, and other equipment for proper amount of water discharged. Adjust as required to meet low water consumption and ADA/Texas Accessibility Standards.

B. Correct any faucet or other equipment as directed by the Architect/Engineer.

C. Protect all drains during construction. Install covers on all floor drains and floor sinks until substantial completion.

D. Do not install mop sinks until substantial completion.

END OF SECTION

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SECTION 23 00 00

BASIC MECHANICAL REQUIREMENTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SECTION INCLUDES

A. Basic mechanical requirements necessary to provide complete installation of all Division 23 work.

1.3 WORK INCLUDED

A. This section of work comprises furnishing of all materials, equipment, tools, scaffolding, rigging, hoisting, labor and transportation necessary for the complete installation of the mechanical systems as shown on the plans and as specified herein.

B. Bidders shall determine the contents of a complete set of drawings and specifications and be aware that they may be bidding from a partial set of drawings, applicable only to the various separate contracts, subcontracts, or trades as may be issued for bidding purposes only. The contract documents and the complete scope of work for the project are illustrated on the combined Architectural, Structural, Plumbing, Heating, Ventilation, Air Conditioning, and Electrical, and each Bidder shall thoroughly acquaint himself with all the details of the complete set of drawings and specifications before submitting his bid. All drawings and specifications form a part of the contract documents for each separate contract and shall be considered as bound therewith in the event partial sets of plans and specifications are issued for bidding only. The submission of bids shall be deemed evidence of the review and examination of all drawings, specifications, and addenda issued for this project as no allowances will be made because of unfamiliarity with any portion of the complete set of documents.

1.4 CODES & REFERENCE STANDARDS

A. General:
   1. Perform all Division 23 work in strict accordance with the requirements and recommendations stated in the codes and standards except when requirements are modified by the contract documents.
   2. Nothing in the Contract Documents shall be construed to permit work not conforming to these codes.
   3. When two or more codes or standards are applicable to the same work, then the stricter code or standard shall govern.
   4. The date of the code or standard that is in effect on the date of issue of the contract documents except when a particular publication date is specified.
   5. The Contractor shall be held responsible for verifying all local codes and ordinances that may alter any part of the plans or specifications. The Contractor shall bear all costs for correcting the deficiencies.

6. Where local codes and ordinances are not in writing or on record, but a local precedence has been set, the Owner shall pay for any additional cost incurred.

B. Applicable Codes and Standards for All Division 23 Work:
   1. International Building Code
   2. International Gas Code
   3. International Plumbing Code
   4. International Mechanical Code
   5. International Energy Conservation Code
   6. National Electrical Code
   7. American Society of Heating, Refrigerating and Air Conditioning Engineers Standards.
   8. Occupational Safety and Health Administration Standards:
      a. OSHA Standard 2207 - Construction Industry Standards
      b. OSHA 29 CFR Part 1926 - Regulation of Excavation
      c. Texas Underground Facility Damage Prevention Act (H.B. 2295)
      d. All other applicable standards
   9. National Fire Protection Association:
      a. NFPA No. 90A Installation of Air Conditioning and Ventilating Systems
   10. Texas State Board of Insurance Standards
   11. Clean Air Act and Clean Air Act Amendments
   12. State Codes:
      a. Texas Department of Labor Boiler Rules and Regulations
      b. All other applicable codes
   13. Local Municipal Codes and Ordinances

1.5 SCHEDULE OF ABBREVIATIONS

A. Reference Standards are listed in Section 23 using abbreviations listed below:
   1. AABCAssociated Air Balance Council
   2. AASHTOAmerican Association of State Highway and Transportation Officials
   3. ADAAmericans with Disabilities Act
   4. ADCAir Diffusion Council
   5. A/EArchitect/ Engineer
   6. AGAAmerican Gas Association
   7. AMCAAir Moving and Conditioning Association
   8. ANSIAmerican National Standards Institute
   9. AHRIAir-Conditioning and Refrigeration Institute
   10. ASHRAEAmerican Society of Heating, Refrigerating and Air-Conditioning Engineers
   11. ASMEAmerican Society of Mechanical Engineers
   12. ASPEAmerican Society of Plumbing Engineers
   13. ASTMAmerican Society for Testing and Materials
   14. AWEAmerican Welding Society
   15. AWWAAmerican Water Works Association
   16. CGACompressed Gas Association
   17. CISPICast Iron Soil Pipe Institute
   18. CSCommercial Standard
   19. CSACanadian Standards Association
   20. DIPRADuctile Iron Pipe Research Association
   21. DOTDepartment of Transportation
   22. DOCDepartment of Commerce

23. FCCFederal Communications Commission
24. FMFactory Mutual
25. FSFederal Specification
26. GSHPAGround Source Heat Pump Association
27. IBCInternational Building Code
28. ITLIndependent Testing Laboratories
29. NECNational Electric Code
30. NFPANational Fire Protection Association
31. NSFNational Sanitation Foundation
32. OSHAOccupational Safety and Health Administration
33. PDIPlumbing and Drainage Institute
34. SMACNASheet Metal and Air Conditioning National Association
35. TCEQTexas Commission on Environmental Quality
36. TDHTexas Department of Health
37. TWCTexas Water Commission
38. UBCUniform Building Code
39. ULUnderwriters Laboratories

1.6 QUALITY ASSURANCE

A. Provide complete installations of all systems.

B. Furnish all items of equipment, material, and labor to complete the Contract even though each and every item necessary is not specifically mentioned or shown.

C. In case of any conflict between the specifications, plans and ordinances, the ordinances shall govern.

D. All materials furnished under this Contract shall be new, free from defects of any kind, of the quality and design hereinafter specified, and shall conform to the standards of Underwriter`s Laboratories Inc., except for equipment which U.L. does not list or provide label service.

E. All mechanical equipment and fixtures shall be the same brand unless scheduled differently on plans.

F. Contractor`s Responsibility:
   1. Erect barricades, protective fencing, and signs to prevent injury to personnel on site.
   2. Make permanent connection to utilities or existing lines. Determine depth and location, and bid accordingly.
   3. Relocate and repair any existing lines cut by general construction work.
   4. Pay all costs in connection with metering devices.
   5. Plans do not show exact location and elevations of lines, nor do they show all offsets required.
   6. Deviate from plans as required to conform to the general construction and provide proper grading.
   7. Maintain all utility services during construction to existing portions of job that remain.
   8. Procure and pay for all necessary permits or licenses to carry out the work.
   9. Obtain and pay for all the necessary certificates of approval which must be delivered to the A/E before final acceptance of the work.
   10. Periodically remove rubbish, clean or repair all surfaces marred by the work required under this contract.

11. Protect work from damage by other trades.
12. Make all tests required by law; pay all costs in connection with the testing.
13. Where job conditions require changes in indicated locations and arrangement, make such changes without extra cost to Owner.
14. Provide motor starters, controls, relays, all low-voltage wiring, conduit and wiring related to HVAC and other equipment and devices to form a complete working system. See Section 26 00 00.

1.7 DEFINITIONS

A. Approval:
   1. It is understood that approval must be obtained from the A/E in writing before proceeding with the proposed work.
   2. Approval by the A/E of any changes, submitted by the Contractor will be considered as general only to aid the Contractor in expediting his work.

B. Contractor:
   1. The Contractor engaged to execute the work included in a particular section only, even though he may be technically described as a Subcontractor to the General Contractor.
   2. If the Contractor engaged to execute said work employs Sub-Contractors to perform various portions of the work included under this Section, he shall be held responsible for the execution of same, in full conformity with Contract Document requirements.
   3. The Contractor shall cooperate at all times and shall be responsible for the satisfactory cooperation of his Subcontractors with the other Contractors on the job so that all of the various phases of the work may be properly coordinated without unnecessary delays or damage to any parts of the work of any Contractor.

C. Provide:
   1. Defined as requiring the furnishing and installing of the item or facility indicated, complete in all respects and ready for operation unless otherwise specifically noted.

1.8 WARRANTY

A. The Contractor shall warranty his work against defective materials and workmanship for a period of one year from the date of acceptance of the job.

B. Neither the final payment nor any provisions in Contract Documents shall relieve the Contractor of the responsibility for faulty materials or workmanship.

C. He shall remedy any defects due thereto, and pay for any damage to other work resulting therefrom, which shall appear within a period of one year from date of substantial completion.

D. The Owner shall give notice of observed defects with reasonable promptness.

E. This Guarantee shall not be construed to include the normal maintenance of the various components of the system covered by these specifications.

1.9 SITE VISIT

A. Before submitting his proposal, each bidder shall examine all plans and specifications relating to the work, shall visit the site of the project and become fully informed of the extent and character of the work required.

B. No consideration will be granted for any alleged misunderstanding of the materials to be furnished or the amount of work to be done, it being fully understood that the tender of a proposal carries with it the agreement to all items and conditions referred to herein, or indicated on the accompanying plans or required by nature of the site of which may be fairly implied as essential to the execution and completion of any and all parts of the work.

1.10 SUBMITTALS

A. Refer to Section 23 00 90 for submittal procedures.

1.11 PROJECT RECORD DOCUMENTS

A. The Contractor shall keep a set of plans on the job, noting daily all changes made in connection with the final installation including exact dimensioned locations of all new and uncovered existing utility piping outside the building.

B. Upon submitting his request for final payment, he shall turn over to the A/E, for subsequent transmittal to the Owner, a clean, neatly marked set of reproducible plans showing "as installed" work and an electronic file with changes of materials.

C. In addition to the above, the Contractor shall accumulate during the job`s progress the following data, in duplication (2 each), prepared in 3 ring binders of sufficient size, black in color, neat in appearance, and turned over to the A/E for checking and subsequent delivery to the Owner. Electronic copies of the following are also acceptable, but they must be saved to a single flash drive or external hard drive:
   1. All warranties, guarantees, and manufacturer`s directions on equipment and material covered by the Contract.
   2. Approved fixture brochures.
   3. Copies of approved shop drawings.
   4. Set of operating instructions. Operating instructions shall also include recommended maintenance and seasonal changeover procedures.
   5. Any and all other data and/or plans required during construction.
   6. Repair parts lists of all major items and equipment including name, address, and telephone number of local supplier or agent.

D. The first page, or pages, shall have the names, addresses, and telephone numbers of the following:
   1. General Contractor and all sub-contractors.
   2. Major Equipment Suppliers.

1.12 TRAINING

A. Upon completion of the work and at a time designated by the Owner`s representative, provide a formal training session for the Owner`s operating personnel to include location, operation, and maintenance of all mechanical equipment and systems, some sections have further instructions.

B. Before proceeding with instruction, prepare a typed outline in triplicate listing the subjects that will be covered. Submit the outline for review by the Owner`s representative.

C. At the conclusion of the instruction, obtain the signatures of the attendees on each copy of the outline to signify that they have a proper understanding of the operation and maintenance of the system. Submit the signed outlines to the Owner`s representative and Engineer as a condition of final acceptance.

1.13 PLANS AND SPECIFICATIONS

A. The plans show diagrammatically the locations of the various lines, ducts, conduits, fixtures, and equipment and the method of connecting and controlling them.

B. It is not intended to show every connection in detail and all fittings required for a complete system.

C. The systems shall include but are not limited to the items shown on the plans.

D. Exact locations of these items shall be determined by reference to the general plans and measurements of the building and in cooperation with other contractors, and in all cases, shall be subject to the approval of the A/E.

E. The A/E reserves the right to make any reasonable change in the location of any part of this work without additional cost to the Owner.

F. Contractor, subcontractor, vendors and suppliers are required to waive subrogation against Owner and Engineer.

1.14 UTILITIES, LOCATIONS, AND ELEVATIONS

A. Locations and elevations of the various utilities within the scope of this work have been obtained from the City and/or other substantially reliable sources and are offered separately from the Contract documents, as a general guide only, without guarantees as to accuracy.

B. The Contractor shall examine the site, shall verify to his own satisfaction the locations, elevations and availability of all utilities and services required, and shall adequately inform himself as to their relation to the work; the submission of bids shall be deemed evidence thereof.

C. The Contractor shall coordinate all services with the Utility Companies during construction, coordinate changes made by Utility Companies to the design of project, and coordinate with the Owner, A/E, and Utility the scheduling of any shutdowns or delays that may occur in providing service.

D. The Contractor shall verify location, conduct all necessary tests, inspections, coordinate with Owner`s representatives and utilities, and check for existing underground utilities and lines before ditching.

E. The Contractor shall be responsible for repair of any cut or damaged lines or utilities he uncovers. There are lines and utilities not shown on any plans.

1.15 SUBSTITUTION OF PRODUCTS

A. Substitution of products specified herein will be considered only when a complete list of proposed alternative equipment is submitted to the Engineer in writing, supported by adequate technical and cost data. This includes a complete description of the proposed substitution, drawings, catalog cuts, performance data, test data, or any other data or information necessary for evaluation.

B. All proposed substitutions and data must be received by the Engineer no less than ten working days prior to the scheduled date for opening of bids.

C. The Engineer will consider all such submittals and the A/E will issue an addendum listing items which the Engineer considers acceptable. Only such items as specified or approved as acceptable will be installed on this project.

D. Manufacturers` names are listed herein and on the plans to establish a standard of quality and design. Where a manufacturer`s name is mentioned, products of other manufacturers will be acceptable, if, in the opinion of the Engineer, the substitute material is of equivalent quality or better than that of the material specified.

E. The Contractor`s Bid represents that the bid price is based solely upon the materials and equipment described in the Bid Documents (including addenda, if any) and that he contemplates no substitutions or extras.

F. Requests for substitution are understood to mean that the Contractor:
   1. Has personally investigated the proposed substitution and determined that it is equal or superior in all respects to that specified.
   2. Will provide the same guarantee for the substitution that he would for that specified.
   3. Will, at no cost to the Owner, replace the substitute item with the specified product if the substitute item fails to perform satisfactorily.
   4. After Award of the Contract, substitutions will be considered only under one or more of the following circumstances:
      a. The substitution is required for compliance with subsequent interpretations of code or insurance requirements.
      b. The specified product is unavailable through no fault of the Contractor.
      c. The manufacturer refuses to warranty the specified products as required.
      d. Subsequent information that the specified product is unable to perform properly or to fit in the designated space.
      e. In the Engineer`s sole judgment, the substitution would be in the Owner`s best interest.
   5. Revisions to the mechanical system shall be under the supervision of the Engineer at a standard hourly rate charged by the Engineer and shall be paid by the Contractor originating the changes.

1.16 PROTECTION OF EQUIPMENT AND MATERIALS

A. The Contractor shall take such precautions as may be necessary to properly protect his apparatus from damage.

B. This shall include the creation of all required temporary shelters to adequately protect any apparatus above the floor of the construction and the covering of apparatus in the completed building with tarpaulins or other protective covering.

C. Failure to comply with the above to the satisfaction of the Owner`s inspector will be sufficient cause for the rejection of the equipment in question and its complete replacement by this Contractor.

D. All apparatus shall be cribbed up from the floor or ground by the Contractor and covered with tarpaulins or other protective covering where necessary or directed.

1.17 FINAL INSPECTION

A. It shall be the duty of this Contractor to make a careful inspection trip of the entire project, assuring himself that the work on the project is ready for final acceptance before calling upon the A/E to make a final inspection.

B. To avoid delay of final acceptance of the work, the Contractor shall have all necessary bonds, warranties, receipts, affidavits, etc., called for in the various articles of these specifications, prepared and signed in advance, together with a letter of transmittal, listing each paper included, and shall deliver the same to the A/E at or before the time of said final inspection. The Contractor is cautioned to check over each bond, receipt, etc., before preparing for submission to verify that the terms check with the requirements of the specifications.

1.18 ASBESTOS

A. No asbestos or asbestos containing materials shall be permitted in this project.

1.19 CUTTING AND PATCHING

A. All Subcontractors shall notify the General Contractor sufficiently ahead of construction of any floors, walls, ceiling, roof, etc., of any openings that will be required for his work.

B. He shall see that all sleeves required for his work are set at proper times so as to avoid delay of the job.

C. All necessary cutting of walls, floors, partitions, ceilings, etc., as required for the proper installation of the work under this Contract shall be done at the Subcontractor`s expense in a neat and workmanlike manner, and as approved by the A/E.

D. No joists, beams, girders, or columns shall be cut by any Contractor without first obtaining written permission of the A/E.

E. Patching of openings and/or alterations shall be provided by the General Contractor.

F. All openings in firewalls and floors shall be completely sealed after installation for a completely airtight installation. Sealing material shall be non-combustible and UL approved. The installed sealing assembly shall not cause the fire rating of the penetrated structure to be decreased.

G. All openings in exterior walls shall be sealed watertight.

1.20 IDENTIFICATION

A. Refer to Section 23 05 53.

1.21 MANUFACTURER`S INSTRUCTIONS

A. All equipment and devices shall be installed in accordance with these plans and specifications, manufacturer`s instructions, and applicable codes.

B. Where specifications call for installation of a product to be in accordance with manufacturer`s instructions and/or where manufacturer`s instructions are required for installation of a product, it shall be the contractor`s responsibility to obtain the necessary applicable manufacturer`s instructions and install the product in accordance with the manufacturer`s instructions.

C. It shall be the Contractor`s responsibility to install all equipment, materials, and devices shown on the plans and as called out in these specifications even if manufacturer`s instructions are absolutely unattainable.

1.22 RELATED WORK

A. Whether specifically identified or not, it is the responsibility of the Mechanical Contractor to coordinate all mechanical work with all related trades.

1.23 ELECTRICAL WIRING AND EQUIPMENT FOR MECHANICAL SYSTEMS

A. All wiring, conduit, boxes, equipment (controls, thermostats, relays, contactors, motor starters, heaters, switches) and any other control devices or equipment required to form a complete and properly operating system, shall be the responsibility of the Mechanical Contractor.

B. The Electrical Contractor shall only provide line voltage (including hook-up) to all mechanical equipment.

C. All mechanical controls and devices shall be low voltage unless otherwise noted or shown on the plans. Where line voltage controls or devices are noted, the Contractor shall provide complete wiring diagrams (approved by the Engineer) to the Electrical Contractor prior to final hook-up.

D. All electrical resistance heating elements which are scheduled to be served by three-phase electrical power shall impose an equal electrical load on all phases. Electrical resistance elements which are not balanced over all three phases are not acceptable.

E. The Mechanical and Electrical plans are based on the equipment and devices scheduled as shown on the plans or as called for in the specifications. Should any mechanical equipment or device be changed or approved from those which are shown or noted, all electrical and/or mechanical changes shall be made at the expense of the trade or contractor initiating the change with no expense to the Owner, Architect, Engineer or their representatives.

F. All wiring provided by this Contractor shall be installed in a workmanlike manner using tie wraps, labels, anchors and etc. Loose wiring is not acceptable.

G. All conduit and boxes required in all walls for control purposes (thermostats, etc.) shall be provided by electrical contractor. All conduit required in attic, clear spaces, or on roof shall be by mechanical contractor.

1.24 DEMOLITION AND REMODEL

A. It shall be the responsibility of this Contractor to see that all demolition and remodeling work involving his trade (including but not limited to chilled and hot water piping used for space cooling and heating, condensate lines, air handlers, mechanical equipment, etc.) is accomplished in a manner and completeness to provide the appearance of new construction work.

B. Abandoned air conditioning units shall be removed and disposed of off-site in a legal manner.

C. Any usable equipment and/or structure damaged during demolition and remodel work shall be replaced.

D. All abandoned and/or otherwise unused piping shall be securely capped using materials of the same composition as the original piping.

E. No exposed piping and/or other materials will be permitted in the finished job.

F. Any abandoned piping which penetrates the slab in an exposed area shall be securely capped below the slab.

1.25 OPERATION PRIOR TO COMPLETION

A. When any piece of mechanical or electrical equipment is operable and the Contractor needs to operate the equipment, he may do so providing that he properly supervises the operation.

B. The warranty period shall, however, not commence until such time as the equipment is operated for the beneficial use of the Owner.

C. Regardless of whether or not the equipment has or has not been operated, the Contractor shall properly clean the equipment, install clean filter media, properly adjust and complete all punch list items before final acceptance by the Owner.

D. The date of acceptance and the start of the warranty may not be the same date.

1.26 SAFETY GUARDS

A. Contractor shall furnish and install all safety guards required. All belt driven equipment, projecting shafts and other rotating parts shall be enclosed or adequately guarded.

1.27 FLAME SPREAD PROPERTIES OF MATERIALS

A. All materials and adhesives used for air conditioning filters, acoustical lining and insulation shall conform to NFPA and UL life and flame spread properties of materials.

B. The composite classifications shall not exceed the flame spread rating and the smoke development rating as outlined by NFPA 255/ ASTM E-84 for the basic material, the finishes, adhesives, etc., specified for each system, and shall be such when completely assembled.

1.28 FILTER ASSEMBLIES

A. All filter housings and assemblies shall be factory built and supplied with the unit. A separate filter rack may be required and is the responsibility of the mechanical contractor to provide.

B. Access doors (panels) must be opened to change the air filters shall be labeled "Filter Access" and the number and size of required filters shall be identified.

C. No piping conduit etc. shall be installed in front of this access door.

D. Install clean filters prior to substantial completion.

E. All air handlers shall have filters installed upstream of all coils.

1.29 LEAD MATERIALS

A. No lead or lead containing materials shall be allowed in any domestic or potable water supply piping, valves, fixtures, components, equipment, or any other item.

1.30 REFRIGERANTS

A. Chlorofluorocarbons (CFCs) and Hydrochlorofluorocarbons (HCFCs) shall not be allowed in any equipment on this project.

B. Comply with ASHRAE Standards 15 and 34.

1.31 REFRIGERANT RECOVERY AND RECYCLE

A. Refrigerants shall not be released to the environment.

B. Contractor shall provide recovery and recycle equipment that has been certified by the Electrical Testing Laboratories or Underwriters Laboratories.

C. Contractor shall also provide properly trained and certified (in accordance with EPA) personnel for refrigerant work during installation, demolition, start-up, servicing, etc.

1.32 ACCESS CLEARANCE

A. Proper access to all installed equipment shall be provided. The Mechanical Contractor shall label all points of access immediately upon installation with a marker pen.

B. A minimum of 3 feet shall be maintained in front of all access points.

C. If another trade violates this space, the Mechanical Contractor shall immediately notify the General Contractor to correct this condition.

D. When equipment is installed above lay-in ceiling the Mechanical Contractor shall coordinate with the Ceiling Contractor to provide access without removing part of T-bar ceiling.

E. No speakers, lights, fire alarm equipment, etc. shall be installed in lay-in ceiling tiles where access is to be gained.

PART 2 PRODUCTS

2.1 NOT APPLICABLE

PART 3 EXECUTION

3.1 TESTING

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 sequence and operation throughout the range of operation regardless of the season the contractor shall test all HVAC equipment in both heating and cooling modes.

B. Each and every phase of the new air conditioning, heating and ventilating systems shall be operated separately, or in conjunction with the other, for a period of time, to demonstrate to the satisfaction of the A/E the ability of the equipment to meet the capacity and performance requirements while maintaining design conditions in accordance with the true intent and purpose of these specifications.

C. Previous to such performance tests, the Contractor shall have set all valves, dampers, motors, controllers, thermostats, etc., and shall have the system operating and maintaining design temperatures, humidity, and air circulation throughout all areas of the building.

D. Make adjustments as required to ensure proper functioning of all systems.

E. Special tests on individual systems are specified under individual sections.

F. See Section 23 05 93 for Testing, Adjusting, and Balancing for HVAC.

END OF SECTION

SECTION 23 00 00

BASIC MECHANICAL REQUIREMENTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SECTION INCLUDES

A. Basic mechanical requirements necessary to provide complete installation of all Division 23 work.

1.3 WORK INCLUDED

A. This section of work comprises furnishing of all materials, equipment, tools, scaffolding, rigging, hoisting, labor, and transportation necessary for the complete installation of the mechanical systems as shown on the plans and as specified herein.

B. Bidders shall determine the contents of a complete set of drawings and specifications and be aware that they may be bidding from a partial set of drawings, applicable only to the various separate contracts, subcontracts, or trades as may be issued for bidding purposes only. The contract documents and the complete scope of work for the project are illustrated on the combined Architectural, Structural, Plumbing, Heating, Ventilating, Air Conditioning, and Electrical, and each Bidder shall thoroughly acquaint himself with all the details of the complete set of drawings and specifications before submitting his bid. All drawings and specifications form a part of the contract documents for each separate contract and shall be considered as bound therewith in the event partial sets of plans and specifications are issued for bidding only. The submission of bids shall be deemed evidence of the review and examination of all drawings, specifications, and addenda issued for this project as no allowances will be made because of unfamiliarity with any portion of the complete set of documents.

1.4 CODES AND REFERENCE STANDARDS

A. General:
   1. Perform all Division 23 work in strict accordance with the requirements and recommendations stated in the codes and standards except when requirements are modified by the contract documents.
   2. Nothing in the Contract Documents shall be construed to permit work not conforming to these codes.
   3. When two or more codes or standards are applicable to the same work, then the stricter code or standard shall govern.
   4. The date of the code or standard that is in effect on the date of issue of the contract documents except when a particular publication date is specified.
   5. The Contractor shall be held responsible for verifying all local codes and ordinances that may alter any part of the plans or specifications. The Contractor shall bear all costs for correcting the deficiencies.

6. Where local codes and ordinances are not in writing or on record, but a local precedence has been set, the Owner shall pay for any additional cost incurred.

B. Applicable Codes and Standards for All Division 23 Work:
   1. International Building Code
   2. International Gas Code
   3. International Plumbing Code
   4. International Mechanical Code
   5. International Energy Conservation Code
   6. National Electrical Code
   7. American Society of Heating, Refrigerating and Air Conditioning Engineers Standards.
   8. Occupational Safety and Health Administration Standards:
      a. OSHA Standard 2207 - Construction Industry Standards
      b. OSHA 29 CFR 1926 - Regulation of Excavation
      c. Texas Underground Facility Damage Prevention Act (H.B. 2295)
      d. All other applicable standards
   9. National Fire Protection Association:
      a. NFPA 90A - Installation of Air Conditioning and Ventilating Systems
   10. Texas State Board of Insurance Standards
   11. Clean Air Act and Clean Air Act Amendments
   12. State Codes:
      a. Texas Department of Labor Boiler Rules and Regulations
      b. All other applicable codes
   13. Local Municipal Codes and Ordinances

1.5 SCHEDULE OF ABBREVIATIONS

A. Reference Standards are listed in Section 23 using abbreviations listed below:
   1. AABC (NSTSB) - Associated Air Balance Council
   2. AASHTO - American Association of State Highway and Transportation Officials
   3. ADA - Americans with Disabilities Act
   4. ADC - Air Diffusion Council
   5. A/E - Architect/ Engineer
   6. AGA - American Gas Association
   7. AMCA (DIR) - Air Moving and Conditioning Association
   8. ANSI - American National Standards Institute
   9. AHRI - Air-Conditioning and Refrigeration Institute
   10. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers
   11. ASME - American Society of Mechanical Engineers
   12. ASPE - American Society of Plumbing Engineers
   13. ASTM- American Society for Testing and Materials
   14. AWE - American Welding Society
   15. AWWA - American Water Works Association
   16. CGA - Compressed Gas Association
   17. CISPI - Cast Iron Soil Pipe Institute
   18. CS - Commercial Standard
   19. CSA - Canadian Standards Association
   20. DIPRA - Ductile Iron Pipe Research Association
   21. DOT - Department of Transportation
   22. DOC - Department of Commerce

23. FCC - Federal Communications Commission
24. FM - Factory Mutual
25. FS - Federal Specification
26. GSHPA - Ground Source Heat Pump Association
27. IBC - International Building Code
28. ITL - Independent Testing Laboratories
29. NEC - National Electric Code
30. NFPA - National Fire Protection Association
31. NSF - National Sanitation Foundation
32. OSHA - Occupational Safety and Health Administration
33. PDI - Plumbing and Drainage Institute
34. SMACNA - Sheet Metal and Air Conditioning National Association
35. TCEQ - Texas Commission on Environmental Quality
36. TDH - Texas Department of Health
37. TWC - Texas Water Commission
38. UBC - Uniform Building Code
39. UL - Underwriters Laboratories

1.6 QUALITY ASSURANCE

A. Provide complete installations of all systems.

B. Furnish all items of equipment, material, and labor to complete the Contract even though each and every item necessary is not specifically mentioned or shown.

C. In case of any conflict between the specifications, plans, and ordinances, the ordinances shall govern.

D. All materials furnished under this Contract shall be new, free from defects of any kind, of the quality and design hereinafter specified, and shall conform to the standards of Underwriter`s Laboratories Inc., except for equipment which U.L. does not list or provide label service.

E. All mechanical equipment and fixtures shall be the same brand unless scheduled differently on plans.

F. Contractor`s Responsibility:
   1. Erect barricades, protective fencing, and signs to prevent injury to personnel on site.
   2. Make permanent connection to utilities or existing lines. Determine depth and location, and bid accordingly.
   3. Relocate and repair any existing lines cut by general construction work.
   4. Pay all costs in connection with metering devices.
   5. Plans do not show exact location and elevations of lines, nor do they show all offsets required.
   6. Deviate from plans as required to conform to the general construction and provide proper grading.
   7. Maintain all utility services during construction to existing portions of job that remain.
   8. Procure and pay for all necessary permits or licenses to carry out the work.
   9. Obtain and pay for all the necessary certificates of approval which must be delivered to the A/E before final acceptance of the work.
   10. Periodically remove rubbish, clean or repair all surfaces marred by the work required under this contract.

11. Protect work from damage by other trades.
12. Make all tests required by law; pay all costs in connection with the testing.
13. Where job conditions require changes in indicated locations and arrangement, make such changes without extra cost to Owner.
14. Provide motor starters, controls, relays, all low-voltage wiring, conduit and wiring related to HVAC and other equipment and devices to form a complete working system. See Section 26 00 00.

1.7 DEFINITIONS

A. Approval:
   1. It is understood that approval must be obtained from the A/E in writing before proceeding with the proposed work.
   2. Approval by the A/E of any changes, submitted by the Contractor will be considered as general only to aid the Contractor in expediting his work.

B. Contractor:
   1. The Contractor engaged to execute the work included in a particular section only, even though he may be technically described as a Subcontractor to the General Contractor.
   2. If the Contractor engaged to execute said work employs Sub-Contractors to perform various portions of the work included under this Section, he shall be held responsible for the execution of same, in full conformity with Contract Document requirements.
   3. The Contractor shall cooperate at all times and shall be responsible for the satisfactory cooperation of his Subcontractors with the other Contractors on the job so that all of the various phases of the work may be properly coordinated without unnecessary delays or damage to any parts of the work of any Contractor.

C. Provide:
   1. Defined as requiring the furnishing and installing of the item or facility indicated, complete in all respects, and ready for operation unless otherwise specifically noted.

1.8 WARRANTY

A. The Contractor shall warranty his work against defective materials and workmanship for a period of one year from the date of acceptance of the job.

B. Neither the final payment nor any provisions in Contract Documents shall relieve the Contractor of the responsibility for faulty materials or workmanship.

C. He shall remedy any defects due thereto, and pay for any damage to other work resulting therefrom, which shall appear within a period of one year from date of substantial completion.

D. The Owner shall give notice of observed defects with reasonable promptness.

E. This Guarantee shall not be construed to include the normal maintenance of the various components of the system covered by these specifications.

1.9 SITE VISIT

A. Before submitting his proposal, each bidder shall examine all plans and specifications relating to the work, shall visit the site of the project and become fully informed of the extent and character of the work required.

B. No consideration will be granted for any alleged misunderstanding of the materials to be furnished or the amount of work to be done, it being fully understood that the tender of a proposal carries with it the agreement to all items and conditions referred to herein, or indicated on the accompanying plans or required by nature of the site of which may be fairly implied as essential to the execution and completion of any and all parts of the work.

1.10 SUBMITTALS

A. Refer to Section 23 00 90 for submittal procedures.

1.11 PROJECT RECORD DOCUMENTS

A. The Contractor shall keep a set of plans on the job, noting daily all changes made in connection with the final installation including exact dimensioned locations of all new and uncovered existing utility piping outside the building.

B. Upon submitting his request for final payment, he shall turn over to the A/E, for subsequent transmittal to the Owner, a clean, neatly marked set of reproducible plans showing "as installed" work and an electronic file with changes of materials.

C. In addition to the above, the Contractor shall accumulate during the job`s progress the following data, in duplication (2 each), prepared in 3 ring binders of sufficient size, black in color, neat in appearance, and turned over to the A/E for checking and subsequent delivery to the Owner. Electronic copies of the following are also acceptable, but they must be saved to a single flash drive or external hard drive:
   1. All warranties, guarantees, and manufacturer`s directions on equipment and material covered by the Contract.
   2. Approved fixture brochures.
   3. Copies of approved shop drawings.
   4. Set of operating instructions. Operating instructions shall also include recommended maintenance and seasonal changeover procedures.
   5. Any and all other data and/or plans required during construction.
   6. Repair parts lists of all major items and equipment including name, address, and telephone number of local supplier or agent.

D. The first page, or pages, shall have the names, addresses, and telephone numbers of the following:
   1. General Contractor and all sub-contractors.
   2. Major Equipment Suppliers.

1.12 TRAINING

A. Upon completion of the work and at a time designated by the Owner`s representative, provide a formal training session for the Owner`s operating personnel to include location, operation, and maintenance of all mechanical equipment and systems, some sections have further instructions.

B. Before proceeding with instruction, prepare a typed outline in triplicate listing the subjects that will be covered. Submit the outline for review by the Owner`s representative.

C. At the conclusion of the instruction, obtain the signatures of the attendees on each copy of the outline to signify that they have a proper understanding of the operation and maintenance of the system. Submit the signed outlines to the Owner`s representative and Engineer as a condition of final acceptance.

1.13 PLANS AND SPECIFICATIONS

A. The plans show diagrammatically the locations of the various lines, ducts, conduits, fixtures, and equipment and the method of connecting and controlling them.

B. It is not intended to show every connection in detail and all fittings required for a complete system.

C. The systems shall include but are not limited to the items shown on the plans.

D. Exact locations of these items shall be determined by reference to the general plans and measurements of the building and in cooperation with other contractors, and in all cases, shall be subject to the approval of the A/E.

E. The A/E reserves the right to make any reasonable change in the location of any part of this work without additional cost to the Owner.

F. Contractor, subcontractor, vendors, and suppliers are required to waive subrogation against Owner and Engineer.

1.14 UTILITIES, LOCATIONS, AND ELEVATIONS

A. Locations and elevations of the various utilities within the scope of this work have been obtained from the City and/or other substantially reliable sources and are offered separately from the Contract documents, as a general guide only, without guarantees as to accuracy.

B. The Contractor shall examine the site, shall verify to his own satisfaction the locations, elevations and availability of all utilities and services required, and shall adequately inform himself as to their relation to the work; the submission of bids shall be deemed evidence thereof.

C. The Contractor shall coordinate all services with the Utility Companies during construction, coordinate changes made by Utility Companies to the design of project, and coordinate with the Owner, A/E, and Utility the scheduling of any shutdowns or delays that may occur in providing service.

D. The Contractor shall verify location, conduct all necessary tests, inspections, coordinate with Owner`s representatives and utilities, and check for existing underground utilities and lines before ditching.

E. The Contractor shall be responsible for repair of any cut or damaged lines or utilities he uncovers. There are lines and utilities not shown on any plans.

1.15 SUBSTITUTION OF PRODUCTS

A. Substitution of products specified herein will be considered only when a complete list of proposed alternative equipment is submitted to the Engineer in writing, supported by adequate technical and cost data. This includes a complete description of the proposed substitution, drawings, catalog cuts, performance data, test data, or any other data or information necessary for evaluation.

B. All proposed substitutions and data must be received by the Engineer no less than ten working days prior to the scheduled date for opening of bids.

C. The Engineer will consider all such submittals and the A/E will issue an addendum listing items which the Engineer considers acceptable. Only such items as specified or approved as acceptable will be installed on this project.

D. Manufacturers` names are listed herein and on the plans to establish a standard of quality and design. Where a manufacturer`s name is mentioned, products of other manufacturers will be acceptable, if, in the opinion of the Engineer, the substitute material is of equivalent quality or better than that of the material specified.

E. The Contractor`s Bid represents that the bid price is based solely upon the materials and equipment described in the Bid Documents (including addenda, if any) and that he contemplates no substitutions or extras.

F. Requests for substitution are understood to mean that the Contractor:
   1. Has personally investigated the proposed substitution and determined that it is equal or superior in all respects to that specified.
   2. Will provide the same guarantee for the substitution that he would for that specified.
   3. Will, at no cost to the Owner, replace the substitute item with the specified product if the substitute item fails to perform satisfactorily.
   4. After Award of the Contract, substitutions will be considered only under one or more of the following circumstances:
      a. The substitution is required for compliance with subsequent interpretations of code or insurance requirements.
      b. The specified product is unavailable through no fault of the Contractor.
      c. The manufacturer refuses to warranty the specified products as required.
      d. Subsequent information that the specified product is unable to perform properly or to fit in the designated space.
      e. In the Engineer`s sole judgment, the substitution would be in the Owner`s best interest.
   5. Revisions to the mechanical system shall be under the supervision of the Engineer at a standard hourly rate charged by the Engineer and shall be paid by the Contractor originating the changes.

1.16 PROTECTION OF EQUIPMENT AND MATERIALS

A. The Contractor shall take such precautions as may be necessary to properly protect his apparatus from damage.

B. This shall include the creation of all required temporary shelters to adequately protect any apparatus above the floor of the construction and the covering of apparatus in the completed building with tarpaulins or other protective covering.

C. Failure to comply with the above to the satisfaction of the Owner`s inspector will be sufficient cause for the rejection of the equipment in question and its complete replacement by this Contractor.

D. All apparatus shall be cribbed up from the floor or ground by the Contractor and covered with tarpaulins or other protective covering where necessary or directed.

1.17 FINAL INSPECTION

A. It shall be the duty of this Contractor to make a careful inspection trip of the entire project, assuring himself that the work on the project is ready for final acceptance before calling upon the A/E to make a final inspection.

B. To avoid delay of final acceptance of the work, the Contractor shall have all necessary bonds, warranties, receipts, affidavits, etc., called for in the various articles of these specifications, prepared and signed in advance, together with a letter of transmittal, listing each paper included, and shall deliver the same to the A/E at or before the time of said final inspection. The Contractor is cautioned to check over each bond, receipt, etc., before preparing for submission to verify that the terms check with the requirements of the specifications.

1.18 ASBESTOS

A. No asbestos or asbestos containing materials shall be permitted in this project.

1.19 CUTTING AND PATCHING

A. All Subcontractors shall notify the General Contractor sufficiently ahead of construction of any floors, walls, ceiling, roof, etc., of any openings that will be required for his work.

B. He shall see that all sleeves required for his work are set at proper times so as to avoid delay of the job.

C. All necessary cutting of walls, floors, partitions, ceilings, etc., as required for the proper installation of the work under this Contract shall be done at the Subcontractor`s expense in a neat and workmanlike manner, and as approved by the A/E.

D. No joists, beams, girders, or columns shall be cut by any Contractor without first obtaining written permission of the A/E.

E. Patching of openings and/or alterations shall be provided by the General Contractor.

F. All openings in firewalls and floors shall be completely sealed after installation for a completely airtight installation. Sealing material shall be non-combustible and UL approved. The installed sealing assembly shall not cause the fire rating of the penetrated structure to be decreased.

G. All openings in exterior walls shall be sealed watertight.

1.20 IDENTIFICATION

A. Refer to Section 23 05 53.

1.21 MANUFACTURER`S INSTRUCTIONS

A. All equipment and devices shall be installed in accordance with these plans and specifications, manufacturer`s instructions, and applicable codes.

B. Where specifications call for installation of a product to be in accordance with manufacturer`s instructions and/or where manufacturer`s instructions are required for installation of a product, it shall be the contractor`s responsibility to obtain the necessary applicable manufacturer`s instructions and install the product in accordance with the manufacturer`s instructions.

C. It shall be the Contractor`s responsibility to install all equipment, materials, and devices shown on the plans and as called out in these specifications even if manufacturer`s instructions are absolutely unattainable.

1.22 RELATED WORK

A. Whether specifically identified or not, it is the responsibility of the Mechanical Contractor to coordinate all mechanical work with all related trades.

1.23 ELECTRICAL WIRING AND EQUIPMENT FOR MECHANICAL SYSTEMS

A. All wiring, conduit, boxes, equipment (controls, thermostats, relays, contactors, motor starters, heaters, switches), and any other control devices or equipment required to form a complete and properly operating system, shall be the responsibility of the Mechanical Contractor.

B. The Electrical Contractor shall only provide line voltage (including hook-up) to all mechanical equipment.

C. All mechanical controls and devices shall be low voltage unless otherwise noted or shown on the plans. Where line voltage controls or devices are noted, the Contractor shall provide complete wiring diagrams (approved by the Engineer) to the Electrical Contractor prior to final hook-up.

D. All electrical resistance heating elements which are scheduled to be served by three-phase electrical power shall impose an equal electrical load on all phases. Electrical resistance elements which are not balanced over all three phases are not acceptable.

E. The Mechanical and Electrical plans are based on the equipment and devices scheduled as shown on the plans or as called for in the specifications. Should any mechanical equipment or device be changed or approved from those which are shown or noted, all electrical and/or mechanical changes shall be made at the expense of the trade or contractor initiating the change with no expense to the Owner, Architect, Engineer or their representatives.

F. All wiring provided by this Contractor shall be installed in a workmanlike manner using tie wraps, labels, anchors and etc. Loose wiring is not acceptable.

G. All conduit and boxes required in all walls for control purposes (thermostats, etc.) shall be provided by electrical contractor. All conduit required in attic, clear spaces, or on roof shall be by mechanical contractor.

1.24 DEMOLITION AND REMODEL

A. It shall be the responsibility of this Contractor to see that all demolition and remodeling work involving his trade (including but not limited to chilled and hot water piping used for space cooling and heating, condensate lines, air handlers, mechanical equipment, etc.) is accomplished in a manner and completeness to provide the appearance of new construction work.

B. Abandoned air conditioning units shall be removed and disposed of off-site in a legal manner.

C. Any usable equipment and/or structure damaged during demolition and remodel work shall be replaced.

D. All abandoned and/or otherwise unused piping shall be securely capped using materials of the same composition as the original piping.

E. No exposed piping and/or other materials will be permitted in the finished job.

F. Any abandoned piping which penetrates the slab in an exposed area shall be securely capped below the slab.

1.25 OPERATION PRIOR TO COMPLETION

A. When any piece of mechanical or electrical equipment is operable and the Contractor needs to operate the equipment, he may do so providing that he properly supervises the operation.

B. The warranty period shall, however, not commence until such time as the equipment is operated for the beneficial use of the Owner.

C. Regardless of whether or not the equipment has or has not been operated, the Contractor shall properly clean the equipment, install clean filter media, properly adjust and complete all punch list items before final acceptance by the Owner.

D. The date of acceptance and the start of the warranty may not be the same date.

1.26 SAFETY GUARDS

A. Contractor shall furnish and install all safety guards required. All belt driven equipment, projecting shafts, and other rotating parts shall be enclosed or adequately guarded.

1.27 FLAME SPREAD PROPERTIES OF MATERIALS

A. All materials and adhesives used for air conditioning filters, acoustical lining, and insulation shall conform to NFPA and UL life and flame spread properties of materials.

B. The composite classifications shall not exceed the flame spread rating and the smoke development rating as outlined by NFPA 255/ ASTM E-84 for the basic material, the finishes, adhesives, etc., specified for each system, and shall be such when completely assembled.

1.28 FILTER ASSEMBLIES

A. All filter housings and assemblies shall be factory built and supplied with the unit. A separate filter rack may be required and is the responsibility of the mechanical contractor to provide.

B. Access doors (panels) must be opened to change the air filters shall be labeled "Filter Access" and the number and size of required filters shall be identified.

C. No piping conduit etc. shall be installed in front of this access door.

D. Install clean filters prior to substantial completion.

E. All air handlers shall have filters installed upstream of all coils.

1.29 LEAD MATERIALS

A. No lead or lead containing materials shall be allowed in any domestic or potable water supply piping, valves, fixtures, components, equipment, or any other item.

1.30 REFRIGERANTS

A. Chlorofluorocarbons (CFCs) and Hydrochlorofluorocarbons (HCFCs) shall not be allowed in any equipment on this project.

B. Comply with ASHRAE Standards 15 and 34.

1.31 REFRIGERANT RECOVERY AND RECYCLE

A. Refrigerants shall not be released to the environment.

B. Contractor shall provide recovery and recycle equipment that has been certified by the Electrical Testing Laboratories or Underwriters Laboratories.

C. Contractor shall also provide properly trained and certified (in accordance with EPA) personnel for refrigerant work during installation, demolition, start-up, servicing, etc.

1.32 ACCESS CLEARANCE

A. Proper access to all installed equipment shall be provided. The Mechanical Contractor shall label all points of access immediately upon installation with a marker pen.

B. A minimum of 3 feet shall be maintained in front of all access points.

C. If another trade violates this space, the Mechanical Contractor shall immediately notify the General Contractor to correct this condition.

D. When equipment is installed above lay-in ceiling the Mechanical Contractor shall coordinate with the Ceiling Contractor to provide access without removing part of T-bar ceiling.

E. No speakers, lights, fire alarm equipment, etc. shall be installed in lay-in ceiling tiles where access is to be gained.

PART 2 PRODUCTS

2.1 NOT APPLICABLE

PART 3 EXECUTION

3.1 TESTING

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 sequence and operation throughout the range of operation regardless of the season the contractor shall test all HVAC equipment in both heating and cooling modes.

B. Each and every phase of the new air conditioning, heating, and ventilating systems shall be operated separately, or in conjunction with the other, for a period of time, to demonstrate to the satisfaction of the A/E the ability of the equipment to meet the capacity and performance requirements while maintaining design conditions in accordance with the true intent and purpose of these specifications.

C. Previous to such performance tests, the Contractor shall have set all valves, dampers, motors, controllers, thermostats, etc., and shall have the system operating and maintaining design temperatures, humidity, and air circulation throughout all areas of the building.

D. Make adjustments as required to ensure proper functioning of all systems.

E. Special tests on individual systems are specified under individual sections.

F. See Section 23 05 93 for Testing, Adjusting, and Balancing for HVAC.

END OF SECTION

SECTION 23 00 90

HVAC SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 SUMMARY

A. This section supplements Division 01 Submittal Procedures and contains additional requirements applicable to Division 23 submittals.

1.2 SECTION INCLUDES

A. This section includes, but is not limited to:
   1. HVAC submittal procedures
   2. List of required Division 23 submittals to the engineer
   3. This section applies only to the Division 23 specifications. Submittals required by other specification divisions are not included here, even though the same subcontractor may be providing work under other divisions.

1.3 RELATED SECTION

A. Division 01 - Submittal Procedures

1.4 DEFINITIONS

A. Product Data: Illustrations, standard schedules, performance charts, instructions, and brochures furnished by the contractor, subcontractor, manufacturer, or supplier to illustrate materials or equipment or to illustrate some portion of the work. Provide a summary of scheduled items with all data in schedules.

B. Shop Drawings: Drawings, diagrams, schedules, and other data specifically prepared for the work by the contractor, subcontractor, manufacturer, or supplier to illustrate some portion of the work.

C. Equipment/Material Submittal Package: A compilation of the product data, shop drawings, and other items as required by the specifications, submitted near the start of the work. Typically, the specifications require the initial submittal package to be submitted within a certain number of days after the work starts.

D. Quality Assurance Submittal: Items submitted before and during the execution of a particular portion of the work for the purpose of guarding against defects and deficiencies.

E. Quality Control Submittal: Items submitted at the completion of a particular portion of the work for the purpose of evaluating completed activities and elements of the work for conformance with contract requirements (e.g. start-up reports).

F. Closeout Submittals: Items submitted at or near the completion of the contract.

1.5 SUBMITTALS

A. The materials, workmanship, design, and arrangement of all work installed under this contract shall be subject to the review of the architect, engineer, and owner.

B. Manufacturers: Manufacturers submitted shall be as per the acceptable manufacturers listed in each specification section or referenced schedule. For additional manufacturers requiring approval, reference the Substitution of Products article in Section 23 00 00.

C. Required Submittals: Refer to the Submittals article of each individual Division 23 specification section for the required items to be submitted.

D. Contractor's Coordination Submittals: The contractor may require his subcontractors to provide drawings, setting diagrams, and similar information to help coordinate the project, but such data shall remain between the contractor and his subcontractors and will not be reviewed by the engineer.

E. Electronic Submittals: E-mail or other electronic forms of submittals from the contractor are required. The procedures described in this section shall be as follows:
   1. The contractor shall supply one electronic copy of the submittal.
   2. The electronic files will either be e-mailed to the architect or posted to a project management and information exchange website, depending on the architect's requirements. The architect and contractor can distribute copies of the files as desired.
   3. The engineer will retain an electronic copy of the submittal and all responses.

F. Coordination Correspondence: The contractor may desire to verify the acceptability of a particular item prior to assembling the initial submittal package. The contractor may send material directly to the engineer for comments and feedback. This communication will be treated as normal coordination correspondence and will not be tracked or documented as a formal submittal. The engineer may or may not respond to such correspondence. If the engineer agrees, in writing, to the use of a particular item, then that same material shall be included in the initial submittal package along with a copy of the correspondence.

G. Unapproved Products: If materials or equipment are installed before being reviewed by the engineer, the contractor shall be liable for the removal and replacement of such unapproved materials and equipment, at no additional expense to the owner. Additionally, if the removal and replacement of rejected materials or equipment necessitates the removal and replacement of other related materials or equipment, then the contractor shall be liable for the removal and replacement of the related materials and equipment at no additional expense to the owner.

H. Product Data: Where the content of manufacturer submittal literature includes data not pertinent to the submittal, clearly indicate which portions of the contents are being submitted for review. Catalogs, pamphlets, or other documents submitted to describe items on which review is being requested shall be specific and identifications in catalogs, pamphlets, etc., of items submitted shall be clearly made in a contrasting ink or highlighting. Data of a general nature shall not be acceptable.

I. Shop Drawings:
   1. Scale and measurements: Make shop drawings accurately to a scale sufficiently large to show all pertinent aspects of the item.
   2. Electronic shop drawing submittals are required.

PART 2 PRODUCTS

2.1 NOT APPLICABLE

PART 3 EXECUTION

3.1 SUBMITTALS

A. Make submittals of product data, shop drawings, samples, quality assurance submittals, quality control submittals, and other items in accordance with the requirements of this section, applicable sections in Division 23, and additional requirements of each individual Division 23 specification section.

B. Grouping of Submittals:
   1. The submittal package shall be coordinated and included in a single submission. Multiple submissions are not acceptable except where prior written approval has been obtained from the engineer. Partial submittals may be rejected, without being reviewed, as not complying with the provisions of the contract.
   2. In the case that multiple submissions are approved, it is the responsibility of the contractor to maintain and update a submittal checklist. The contractor shall ensure that all applicable submittal sections are submitted to the Engineer. If a submittal section is not submitted, it will be considered rejected until reviewed by the Engineer.
   3. If submittal sections are submitted as individual submittal files, the submittal sections will be grouped and returned as one file with one set of submittal responses.

C. Electronic Submittal Organization:
   1. Electronic submittals are to be submitted as a single PDF file. Within the PDF file, each section shall be bookmarked.
   2. Provide an electronic submittal cover sheet that lists at least the following:
      a. Project name
      b. Date
      c. Name and address of architect
      d. Name and address of engineer
      e. Name, address, and telephone number of prime contractor
      f. Name, address, and telephone number of HVAC contractor
      g. Name, address, and telephone number of HVAC supplier
   3. Provide an electronic index sheet listing all items submitted.
   4. The contractor shall call to the attention of the engineer, clouded in the submittal and noted after the index sheet, any instance in which the submittals are known to differ from the requirements of the contract documents.
   5. Organize all required items by specification section. The material for each specification section shall be organized as follows:
      a. Provide an electronic section cover sheet that lists the same information as the submittal cover sheet, plus the specification number and title and the name, address, and telephone number of the vendor or vendor’s representative, if applicable.
      b. Refer to the individual Division 23 specification sections for any required organization of the submittal material within each submittal section.

c. Bookmarked sections shall be arranged by specification section number in numerical order.
d. Submit in accordance with these procedures and procedures described in Division 01 Submittal Procedures.
e. Submittals not organized as described here may be rejected, without being reviewed, as not complying with the provisions of the contract.

D. Response to engineer's review:
1. Review comments: Review comments of the engineer will either be shown on the returned sets to the contractor or shown on a document attached to the sets. If the comments are on an attached document, then the engineer will place a note on the submittal referring to the attached comments. In such cases, the engineer's signature will appear only on the attached document. If the attached, signed document becomes physically separated from the submittal, then the submittal will no longer be considered as being a reviewed submittal.
2. Complete rejection: If the submittal is not complete or does not meet the requirements of this specification section, then the engineer may reject the entire submittal and return the submittal without further review or comment. In such cases, the entire submittal shall be completely revised and resubmitted. The resubmittal shall be given a new submittal number and shall be documented and processed as a separate submittal from the original.
3. Held for completion: If the submittal is not complete, but is only missing some minor item, the engineer may, at the engineer's sole discretion, hold the submittal rather than rejecting and returning the submittal. In such cases, the engineer will notify the architect and contractor that the submittal is being held for completion. The contractor will be given a predetermined amount of time to provide the missing item. Upon receipt of the missing item, the engineer will insert the missing item into the submittal package and proceed with the review process.
4. Partial rejection: The engineer may reject only certain portions of the submittal. In such cases, only those rejected portions or items need to be revised and resubmitted.
5. Provide as noted and corrected: The engineer may note a required change to a submitted item, but may not consider the change serious enough to require a resubmittal. In such cases, the engineer will note that the item is to be provided as noted or corrected. In such cases, the contractor may proceed to provide the item. However, if subsequent observations reveal that the noted change was not made, then the contractor shall be liable for removal and replacement of the item at no additional cost to the owner.
6. Reviewed without comment: The contractor may proceed to provide all materials and equipment as submitted.

E. Close-out Submittals:
1. Provide close-out submittals in accordance with the requirements of Division 1.

END OF SECTION

SECTION 23 00 90

HVAC SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 SUMMARY

A. This section supplements Division 01 Submittal Procedures and contains additional requirements applicable to Division 23 submittals.

1.2 SECTION INCLUDES

A. This section includes, but is not limited to:
   1. HVAC submittal procedures
   2. List of required Division 23 submittals to the engineer
   3. This section applies only to the Division 23 specifications. Submittals required by other specification divisions are not included here, even though the same subcontractor may be providing work under other divisions.

1.3 RELATED SECTION

A. Division 01 - Submittal Procedures

1.4 DEFINITIONS

A. Product Data: Illustrations, standard schedules, performance charts, instructions, and brochures furnished by the contractor, subcontractor, manufacturer, or supplier to illustrate materials or equipment or to illustrate some portion of the work. Provide a summary of scheduled items with all data in schedules.

B. Shop Drawings: Drawings, diagrams, schedules, and other data specifically prepared for the work by the contractor, subcontractor, manufacturer, or supplier to illustrate some portion of the work.

C. Equipment/Material Submittal Package: A compilation of the product data, shop drawings, and other items as required by the specifications, submitted near the start of the work. Typically, the specifications require the initial submittal package to be submitted within a certain number of days after the work starts.

D. Quality Assurance Submittal: Items submitted before and during the execution of a particular portion of the work for the purpose of guarding against defects and deficiencies.

E. Quality Control Submittal: Items submitted at the completion of a particular portion of the work for the purpose of evaluating completed activities and elements of the work for conformance with contract requirements (e.g. start-up reports).

F. Closeout Submittals: Items submitted at or near the completion of the contract.

1.5 SUBMITTALS

A. The materials, workmanship, design, and arrangement of all work installed under this contract shall be subject to the review of the architect, engineer, and owner.

B. Manufacturers: Manufacturers submitted shall be as per the acceptable manufacturers listed in each specification section or referenced schedule. For additional manufacturers requiring approval, reference the Substitution of Products article in Section 23 00 00.

C. Required Submittals: Refer to the Submittals article of each individual Division 23 specification section for the required items to be submitted.

D. Contractor's Coordination Submittals: The contractor may require his subcontractors to provide drawings, setting diagrams, and similar information to help coordinate the project, but such data shall remain between the contractor and his subcontractors and will not be reviewed by the engineer.

E. Electronic Submittals: E-mail or other electronic forms of submittals from the contractor are required. The procedures described in this section shall be as follows:
   1. The contractor shall supply one electronic copy of the submittal.
   2. The electronic files will either be e-mailed to the architect or posted to a project management and information exchange website, depending on the architect's requirements. The architect and contractor can distribute copies of the files as desired.
   3. The engineer will retain an electronic copy of the submittal and all responses.

F. Coordination Correspondence: The contractor may desire to verify the acceptability of a particular item prior to assembling the initial submittal package. The contractor may send material directly to the engineer for comments and feedback. This communication will be treated as normal coordination correspondence and will not be tracked or documented as a formal submittal. The engineer may or may not respond to such correspondence. If the engineer agrees, in writing, to the use of a particular item, then that same material shall be included in the initial submittal package along with a copy of the correspondence.

G. Unapproved Products: If materials or equipment are installed before being reviewed by the engineer, the contractor shall be liable for the removal and replacement of such unapproved materials and equipment, at no additional expense to the owner. Additionally, if the removal and replacement of rejected materials or equipment necessitates the removal and replacement of other related materials or equipment, then the contractor shall be liable for the removal and replacement of the related materials and equipment at no additional expense to the owner.

H. Product Data: Where the content of manufacturer submittal literature includes data not pertinent to the submittal, clearly indicate which portions of the contents are being submitted for review. Catalogs, pamphlets, or other documents submitted to describe items on which review is being requested shall be specific and identifications in catalogs, pamphlets, etc., of items submitted shall be clearly made in a contrasting ink or highlighting. Data of a general nature shall not be acceptable.

I. Shop Drawings:
   1. Scale and measurements: Make shop drawings accurately to a scale sufficiently large to show all pertinent aspects of the item.
   2. Electronic shop drawing submittals are required.

PART 2 PRODUCTS

2.1 NOT APPLICABLE

PART 3 EXECUTION

3.1 SUBMITTALS

A. Make submittals of product data, shop drawings, samples, quality assurance submittals, quality control submittals, and other items in accordance with the requirements of this section, applicable sections in Division 23, and additional requirements of each individual Division 23 specification section.

B. Grouping of Submittals:
   1. The submittal package shall be coordinated and included in a single submission. Multiple submissions are not acceptable except where prior written approval has been obtained from the engineer. Partial submittals may be rejected, without being reviewed, as not complying with the provisions of the contract.
   2. In the case that multiple submissions are approved, it is the responsibility of the contractor to maintain and update a submittal checklist. The contractor shall ensure that all applicable submittal sections are submitted to the Engineer. If a submittal section is not submitted, it will be considered rejected until reviewed by the Engineer.
   3. If submittal sections are submitted as individual submittal files, the submittal sections will be grouped and returned as one file with one set of submittal responses.

C. Electronic Submittal Organization:
   1. Electronic submittals are to be submitted as a single PDF file. Within the PDF file, each section shall be bookmarked.
   2. Provide an electronic submittal cover sheet that lists at least the following:
      a. Project name
      b. Date
      c. Name and address of architect
      d. Name and address of engineer
      e. Name, address, and telephone number of prime contractor
      f. Name, address, and telephone number of HVAC contractor
      g. Name, address, and telephone number of HVAC supplier
   3. Provide an electronic index sheet listing all items submitted.
   4. The contractor shall call to the attention of the engineer, clouded in the submittal and noted after the index sheet, any instance in which the submittals are known to differ from the requirements of the contract documents.
   5. Organize all required items by specification section. The material for each specification section shall be organized as follows:
      a. Provide an electronic section cover sheet that lists the same information as the submittal cover sheet, plus the specification number and title and the name, address, and telephone number of the vendor or vendor’s representative, if applicable.
      b. Refer to the individual Division 23 specification sections for any required organization of the submittal material within each submittal section.

c. Bookmarked sections shall be arranged by specification section number in numerical order.
d. Submit in accordance with these procedures and procedures described in Division 01 Submittal Procedures.
e. Submittals not organized as described here may be rejected, without being reviewed, as not complying with the provisions of the contract.

D. Response to engineer's review:
1. Review comments: Review comments of the engineer will either be shown on the returned sets to the contractor or shown on a document attached to the sets. If the comments are on an attached document, then the engineer will place a note on the submittal referring to the attached comments. In such cases, the engineer's signature will appear only on the attached document. If the attached, signed document becomes physically separated from the submittal, then the submittal will no longer be considered as being a reviewed submittal.
2. Complete rejection: If the submittal is not complete or does not meet the requirements of this specification section, then the engineer may reject the entire submittal and return the submittal without further review or comment. In such cases, the entire submittal shall be completely revised and resubmitted. The resubmittal shall be given a new submittal number and shall be documented and processed as a separate submittal from the original.
3. Held for completion: If the submittal is not complete, but is only missing some minor item, the engineer may, at the engineer's sole discretion, hold the submittal rather than rejecting and returning the submittal. In such cases, the engineer will notify the architect and contractor that the submittal is being held for completion. The contractor will be given a predetermined amount of time to provide the missing item. Upon receipt of the missing item, the engineer will insert the missing item into the submittal package and proceed with the review process.
4. Partial rejection: The engineer may reject only certain portions of the submittal. In such cases, only those rejected portions or items need to be revised and resubmitted.
5. Provide as noted and corrected: The engineer may note a required change to a submitted item, but may not consider the change serious enough to require a resubmittal. In such cases, the engineer will note that the item is to be provided as noted or corrected. In such cases, the contractor may proceed to provide the item. However, if subsequent observations reveal that the noted change was not made, then the contractor shall be liable for removal and replacement of the item at no additional cost to the owner.
6. Reviewed without comment: The contractor may proceed to provide all materials and equipment as submitted.

E. Close-out Submittals:
1. Provide close-out submittals in accordance with the requirements of Division 1.

END OF SECTION

SECTION 23 05 19

METERS AND GAUGES FOR HVAC PIPING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions, Division 01 Specifications, and Section 23 00 00, apply to this Section.

1.2 SECTION INCLUDES

A. Thermometers

B. Pressure gauges

C. Flow meters

D. Pete`s plugs

1.3 RELATED SECTIONS

A. Section 22 05 30 - Pipe and Pipe Fittings - General

B. Section 23 00 00 - Basic Mechanical Requirements

C. Section 23 05 93 - Testing, Adjusting and Balancing for HVAC

D. Section 23 09 23 - Energy Management Control System

E. Section 23 21 13 - Hydronic Piping, Valves, and Appurtenances

F. Section 23 21 23 - Hydronic Pumps

G. Section 23 33 33 - Access Doors

H. Section 23 52 33 - Water Tube Boilers

1.4 SUBMITTALS

A. Provide submittal data on all items specified in this section in accordance with Specification Section 23 00 90, General Conditions, and Division 01.

PART 2 PRODUCTS

2.1 THERMOMETERS

A. Type:
   1. 9" adjustable angle thermometer

B. Construction:
   1. Temperature range:
      a. Fahrenheit degrees as approved by the Engineer.
   2. Window:

a. Unbreakable, Heat resistant Acrylic.
3. Furnish with separable socket.
4. Manufacturer/Model:
a. Trerice
b. MILJOCO

2.2 PRESSURE GAUGES

A. Type:
1. 4" dial type pressure gauge

B. Manufacturer/Model:
1. Trerice
2. MILJOCO

C. Construction:
1. Pressure range:
a. PSI as approved by Engineer.
2. Cast aluminum case
3. Double strength clear glass window
4. Stainless steel movement
5. Phosphor bronze tube with brass socket
6. Furnish with a quarter turn lever handle gauge cock.
7. Accuracy:
a. 1% of scale range.

2.3 CHILLED/HOT WATER FLOW METERS

A. Type:
1. Dual turbine flow meter

B. Manufacturer:
1. ONICON Model F-1200

C. Construction:
1. Two contra-rotating axial turbines with electronic impedance-based sensing, and an averaging circuit to reduce measurement errors due to swirl and flow profile distortion.
2. Output signal 0-15V
3. Accuracy:
a. ± 0.5% of rate at calibrated velocity
b. ± 1.0% of rate over a 10:1 turndown
c. ± 2.0% of rate over a 50:1 turndown

2.4 CONDENSER WATER FLOW METERS

A. Type:
1. Insertion electromagnetic flow meter

B. Manufacturer:
1. ONICON Model F-3500

C. Construction:
1. Wetted metal components to be 316SS.

2. Meter shall average velocity readings from two sets of diametrically opposed electrodes
3. Output signal 0-10V
4. Accuracy:
   a. ± 1.0% of rate from 2-20ft/s

2.5 PETE`S PLUGS

A. Provide two sets of suitable pressure and temperature gauges for use with the plugs.

PART 3 EXECUTION

3.1 INSTALLATION

A. Furnish and install thermometers, pressure gauges, and Pete`s plugs where indicated on plans in accordance with manufacturer’s instructions.

B. Install thermometers at each pump, and on the return water piping of chilled water and hot water systems.

C. Install pressure gages across each pump.

D. Flow meters shall be installed per manufacturer’s instructions. Particular attention to be paid to upstream and downstream straight pipe runs. Coordinate exact installation location with engineer.

E. Provide 10 extra Pete’s plugs as located by test and balance and controls companies.

END OF SECTION

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SECTION 23 05 29

HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions, Division 1 Specifications, and Section 23 00 00, apply to this Section.

1.2 SECTION INCLUDES

A. Refrigerant Piping supports

B. Other supports

1.3 RELATED SECTIONS

A. Section 23 00 00 - Basic Mechanical Requirements

B. Section 23 09 23 - Energy Management Control System

C. Section 23 31 13 - Metal Ductwork

D. Section 23 34 16 - HVAC Fans

E. Section 23 64 23 - Air Cooled Scroll Compressor Chillers

F. Section 23 81 26 - Split System HVAC Units

1.4 SUBMITTALS

A. Product Data:
   1. Provide submittal data on all items specified in this section in accordance with Section 23 00 90, General Conditions, and Division 1.
   2. Submit shop drawings and catalog data with locations of use.

1.5 REFERENCES

A. Refer to Section 23 00 00 for complete names of references identified in this section.

B. SMACNA Standards

C. ASHRAE - American Society of Heating, Refrigeration and Air Conditioning Engineers

1.6 QUALITY ASSURANCE

A. Isolation devices must be provided by a company whose sole business is to provide isolation equipment.

B. All equipment and materials to be installed in workmanlike manner by experienced mechanics and as recommended by the manufacturers.

C. Design Data: Complete design of isolation equipment including confirmation that no noise will be transmitted to structure of building.

PART 2 PRODUCTS

2.1 GENERAL

A. Provide isolation and support devices as required for all mechanical equipment.

2.2 MANUFACTURERS

A. Amber/Booth

B. Anvil

C. Kenetics

D. Korfund Vibration Mountings

E. Mason

F. Peabody

G. Vibro Acoustics

2.3 CONDENSING UNIT ISOLATION

A. Provide isolation pad between unit and structure as shown on plans.

2.4 FLEXIBLE DUCT CONNECTIONS

A. Use "Ventglas" fabric, fireproof, waterproof, and mildew resistant, approximately 30 ounces per square yard.

B. Comply with SMACNA standards.

2.5 HVAC PIPE SUPPORTS

A. Hangers:
   1. All Copper Piping
      a. Copper plated ferrous hangers.
   2. 2" and smaller piping in walls:
      a. May be split cast ring type with fastening device in walls and chases.
   3. All Other Above Ceiling Locations:
      a. Adjustable clevis type. Hangers to accommodate circumference of pipe and saddles.

B. Hanger Rods:
   1. Type:
      a. Minimum 3/8 inch diameter with machine threads.

C. Minimum Steel Hanger Rod Diameter for Individually Suspended Horizontal Pipes:
   1. 2" and smaller diameter pipe:
      a. 3/8"
   2. 2-1/2" to 3-1/2" diameter pipe:
      a. 1/2"
   3. 4" to 5" diameter pipe:
      a. 5/8"

4. 6" diameter pipe or larger:
    a. 3/4"

2.6 SLEEVES

A. Application:
    1. Provide sleeves for all pipes and conduits which pass through a concrete slab, masonry wall/concrete wall, roof, or other portion of the building structure.

B. Above Grade and/or dry locations:
    1. Material:
        a. 20 or 22 gauge galvanized steel.
    2. Size:
        a. As necessary to allow free passage of the insulated pipe.

C. Passing through fire-rated enclosures:
    1. Material:
        a. Galvanized or black steel pipe.
        b. Non-combustible.
        c. PVC will not be allowed.

PART 3 EXECUTION

3.1 ISOLATION DEVICES AND PAD INSTALLATION

A. Install isolation pads between floor and equipment pads according to manufacturer`s recommendations and approved shop drawings.

B. Install flexible duct connections where ducts connect to fans or air handling units.

C. All joints to be airtight.

D. Provide a minimum of 1/2" slack in connections, and a minimum of 2½" distance between the edges of ducts.

E. Comply with recommendations of ASHRAE for the selection and application of vibration materials and units.

3.2 SECURING AND SUPPORTING OF HVAC PIPING

A. Support all pipe from the building structure by means of approved hangers and supports while maintaining required grade and pitch, preventing vibration and providing for expansion and contraction.

B. Secure all hangers to approved inserts wherever possible.

C. Set hanger inserts in place when the concrete is poured.

D. If Joists Are Used for Attachment:
    1. 2" diameter or smaller:
        a. May be attached to the bottom of joists.
    2. Greater than 2" diameter:
        a. Must be attached to the top cord of the joists.
    3. Do not support any piping and trapeze hangers from joist bridging on roof and floor deck.

E. If Structural Steel Framing Is Used for Attachment:
   1. Use approved beam clamps.
   2. Where required, install channels to span between framing members.
   3. Do not attach hangers to the roof deck or cross bracing.

F. Hanger Spacing:
   1. Schedule 40 Black Steel Piping (Chilled water/ Hot water piping):
      a. 1/2" diameter pipe → 6`-0" or less
      b. 3/4" diameter pipe → 8`-0" or less
      c. 1-1/4" diameter pipe → 10’-0” or less
      d. Vertical:
         1) Every Floor Level Minimum
         2) Adequately support at their bases, either by a suitable hanger placed in the horizontal line near the riser, or by a base fitting set on a pedestal or foundation.
         3) Support from each floor slab by means of an approved clamp-type support which bears on the slab or beam.
   2. Copper Piping (Refrigerant Piping):
      a. Smaller Than 1¼” → 6`-0" or less
      b. 1 ½” and Larger → 10`-0" or less
      c. Vertical → 10`-0" or less

G. Change of Direction:
   1. Install supports within two feet of change of direction.
   2. Brackets of approved type may be used along the walls.
   3. Install hangers within 2 feet of each change in vertical or horizontal direction, pipe tees and on each side of valves, strainers, etc.
   4. Multiple horizontal pipes, smaller than 12" diameter pipe, may be supported on trapeze hangers. Space trapeze hangers in accordance with the schedule for pipe spacing based upon the smallest size pipe.
   5. Properly size the trapeze members for the piping load they are to support. The number of pipes on the trapeze must be approved by the Engineer to prevent overloading of the building structure.
   6. Where pipes are insulated, oversize the hanger accordingly to accommodate the outside diameter of the insulation. Provide half-round 16 gauge galvanized steel shields, not less than 12" long and rolled to fit the insulation diameter, between the insulation and the hanger.
   7. When pipe is guided at top and bottom, cover the entire pipe circumference with metal shields.
   8. Adhere metal shield to the insulation so that the metal will not slide with respect to the insulation.
   9. Wood struts shall not be used to support piping in walls.

3.3 SLEEVES

A. Above Grade and/or Dry Locations:
   1. Walls:
      a. Mount flush on both sides.
   2. Floors:
      a. Mount 2 inches above finished floor in pipe chases.

B. Passing Through Fire-Rated Enclosure:
   1. Fill the void space around the pipe in accordance with NFPA requirements.
   2. Do not allow the sleeve installation to lower the fire rating of the assembly.

END OF SECTION

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SECTION 23 05 29

HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions, Division 1 Specifications, and Section 23 00 00, apply to this Section.

1.2 SECTION INCLUDES

A. Isolation pads

B. Concrete bases

C. Expansion joints

D. Chilled water, Hot water, and Refrigerant Piping supports

E. Other supports

1.3 RELATED SECTIONS

A. Section 23 00 00 - Basic Mechanical Requirements

B. Section 23 09 23 - Energy Management Control System

C. Section 23 21 23 - Hydronic Pumps

D. Section 23 31 13 - Metal Ductwork

E. Section 23 34 16 - HVAC Fans

F. Section 23 35 13 - Dust Collection System

G. Section 23 51 13 - Stage Vents

H. Section 23 52 33 - Water Tube Boilers

I. Section 23 64 23 - Air Cooled Scroll Compressor Chillers

J. Section 23 64 26 - Air Cooled Screw Compressor Chillers

K. Section 23 73 26 - Dedicated Outdoor Air, Air Handling Units

L. Section 23 81 26 - Split System HVAC Units

M. Section 23 81 46 - Water Source Heat Pump Units

1.4 SUBMITTALS

A. Product Data:
   1. Provide submittal data on all items specified in this section in accordance with Section 23 00 90, General Conditions, and Division 1.

2. Submit shop drawings and catalog data with locations of use.

1.5 REFERENCES

A. Refer to Section 23 00 00 for complete names of references identified in this section.

B. SMACNA Standards

C. ASHRAE - American Society of Heating, Refrigeration and Air Conditioning Engineers

1.6 QUALITY ASSURANCE

A. Isolation devices must be provided by a company whose sole business is to provide isolation equipment.

B. All equipment and materials to be installed in workmanlike manner by experienced mechanics and as recommended by the manufacturers.

C. Design Data: Complete design of isolation equipment including confirmation that no noise will be transmitted to structure of building.

PART 2 PRODUCTS

2.1 GENERAL

A. Provide isolation and support devices as required for all mechanical equipment.

2.2 MANUFACTURERS

A. Amber/Booth

B. Anvil

C. Kenetics

D. Korfund Vibration Mountings

E. Mason

F. Peabody

G. Vibro Acoustics

2.3 CONDENSING UNIT ISOLATION

A. Provide isolation pad between unit and structure as shown on plans.

2.4 FLEXIBLE DUCT CONNECTIONS

A. Use "Ventglas" fabric, fireproof, waterproof, and mildew resistant, approximately 30 ounces per square yard.

B. Comply with SMACNA standards.

2.5 BASE MOUNTED PUMP ISOLATION

A. Provide isolation pads per manufacturer`s recommendations or as detailed on plans.

B. Provide vibration isolation expansion joints at all inlets and outlets of pumps.

2.6 ISOLATION FOR AIR HANDLERS ABOVE 5 TONS

A. Spring isolators:
   1. Type:
      a. Open stable steel spring type with a minimum deflection of one inch.

B. Concrete Pad:
   1. Type:
      a. 5 inch housekeeping pad

2.7 HVAC PIPE SUPPORTS

A. Hangers:
   1. All Copper Piping
      a. Copper plated ferrous hangers.
   2. 2" and smaller piping in walls:
      a. May be split cast ring type with fastening device in walls and chases.
   3. All Other Above Ceiling Locations:
      a. Adjustable clevis type. Hangers to accommodate circumference of pipe and saddles.

B. Hanger Rods:
   1. Type:
      a. Minimum 3/8 inch diameter with machine threads.

C. Minimum Steel Hanger Rod Diameter for Individually Suspended Horizontal Pipes:
   1. 2" and smaller diameter pipe:
      a. 3/8"
   2. 2-1/2" to 3-1/2" diameter pipe:
      a. 1/2"
   3. 4" to 5" diameter pipe:
      a. 5/8"
   4. 6" diameter pipe or larger:
      a. 3/4"

2.8 SLEEVES

A. Application:
   1. Provide sleeves for all pipes and conduits which pass through a concrete slab, masonry wall/concrete wall, roof, or other portion of the building structure.

B. Above Grade and/or dry locations:
   1. Material:
      a. 20 or 22 gauge galvanized steel.
   2. Size:
      a. As necessary to allow free passage of the insulated pipe.

C. Passing through fire-rated enclosures:
   1. Material:
      a. Galvanized or black steel pipe.
      b. Non-combustible.

c. PVC will not be allowed.

PART 3 EXECUTION

3.1 ISOLATION DEVICES AND PAD INSTALLATION

A. Install isolation pads between floor and equipment pads according to manufacturer`s recommendations and approved shop drawings.

B. Install flexible duct connections where ducts connect to fans or air handling units.

C. All joints to be airtight.

D. Provide a minimum of 1/2" slack in connections, and a minimum of 2½" distance between the edges of ducts.

E. Comply with recommendations of ASHRAE for the selection and application of vibration materials and units.

3.2 SECURING AND SUPPORTING OF HVAC PIPING

A. Support all pipe from the building structure by means of approved hangers and supports while maintaining required grade and pitch, preventing vibration and providing for expansion and contraction.

B. Secure all hangers to approved inserts wherever possible.

C. Set hanger inserts in place when the concrete is poured.

D. If Joists Are Used for Attachment:
1. 2" diameter or smaller:
   a. May be attached to the bottom of joists.
2. Greater than 2" diameter:
   a. Must be attached to the top cord of the joists.
3. Do not support any piping and trapeze hangers from joist bridging on roof and floor deck.

E. If Structural Steel Framing Is Used for Attachment:
1. Use approved beam clamps.
2. Where required, install channels to span between framing members.
3. Do not attach hangers to the roof deck or cross bracing.

F. Hanger Spacing:
1. Schedule 40 Black Steel Piping (Chilled water/ Hot water piping):
   a. 1/2" diameter pipe → 6`-0" or less
   b. 3/4" diameter pipe → 8`-0" or less
   c. 1-1/4" diameter pipe → 10’-0” or less
   d. Vertical:
      1) Every Floor Level Minimum
      2) Adequately support at their bases, either by a suitable hanger placed in the horizontal line near the riser, or by a base fitting set on a pedestal or foundation.
      3) Support from each floor slab by means of an approved clamp-type support which bears on the slab or beam.

2. Copper Piping (Refrigerant Piping):
   a. Smaller Than 1¼" → 6`-0" or less
   b. 1 ½" and Larger → 10`-0" or less
   c. Vertical → 10`-0" or less

G. Change of Direction:
1. Install supports within two feet of change of direction.
2. Brackets of approved type may be used along the walls.
3. Install hangers within 2 feet of each change in vertical or horizontal direction, pipe tees and on each side of valves, strainers, etc.
4. Multiple horizontal pipes, smaller than 12" diameter pipe, may be supported on trapeze hangers. Space trapeze hangers in accordance with the schedule for pipe spacing based upon the smallest size pipe.
5. Properly size the trapeze members for the piping load they are to support. The number of pipes on the trapeze must be approved by the Engineer to prevent overloading of the building structure.
6. Where pipes are insulated, oversize the hanger accordingly to accommodate the outside diameter of the insulation. Provide half-round 16 gauge galvanized steel shields, not less than 12" long and rolled to fit the insulation diameter, between the insulation and the hanger.
7. When pipe is guided at top and bottom, cover the entire pipe circumference with metal shields.
8. Adhere metal shield to the insulation so that the metal will not slide with respect to the insulation.
9. Wood struts shall not be used to support piping in walls.

3.3 SLEEVES

A. Above Grade and/or Dry Locations:
1. Walls:
   a. Mount flush on both sides.
2. Floors:
   a. Mount 2 inches above finished floor in pipe chases.

B. Passing Through Fire-Rated Enclosure:
1. Fill the void space around the pipe in accordance with NFPA requirements.
2. Do not allow the sleeve installation to lower the fire rating of the assembly.

END OF SECTION

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SECTION 23 05 32

ROOF CURBS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions, Division 1 Specifications, and Section 23 00 00, apply to this Section.

1.2 SECTION INCLUDES

A. Roof curbs for rooftop packaged HVAC units, exhaust fans, and supply fans.

1.3 RELATED SECTIONS

A. Section 23 00 00 - Basic Mechanical Requirements

B. Section 23 34 16 - HVAC Fans

1.4 REFERENCES

A. ASTM D4586 - Fibrated Asphalt Roof Cement

1.5 SUBMITTALS

A. Product Data:
   1. Submit manufacturer`s product data sheets, including installation instructions, in accordance with Section 23 00 90, General Conditions, and Division 01.
   2. Submit with equipment that curb is used with.

B. Shop Drawings:
   1. Submit for prefabricated equipment supports in accordance with Section 23 00 90, General Conditions, and Division 01.

PART 2 PRODUCTS

2.1 ROOF CURBS FOR EXHAUST FANS

A. Roof Curbs for Metal Roofs:
   1. Type - Prefabricated insulated curb.
   2. Material - Same as roof material.
   3. Construction:
      a. Designed to meet local wind zone load/rating
      b. Designed to support weight of the exhaust or supply fan.
      c. Welded corners and seams joined by continuous welds. Add Cricket if curb is wider than 16-inches.
      d. Internally reinforced.
      e. Top of all curbs to be level with pitch built into the curb when deck slopes ¼ inch per foot or greater.
      f. Contractor to whenever possible span minimum 2 seams. Flanges cannot terminate at seams

4. Fiberglass Insulation:
    a. Thickness - 1 ½ inches
    b. Density - 3 lbs.
    c. Factory installed.
5. Height - 16 inches above roof deck or as shown on plans.
6. Manufacturers:
    a. Fan manufacturer
    b. TECO Metal Products
    c. ThyCurb
    d. Rooftop Systems

2.2 RELATED MATERIALS

A. Nails:
    1. Type:
        a. Stainless steel, flathead, wire, barbed, slating type.
    2. Washers:
        a. Neoprene.

B. Flashing Cement:
    1. ASTM D4586 - Type 1
    2. Asbestos free

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that substrates are smooth and clean to extent needed for work.

3.2 INSTALLATION

A. General:
    1. Install prefabricated roof curbs beneath new exhaust fans, supply fans, and all other mechanical equipment on the roof.
    2. Install work watertight, without waves, warps, buckles, fastening stresses or distortion.
    3. Allow for expansion and contraction.
    4. Coat contact surfaces of dissimilar metals with zinc chromate paint.
    5. Set LEVEL and square on structural framing beneath roof deck.
    6. Securely fasten curb flanges with bolts through flanges.
    7. Seal bolt heads with flashing cement.

B. Roof Curb Heights:
    1. Verify roofing insulation thickness where curbs are to be installed. Coordinate height above roof to meet roofing manufacturer`s specifications.
    2. Minimum Height:
        a. 12-inches above finished roof.

END OF SECTION

SECTION 23 05 53

IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions, Division 01 Specifications, and Section 23 00 00, apply to this Section.

1.2 SECTION INCLUDES

A. Identification required for mechanical systems.

B. Code required identification not shown on plans nor specified herein shall be provided.

1.3 RELATED SECTION

A. Section 23 00 00 - Basic Mechanical Requirements

1.4 SUBMITTALS

A. Provide submittal data on all items specified in this section in accordance with Specification Section 23 00 90, General Conditions, and Division 01.

B. Submit wording of nameplates with submittals.

C. Submit a list of all products incorporated in this section.

1.5 REFERENCES

A. Comply with ANSI A13.1

B. USAS Code B31.8

C. NTSB-PSS-73-1

D. AGA

1.6 DESCRIPTION OF WORK

A. Nameplates and tags are to be provided for all mechanical equipment and piping in the project. Identification is also required for the following, but is not limited to:
   1. Air Handlers
   2. Water Heaters
   3. Condensing Units
   4. Duct Dampers
   5. Filter Sizes for Air Handlers
   6. Fire Dampers
   7. Heat Exchangers
   8. Piping
   9. Supply/Exhaust Fans

10. Valves

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Seton

B. Brady

C. MSI

2.2 EQUIPMENT LABELS

A. Type: Engraving-Stock, melamine plastic laminate, 3 layer.
   1. Thickness:
      a. Less than 25 square inches: 1/16 inch
      b. 25 square inches or more: 1/8 inch

B. Color:
   1. Black

C. Conform to FS L-P-387A

2.3 LETTERING

A. Style:
   1. Engraved standard print.

B. Size:
   1. 3/16 inch to 1/4 inch

C. Color:
   1. White letters, black background

2.4 NAMEPLATE/TAG INFORMATION

A. HVAC Equipment:
   1. Unit mark from Drawings/Owner
   2. Voltage - Phase
   3. Manufacturer and Model Number
   4. Filter size

2.5 NAMEPLATE FASTENERS

A. Securely attach nameplates to equipment with non-corroding stainless steel screws.

B. Non-corroding pop rivets are acceptable.

C. Stick-ons or adhesives will not be allowed.

2.6 PIPING AND CONTROL DIAGRAM SIGNS

A. Material: 1/4 inch acrylic cover and backing screwed together with brass screw/bolts.
   1. Size:
      a. Minimum: 12" x 17"

b. Maximum: 24" x 36"

B. Provide a diagram in each mechanical room similar to the diagrams shown on the plans, and/or as required for the area served. This diagram to reflect as-built conditions.

2.7 IDENTIFICATION OF PRODUCTS

A. Provide pipe markers with the following features.
1. Letters from 1/2" to 3-1/2"; size letters to afford readability from the appropriate viewing position.
2. Repeated and reversed words for viewing from 360o around pipe.
3. Self-clinging, coiled markers that snap into place around pipe and do not require any other securement.
4. Integral directional arrows.

B. Letters on Field:
1. Identify the specific material conveyed. (i.e. "Domestic Cold Water", "Sprinkler", etc.)

C. Model:
1. Less than 3/4":
a. Tags: Piping System Devices, color codes for hazard.
2. 3/4" up to 6"; snap-on.
3. Over 6"; strap-on, with stainless steel spring straps.
4. Use tags and/or nameplates that are scratch resistant and UV resistant for outdoor equipment and piping.

D. Piping System Devices (Valves, Thermometers, Pressure Gages, etc., and Pipe Less Than 3/4"):
1. Identify with the following:
a. Tags:
1) Not less than 1-1/2 inch brass or aluminum tags, round, square, or octagonal.
b. Stamp tags with minimum 1/2" high descriptive characters, 1/2" high numbers with black enamel-filled indentations.

E. Attachment:
1. Stainless steel or solid brass jack chain, or stainless steel or brass "S" hooks

F. Ductwork:
1. Stenciled letters or self-adhesive labels, minimum 1" high characters.
2. Red ribbon at each balancing damper.

G. Underground Warning Tapes:
1. Provide materials that meet the codes or have the approvals listed below:
a. Office of Pipeline Safety Regulation, USAS Code B31.8.
b. GSA Public Building Service Guide Specification.
c. National Transportation Safety Board Report NTSB-PSS-73-1.
d. AGA Report 72-D-56.
e. API Report API RP 1109.
2. Material:
a. Plastic, continuous tape, color-coded, marked for hazard.

b. For Non-metallic Piping System:
1) Aluminum foil core encased in plastic.
c. Metallic Piping:
1) Plastic tape.
3. Color:
a. Colored (not printed color) plastic, coded for material conveyed by piping.
4. Width:
a. As scheduled for piping system burial depth.
5. Legend:
a. "Caution [<>] Line Buried Below".
6. Tape Colors:

Utility	Color
Natural Gas, Oil, Dangerous Materials	Hi-Visibility Safety Yellow
Communications	Safety Alert Orange

7. Model:
a. Metallic Piping System:
1) Polyethylene Tape.
b. Non-Metallic Piping System:
1) Metallic Detection Tape.

H. Underground Gas Piping:
1. Attach No. 18 gauge copper tracer wire to the piping and terminate above grade at each end.

I. Pipeline Markers for Pipe Beneath Pavement and Slabs:
1. Minimum 2" round, square, or octagonal, same as specified in Subparagraph: Piping System Devices.

J. Attachment:
1. 1-1/2" screw, bolted to tag as anchor.
2. Anchor Setting Compound:
a. Epoxy or epoxy grout, compatible with the pavement.

PART 3 EXECUTION

3.1 GENERAL

A. Contractor shall verify room numbers with Owner/Engineer before nameplates are fabricated.

B. The following shall be permanently and clearly identified:
1. Each air handler, condensing unit, compressor, exhaust fan, and pump.
2. Each zone duct, outside air duct, and return air duct whose duty is not immediately apparent.
3. Each valve whose service and/or duty is not immediately apparent.

3.2 INSTALLATION

A. Install signs on non-removable panels. Attach to equipment with pop rivets or stainless steel screws.

B. Mount in an easily visible location.

C. All labeling identification shall conform to final room numbers. Coordinate with General Contractor, A/E, and Owner to secure construction room numbers.

D. Provide all additional signage required by local authority at no cost to the Owner.

E. Provide filter sizes and quantity on all air handlers.

F. Complete installation in accordance with ANSI A13.1 and manufacturer`s installation instructions and with the Drawings. Fasten each unit securely in place with stainless steel screws.

G. Equipment Labeling:
   1. Install on scheduled items of equipment, including the following:
      a. Air conditioning equipment
      b. Pumps
      c. Control panels and major control components
      d. Include Mark Number and descriptive name from Drawing and Specification schedules
      e. Attach with corrosion resistant, stainless steel screws or pop rivets
      f. Install 1/2" diameter adhesive marker (color to be approved by A/E), and apply to T-bar below any mechanical equipment and fire dampers above lay-in ceiling.

H. Piping System Color Coding:
   1. Designate for painter the following:
      a. Types of piping services
      b. Direction of flow
      c. Other information required for proper identification.

I. Surfaces to be Painted:
   1. Bare piping
   2. Insulation covering of insulated piping

J. Paint according to the following schedule:

System	**Pastel Color**
Gas Piping on Roof	Black or as required by local authority having jurisdiction

K. Piping System Devices (Valves, Thermometers, Pressure Gages, etc.):
   1. Identify with the following information:
      a. System
      b. Device number
      c. Device Function

L. Device Chart:
   1. Key devices to device chart
   2. Give complete description of device function and system.

M. Key devices to drawings as follows:
   1. Floor plans
   2. Schematic drawings of piping systems

N. Underground Warning Tapes:
1. Tape Widths:

Piping Burial Depth	Tape Width
10"	2"
20"	3"
27"	6"
30"	9"
40"	12"
50" or more	18"

O. Recommended Tape Bury Depth:
1. Minimum Depth:
   a. 6".
2. Distance Between Pipe and Tape:
   a. Minimum 12".
   b. Maximum Depth: 12".
3. Tie tape to pipe where pipe leaves the ground.

P. Pipeline Markers for Pipe Beneath Pavement and Slabs.
1. Location:
   a. Accuracy:
      1) Plus or minus 6" from piping centerline.
   b. Flat Edge Pavement and Slabs:
      1) Set within 6" of pavement or slab edge.
   c. Concrete Curbs:
      1) Set in top of curb.
   d. Spacing:
      1) Each change in direction, each edge of pavement or slab, maximum spacing of 100`.
2. Legend:
   a. Same as tags plus an engraved or stamped line; set marker with line parallel to buried line.
3. Attachment:
   a. Drill hole for anchor bolt, full depth of bolt plus 1/2"; set full tag and bolt in epoxy, flush with pavement or slab.

END OF SECTION

SECTION 23 05 53

IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions, Division 01 Specifications, and Section 23 00 00, apply to this Section.

1.2 SECTION INCLUDES

A. Identification required for mechanical systems.

B. Code required identification not shown on plans nor specified herein shall be provided.

1.3 RELATED SECTION

A. Section 23 00 00 - Basic Mechanical Requirements

1.4 SUBMITTALS

A. Provide submittal data on all items specified in this section in accordance with Specification Section 23 00 90, General Conditions, and Division 01.

B. Submit wording of nameplates with submittals.

C. Submit a list of all products incorporated in this section.

1.5 REFERENCES

A. Comply with ANSI A13.1

B. USAS Code B31.8

C. NTSB-PSS-73-1

D. AGA

1.6 DESCRIPTION OF WORK

A. Nameplates and tags are to be provided for all mechanical equipment and piping in the project. Identification is also required for the following, but is not limited to:
   1. Air Handlers
   2. Boilers/Water Heaters
   3. Condensing Units
   4. Duct Dampers
   5. Filter Sizes for Air Handlers
   6. Fire Dampers
   7. Heat Exchangers
   8. Outside Air Units
   9. Piping

10. Pumps
11. Starters
12. Supply/Exhaust Fans
13. Valves

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Seton

B. Brady

C. MSI

2.2 EQUIPMENT LABELS

A. Type: Engraving-Stock, melamine plastic laminate, 3 layer.
   1. Thickness:
      a. Less than 25 square inches: 1/16 inch
      b. 25 square inches or more: 1/8 inch

B. Color:
   1. Black

C. Conform to FS L-P-387A

2.3 LETTERING

A. Style:
   1. Engraved standard print.

B. Size:
   1. 3/16 inch to 1/4 inch

C. Color:
   1. White letters, black background

2.4 NAMEPLATE/TAG INFORMATION

A. HVAC Equipment:
   1. Unit mark from Drawings/Owner
   2. Voltage - Phase
   3. Manufacturer and Model Number
   4. Filter size

2.5 NAMEPLATE FASTENERS

A. Securely attach nameplates to equipment with non-corroding stainless steel screws.

B. Non-corroding pop rivets are acceptable.

C. Stick-ons or adhesives will not be allowed.

2.6 PIPING AND CONTROL DIAGRAM SIGNS

A. Material: 1/4 inch acrylic cover and backing screwed together with brass screw/bolts.

1. Size:
   a. Minimum: 12" x 17"
   b. Maximum: 24" x 36"

B. Provide a diagram in each mechanical room similar to the diagrams shown on the plans, and/or as required for the area served. This diagram to reflect as-built conditions.

2.7 IDENTIFICATION OF PRODUCTS

A. Provide pipe markers with the following features.
   1. Letters from 1/2" to 3-1/2"; size letters to afford readability from the appropriate viewing position.
   2. Repeated and reversed words for viewing from 360o around pipe.
   3. Self-clinging, coiled markers that snap into place around pipe and do not require any other securement.
   4. Integral directional arrows.

B. Letters on Field:
   1. Identify the specific material conveyed. (i.e. "Domestic Cold Water", "Sprinkler", etc.)

C. Model:
   1. Less than 3/4":
      a. Tags: Piping System Devices, color codes for hazard.
   2. 3/4" up to 6"; snap-on.
   3. Over 6"; strap-on, with stainless steel spring straps.
   4. Use tags and/or nameplates that are scratch resistant and UV resistant for outdoor equipment and piping.

D. Piping System Devices (Valves, Thermometers, Pressure Gages, etc., and Pipe Less Than 3/4"):
   1. Identify with the following:
      a. Tags:
         1) Not less than 1-1/2 inch brass or aluminum tags, round, square, or octagonal.
      b. Stamp tags with minimum 1/2" high descriptive characters, 1/2" high numbers with black enamel-filled indentations.

E. Attachment:
   1. Stainless steel or solid brass jack chain, or stainless steel or brass "S" hooks

F. Ductwork:
   1. Stenciled letters or self-adhesive labels, minimum 1" high characters.
   2. Red ribbon at each balancing damper.

G. Underground Warning Tapes:
   1. Provide materials that meet the codes or have the approvals listed below:
      a. Office of Pipeline Safety Regulation, USAS Code B31.8.
      b. GSA Public Building Service Guide Specification.
      c. National Transportation Safety Board Report NTSB-PSS-73-1.
      d. AGA Report 72-D-56.
      e. API Report API RP 1109.
   2. Material:

a. Plastic, continuous tape, color-coded, marked for hazard.
b. For Non-metallic Piping System:
1) Aluminum foil core encased in plastic.
c. Metallic Piping:
1) Plastic tape.
3. Color:
a. Colored (not printed color) plastic, coded for material conveyed by piping.
4. Width:
a. As scheduled for piping system burial depth.
5. Legend:
a. "Caution [<>] Line Buried Below".
6. Tape Colors:

Utility	**Color**
Natural Gas, Oil, Dangerous Materials	Hi-Visibility Safety Yellow
Communications	Safety Alert Orange

7. Model:
a. Metallic Piping System:
1) Polyethylene Tape.
b. Non-Metallic Piping System:
1) Metallic Detection Tape.

H. Underground Gas Piping:
1. Attach No. 18 gauge copper tracer wire to the piping and terminate above grade at each end.

I. Pipeline Markers for Pipe Beneath Pavement and Slabs:
1. Minimum 2" round, square, or octagonal, same as specified in Subparagraph: Piping System Devices.

J. Attachment:
1. 1-1/2" screw, bolted to tag as anchor.
2. Anchor Setting Compound:
a. Epoxy or epoxy grout, compatible with the pavement.

PART 3 EXECUTION

3.1 GENERAL

A. Contractor shall verify room numbers with Owner/Engineer before nameplates are fabricated.

B. The following shall be permanently and clearly identified:
1. Each air handler, condensing unit, compressor, exhaust fan, and pump.
2. Each zone duct, outside air duct, and return air duct whose duty is not immediately apparent.
3. Each valve whose service and/or duty is not immediately apparent.

3.2 INSTALLATION

A. Install signs on non-removable panels. Attach to equipment with pop rivets or stainless steel screws.

B. Mount in an easily visible location.

C. All labeling identification shall conform to final room numbers. Coordinate with General Contractor, A/E, and Owner to secure construction room numbers.

D. Provide all additional signage required by local authority at no cost to the Owner.

E. Provide filter sizes and quantity on all air handlers.

F. Complete installation in accordance with ANSI A13.1 and manufacturer`s installation instructions and with the Drawings. Fasten each unit securely in place with stainless steel screws.

G. Equipment Labeling:
   1. Install on scheduled items of equipment, including the following:
      a. Air conditioning equipment
      b. Pumps
      c. Control panels and major control components
      d. Include Mark Number and descriptive name from Drawing and Specification schedules
      e. Attach with corrosion resistant, stainless steel screws or pop rivets
      f. Install 1/2" diameter adhesive marker (color to be approved by A/E), and apply to T-bar below any mechanical equipment and fire dampers above lay-in ceiling.

H. Piping System Color Coding:
   1. Designate for painter the following:
      a. Types of piping services
      b. Direction of flow
      c. Other information required for proper identification.

I. Surfaces to be Painted:
   1. Bare piping
   2. Insulation covering of insulated piping

J. Paint according to the following schedule:

System	**Pastel Color**
Condenser Water	Green
Gas Piping on Roof	Black or as required by local authority having jurisdiction

K. Piping System Devices (Valves, Thermometers, Pressure Gages, etc.):
   1. Identify with the following information:
      a. System
      b. Device number
      c. Device Function

L. Device Chart:
   1. Key devices to device chart
   2. Give complete description of device function and system.

M. Key devices to drawings as follows:
   1. Floor plans
   2. Schematic drawings of piping systems

N. Underground Warning Tapes:
1. Tape Widths:

Piping Burial Depth	Tape Width
10"	2"
20"	3"
27"	6"
30"	9"
40"	12"
50" or more	18"

O. Recommended Tape Bury Depth:
1. Minimum Depth:
   a. 6".
2. Distance Between Pipe and Tape:
   a. Minimum 12".
   b. Maximum Depth: 12".
3. Tie tape to pipe where pipe leaves the ground.

P. Pipeline Markers for Pipe Beneath Pavement and Slabs.
1. Location:
   a. Accuracy:
      1) Plus or minus 6" from piping centerline.
   b. Flat Edge Pavement and Slabs:
      1) Set within 6" of pavement or slab edge.
   c. Concrete Curbs:
      1) Set in top of curb.
   d. Spacing:
      1) Each change in direction, each edge of pavement or slab, maximum spacing of 100`.
2. Legend:
   a. Same as tags plus an engraved or stamped line; set marker with line parallel to buried line.
3. Attachment:
   a. Drill hole for anchor bolt, full depth of bolt plus 1/2"; set full tag and bolt in epoxy, flush with pavement or slab.

END OF SECTION

SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions, Division 1 Specifications, and Section 23 00 00, apply to this Section.

1.2 SECTION INCLUDES

A. Testing and balancing services for the heating, ventilating, and air conditioning (HVAC) systems of this project.

B. The testing and balancing agency will be responsible for the satisfactory execution of testing and balancing of the HVAC systems.

C. The following are acceptable agencies:
1. Complete System Balance
2. Delta-T, Inc.
3. Engineered Air Balance
4. PHI Service Agency, Inc.
5. Air Balancing Company, Inc.

1.3 RELATED SECTIONS

A. Section 23 00 00 - Basic Mechanical Requirements

B. Section 23 07 13 - Duct and Grille Insulation

C. Section 23 09 23 - Energy Management Control System

D. Section 23 31 13 - Metal Ductwork

E. Section 23 34 16 - HVAC Fans

F. Section 23 37 13 - Diffusers, Registers, and Grilles

G. Section 23 81 26 - Split System HVAC Units

1.4 STANDARDS

A. The balancing agency shall perform the services specified herein in accordance with the Associated Air Balance Council`s National Standards, including revisions, to the date of the contract.

B. All terms in this specification shall have their meaning defined as stated in the National Standards.

C. If these specifications set forth more stringent requirements than the AABC National Standards, these specifications shall prevail.

1.5 QUALIFICATIONS OF THE BALANCING AGENCY

A. The balancing agency shall be a member of the Associated Air Balance Council (AABC) and/or certified by the National Environmental Balancing Bureau (NEBB).

B. 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 and/or the National Environmental Balancing Bureau (NEBB).

C. This certified "Test and Balance Engineer" shall be responsible for supervision and certification for the total work herein specified.

D. The balancing agency shall submit records of experience in the field of air and hydronic system balancing or any other data as requested by the Owner/Engineer. The supervisory personnel for the firm shall have at least five (5) years' experience, and be a full-time employee for a minimum of six (6) months prior to the project. All employees used in this project shall be qualified technicians in this specific field.

E. 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 Owner to determine the balancing agency`s performance capability.

F. The balancing agency shall have operated for a minimum of five (5) years under its current name.

1.6 DOCUMENTS

A. The General Contractor will provide the balancing agency one copy of the following documents:
   1. Project drawings (mechanical sepias if requested) and specifications.
   2. Reviewed construction revisions pertaining to the HVAC systems.
   3. Reviewed submittal data on HVAC equipment and systems to be installed by the Mechanical Subcontractor.
   4. Reviewed HVAC shop drawings.
   5. Reviewed HVAC wiring diagrams, control diagrams, and equipment brochures, as appropriate.

1.7 COORDINATION

A. It will be necessary for the balancing agency to perform its services in close coordination with the Mechanical Subcontractor.

B. The plans and specifications indicate meters, valves, dampers, and other devices for the purpose of adjusting the system to obtain optimum operating conditions. It will be the responsibility of the Mechanical Subcontractor to install these devices in a manner that will leave them accessible, readily adjustable, and complete. The balancing agency shall provide guidance if there is a questionable arrangement of a control or balancing device.

C. The General Contractor, Mechanical Contractor, Temperature Controls Subcontractor, and the suppliers of the HVAC equipment shall all cooperate with the balancing agency to provide all necessary data on the design and proper application of the system components. In addition, they shall furnish all labor and materials

required to eliminate any system deficiencies.

1.8 RESPONSIBILITIES OF THE MECHANICAL CONTRACTOR

A. The Mechanical Contractor shall complete the installation and start all HVAC systems to ensure they are working properly and shall perform all other items as described hereinafter to assist the balancing agency in performing the testing and balancing of the HVAC systems.

B. Air Distribution Systems:
   1. Verify installation for conformity to design.
   2. Terminate all supply, return, and exhaust ducts, and pressure test them, for leakage, as required by specification.
   3. Ensure that all splitters, extractors, and volume and fire dampers are properly located and functional. Dampers serving requirements of minimum and maximum outside, return, relief, and exhaust air shall provide tight closure and full opening, with a smooth and free operation.
   4. Verify that all supply, return, exhaust, and transfer grilles; registers; diffusers; and high-pressure terminal units are installed and operational.
   5. Ensure that air-handling systems, units, and associated apparatus, such as heating and cooling coils, filter sections, access doors, etc., are blanked and/or sealed to eliminate excessive bypass or leakage of air.
   6. Ensure that all fans (supply, return, relief, and exhaust) are operating and free of vibration. All fans and drives shall be checked for proper fan rotation and belt tension. Overload protection shall be of proper size and rating. A record of motor current and voltage shall be made to verify that the motors do not exceed nameplate rating.
   7. Make any necessary changes to the sheaves, belts, and dampers, as required by the balancing agency, at no additional cost to the Owner.
   8. Install clean filters.

1.9 RESPONSIBILITIES OF THE TEMPERATURE CONTROLS CONTRACTOR

A. The Temperature-Controls Contractor shall allow sufficient time in the project to provide assistance and instruction to the balancing agency in the proper use and setting of control components such as, but not limited to, computers, static pressure controllers, or any other device that may need set points changed so that the testing and balancing work can be performed.

B. Furnish to the balancing agency any software and cables required to make adjustments to controls. Any unique micro-processor required to set controls shall be furnished by Temperature Controls Contractor.

C. The Temperature Controls Contractor shall complete the installation of the temperature control system, and operate and test all control systems to ensure they are functioning properly as designed. The Temperature Controls Contractor shall assist the balancing agency in testing and balancing the HVAC systems, as described hereinafter.
   1. Verify that all control components are installed in accordance with project requirements and are functional, including all electrical interlocks, damper sequences, air, and water reset, and fire and freeze stats.
   2. Verify that all controlling instruments are calibrated and set for design operating conditions.

3. Calibrate room thermostats/sensors after installation, and before the thermostat control verification tests are performed. The balancing agency shall prove the accuracy of final settings by taking temperature readings. The readings shall be in a typical conditioned space for each separately controlled zone.

1.10 PRE-BALANCING CONFERENCE

A. Prior to beginning of the testing, adjusting, and balancing procedures, schedule and conduct a conference with the Architect/Engineer, General Contractor, Mechanical Contractor, Electrical Contractor, and Temperature Controls Contractor. The objective of the conference is final coordination and verification of system operation and readiness for testing, adjusting, and balancing.

1.11 NOTIFICATION FOR TESTING AND BALANCING WORK TO BEGIN

A. The general contractor shall notify the balancing agency in writing when all heating, ventilating, and air conditioning systems are complete and ready for testing and balancing. The Mechanical Contractor shall attest that he has completed all items as described in "RESPONSIBILITIES OF THE MECHANICAL CONTRACTOR" Section of these specifications.

B. If upon commencing the work, the balancing agency finds that the systems are not ready, or if a dispute occurs as to the readiness of the systems, the balancing agency shall request an inspection to be made by the Mechanical Engineer. This inspection shall establish to the satisfaction of the represented parties whether or not the systems meet the basic requirements for testing and balancing. Should the inspection reveal the notification to have been premature, the balancing agency shall be reimbursed for all costs for the inspection and work previously accomplished. Furthermore, such items that are not ready for testing and balancing shall be completed and placed in operational readiness before testing and balancing services shall again be requested.

PART 2 PRODUCTS

2.1 NOT APPLICABLE

PART 3 EXECUTION

3.1 SCOPE

A. In accordance with Project Drawings and Specifications and as specified herein, the balancing agency shall provide all supervision, personnel, instruments, calibration equipment, and all other materials and services necessary to perform all testing and balancing of the heating, ventilating, and air conditioning systems. All test data including all pertinent calculations shall be reported on appropriate forms.

3.2 GENERAL

A. The testing and balancing of the heating, ventilating, and air conditioning systems shall be performed by an independent balancing agency approved by the Engineer. The balancing agency shall have a minimum of five years specialized experience in air and hydronic system balancing, possess calibrated instruments, certified "Test and Balance Engineers", and skilled technicians to perform all required tests. The balancing agency shall be a certified member of the Associated Air Balance Council

and/or the National Environmental Balancing Bureau (NEBB).

B. The tests shall demonstrate the specified capacities and operation of all equipment and materials comprising the systems. The balancing agency shall then make available to the Owner`s representative such instruments and technicians as are required for spot checks of the system.

C. The balancing agency shall not instruct or direct the Mechanical Contractor in any of the work. Any proposed changes or revisions in the work shall be submitted to the Architect and General Contractor in writing.

D. Document Review:
1. The Test and Balance Firm shall be responsible for reviewing the HVAC plans and specifications relating to the test and balance services for proper arrangement and adequate provisions of devices for testing, adjusting, and balancing.
2. Test and Balance Firm shall review HVAC manufacturers' submittals data relative to balanceability.
3. Test and Balance Firm shall review submitted HVAC automatic temperature control sequences for conformity to the specifications.

3.3 SERVICES

A. During construction, the balancing agency shall inspect the installation of pipe systems, sheet metal work, temperature controls, and other component parts of the heating, ventilating, and air conditioning systems.

B. The inspections shall be performed periodically as the work progresses. A minimum of two inspections are required as follows: (1) when 60 percent of the ductwork is installed; (2) when 90 percent of the equipment is installed. The balancing agency shall submit a brief written report of each inspection to the General Contractor and Engineer.

C. 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 in the building.

3.4 DEFICIENCIES

A. If in the process of performing the TAB work, any deficiencies encountered shall be brought to the attention of the contractor responsible through defined procedures and entered in the punch list of deficiencies on the next daily Status Report. If correction of the deficiency is urgent, the matter shall be brought to the attention of all involved parties for quick resolution. The General Contractor shall provide and coordinate services of qualified responsible subcontractors, suppliers, and personnel as required to correct, repair, or replace any and all deficient items or conditions during the testing, adjusting, and balancing period.

B. The notification may be for single or multiple deficiencies. The work necessary to correct items on the listing shall be performed and verified in writing by the affected trade.

C. All deficiencies that prevent proper TAB work from being completed shall be corrected prior to submittal of the Final TAB Report, unless the correction of such deficiencies cannot be accomplished in a reasonable period of time, in which case the

Mechanical Engineer may grant permission to submit the Final TAB Report with the deficiencies detailed in the report.

3.5 AIR SYSTEM PROCEDURES

A. The balancing agency shall perform the following testing and balancing functions in accordance with the Associated Air Balance Council`s National Standards:
   1. Fan Speeds:
      a. For all multistage units, low and high fan speeds must be individually set.
      b. Test and adjust fan RPM to achieve design CFM requirements.
   2. Current and Voltage:
      a. Measure and record motor current and voltage.
   3. Pitot-tube Traverse:
      a. Perform a Pitot-tube traverse of main supply and return ducts to obtain total CFM. If a Pitot-tube traverse is not practical, the summation of the outlets or inlets may be used. An explanation of why a traverse was not made must appear on the appropriate datasheet.
   4. Outside Air:
      a. Test and adjust system minimum outside air by Pitot-tube traverse. If a Pitot-tube traverse is not practical, the percentage of outside air may be determined by calculations from the return air, outside air, and mixed air temperatures. Make allowances for heat of compression and motor heat where applicable.
   5. Static Pressure:
      a. Test and record system static pressures, including suction and discharge static pressure of each fan.
   6. Air Temperature:
      a. Take wet-bulb and dry-bulb air temperatures on the entering and leaving side of each cooling coil. Dry-bulb temperature shall be taken on the entering and leaving side of each heating coil.
   7. Zone Ducts:
      a. Adjust zone ducts to within design CFM requirements. At least one zone balancing damper shall be completely open.
   8. Main Ducts:
      a. Adjust main ducts to within design CFM requirements and traverse for total CFM quantities.
   9. Branch Ducts:
      a. Adjust branch ducts to within design CFM requirements. Multi-diffuser branch ducts shall have at least one outlet or inlet volume damper completely open.
   10. Tolerances:
      a. Test and balance each diffuser, grille, and register to within 10 percent of design requirements.
   11. Identification:
      a. Identify the location and area of each grille, diffuser, register, and terminal box. This information shall be recorded on air outlet data sheets.
   12. Description:
      a. Record the size, type, and manufacturer of each diffuser, grille, and register on air outlet data sheets.
   13. Terminal Boxes:
      a. Set volume regulators on all terminal boxes to meet design maximum and minimum CFM requirements. All associated temperature controls shall be

checked for proper operation and calibration. If the terminal boxes have separate settings for heating and cooling CFM, the CFM quantities for each shall be recorded on air outlet data sheets. All diffusers connected to the terminal box shall be read in the heating and cooling modes and their readings recorded on air outlet data sheets.

14. Minimizing Drafts:
    a. Adjust all diffusers, grilles, and registers to minimize drafts in all areas.

3.6 VERIFICATION OF TEMPERATURE CONTROL

A. The balancing agency shall be assisted by the Temperature Controls Contractor in verifying the operation and calibration of all temperature control systems. The following tests shall be conducted:
   1. Verify that all control components are installed in accordance with project requirements and are functional, including all electrical interlocks, damper sequences, air and water reset, and fire and freeze stats.
   2. Verify that all controlling instruments are calibrated and set for design operating conditions.
   3. Verify the accuracy of the final settings by taking temperature readings. The readings shall be in a typical conditioned space for each separately controlled zone.

B. In the process of performing the TAB work, the balancing agency firm shall:
   1. Verify that all dampers, valves, and other controlled devices are operated by the intended controller.
   2. Verify that all dampers and valves are in the position indicated by the controller (open, closed, or modulating).
   3. Verify the integrity of valves and dampers in terms of tightness of close-off and of full-open position. This includes dampers in VAV terminals.
   4. Check that all valves are properly installed in the piping system in relation to direction of flow and location.
   5. Verify the proper application of all normally open and normally closed valves.
   6. Check the locations of all thermostats and humidistats for potential erratic operation from outside influences such as sunlight, drafts, or cold/hot walls.
   7. Check the locations of all sensors to determine whether their position will allow them to sense only the intended temperatures or pressures of the media.
   8. Check the sequence of operation for any control mode to ensure that it is in accordance with the Contract Documents.

C. Verify that all controller set points meet the design intent. Record observations of systems under DDC control. Record all default set points if different from operating set points.

D. Check all dampers for free and full operation, and record any obstructions.

E. Verify the operation of all interlock systems.

F. Perform all system verifications to assure the safety of the system and its components.

G. Verify that the changeover from heating to cooling mode occurs as specified.

3.7 TEST AND BALANCE REPORT

A. The test and balance report shall be complete with logs, data, and records as required herein. All logs, data, and records shall be typed on white bond paper and bound and submitted in a single PDF file. The report shall be certified, accurate and complete by the balancing agency`s certified Test and Balance Engineer.

B. The report shall contain the following general data in a format selected by the balancing agency:
   1. Project number
   2. Contract number
   3. Project title
   4. Project location
   5. Project Architect
   6. Project Mechanical Engineer
   7. Test & Balance agency
   8. Test & Balance Engineer
   9. General Contractor
   10. Mechanical Subcontractor
   11. Dates tests were performed
   12. Certification

C. The test and balance report shall be recorded on report forms conforming to the recommended forms in the AABC National Standards. At a minimum, the report shall include:
   1. Preface:
      a. A general discussion of the system, any abnormalities, and problems encountered.
      b. A deficiency log detailing system abnormalities that do not meet these specifications.
      c. The list of instruments including type, model, manufacturer, serial number, and calibration dates.
   2. Air System Data:
      a. All test and balance data indicating design conditions, and actual conditions of operation for each device and/or piece of HVAC equipment.
      b. Outside Air Temperatures, dry bulb, and wet bulb.
      c. Entering Air Temperatures, dry bulb, and wet bulb.
      d. Discharge Air Temperatures, dry bulb, and wet bulb.
      e. Suction and discharge static pressures across each fan.
   3. System Identification:
      a. In each report, the zones, supply, return, exhaust openings, and traverse points shall be numbered and/or lettered on mechanical drawings corresponding to the numbers and letters used on the report data sheets.
   4. Controls:
      a. Document verification of controls.
   5. Occupancy Inspection:
      a. Make a total of three (3) inspections within ninety (90) days after occupancy of the building, and make adjustments if required, to ensure that satisfactory conditions are being maintained throughout. Inspections to be coordinated with Architect/Engineer and Owner and shall be documented with a supplemental report containing data and information as required.

6. Instructions to Operating Personnel:
   a. Test and Balance Firm shall instruct the operating personnel regarding the following:
      1) Systems Operation
      2) Unusual Operating Conditions.
      3) System Troubleshooting Procedures.

3.8 REPORT SUBMITTAL

A. The test and balance report are required and shall be submitted to the General Contractor for distribution to the Owner, Architect, and Mechanical Engineer. The test and balance report shall be submitted in a single, fully bound PDF file.

3.9 FINAL ACCEPTANCE

A. At the time of final inspection, the balancing agency shall recheck, in the presence of the Owner`s representative, specific and random selections of data recorded in the certified test and balance report.

B. Points and areas for recheck shall be selected by the Owner`s representative.

C. Measurements and test procedures shall be the same as the original test and balance.

D. Selections for recheck, specific plus random, shall not normally exceed 15 percent of the total number tabulated in the report, except where special air systems require a complete recheck for safety reasons.

E. If random tests demonstrate a measured flow deviation of 10 percent or more from that recorded in the certified test and balance report, the report shall automatically be rejected. In the event the report is rejected, all systems shall be readjusted and tested, new data recorded, a new certified test and balance report submitted, and a new inspection test made, all at no additional cost to the Owner.

3.10 OPPOSITE SEASON TEST

A. Opposite season test and balance work shall be required for systems that cannot be tested and balanced due to climate or seasonal conditions. An example would be Chiller operation in the winter season, or Boiler operation in the summer season. In such case, the balancing agency shall perform an inspection of the buildings HVAC system during the opposite season from that in which the initial adjustments were made. The balancing agency shall make any necessary modifications to the initial adjustments to produce optimum system operation in compliance with the contract documents. The TAB agency shall contact the Owner’s Commissioning Agent, to coordinate such work, no less than 14 calendar days prior to any Opposite Season Testing.

B. Opposite Season Testing is not required if the Owner’s Commissioning Agent can simulate off season conditions via the building automated controls system.

END OF SECTION

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SECTION 23 07 13

DUCT AND GRILLE INSULATION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions, Division 01 Specifications, and Section 23 00 00, apply to this Section.

1.2 SECTION INCLUDES

A. External duct insulation

B. Internal duct liner

1.3 RELATED SECTIONS

A. Section 23 00 00 - Basic Mechanical Requirements

B. Section 23 31 13 - Metal Ductwork

C. Section 23 37 13 - Diffusers, Registers, and Grilles

1.4 SUBMITTALS

A. Product Data:
1. Provide submittal data on all equipment specified in this section in accordance with Section 23 00 90, General Conditions, and Division 01.
2. Submit product data indicating typical catalog of information.
3. Submit product data sheets indicating dimensions, general assembly, and ratings.
4. Submit manufacturer`s installation instructions.
5. Submit kitchen exhaust duct wrap to City for approval prior to submitting to Engineer.

1.5 REFERENCES

A. Refer to Section 23 00 00 for complete names of references identified in this section.
1. ASTM E84 - Standard test for surface burning characteristics of building materials.
2. NFPA 221 - Fire walls and fire barrier walls.
3. NFPA 255 - Surface burning characteristics of building materials.
4. NFPA 96 - Ventilation control and fire protection of commercial cooking operations.
5. UL 723 - Test for surface burning characteristics of building materials.
6. UL 1978 - First Edition Standard for Grease Ducts
7. ASTM C553 - Standard specification for mineral fiber blanket thermal insulation for commercial and industrial applications.
8. ASTM C1071 - Fibrous glass duct lining insulation (thermal and sound).
9. IECC - International Energy Conservation Code
10. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials

11. ASTM C916-85(2001)e1 - Standard Specification for Adhesives for Duct Thermal Insulation
12. ASTM C1136-02 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation
13. ASTM A635/A635M-02 - Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Carbon, Commercial Steel, Drawing Steel, Structural, High-Strength Low-Alloy, and High-Strength Low-Alloy with Improved Formability, Hot-Rolled, General Requirements
14. ASTM A924 - Hot Dip Galvanized Coils & Sheets - Tolerances

1.6 QUALITY ASSURANCE

A. Fire Hazard Rating:
   1. All insulation used on the project 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. Bear UL label.
   2. These ratings must be as tested on the composite of insulation, jacket or facing, and adhesive.
   3. Components such as adhesives, mastics and cements must meet the same individual ratings as minimum requirements.
   4. Install in accordance with SMACNA standards.

B. Insulations shall not contain formaldehyde, asbestos, lead, mercury, mercury compounds, or poly-brominated diphenyl ether fire retardants.

C. Fiberglass insulations shall have a minimum of 50 percent recycled glass content; certified and UL Validated.

D. Fiberglass insulations shall have a bio-based, formaldehyde-free binder and be UL GREENGUARD Gold certified.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original sealed containers or unopened packages, and clearly labeled with manufacturer`s name, product identification, and lot numbers.

B. Store materials out of weather and in an enclosed shelter.

PART 2 PRODUCTS

2.1 APPLICATIONS

A. Supply ducts

B. Return ducts

C. Outside air ducts

D. Supply and return diffusers

E. Grilles

F. Registers with exposed surfaces in unconditioned areas

G. General exhaust ducts do not receive insulation

2.2 MANUFACTURERS

A. Owens Corning

B. Knauf Insulation

C. Manson Insulation

D. Johns Manville

2.3 EXTERNAL DUCT WRAP AND GRILLE INSULATION

A. Minimum Thickness and Density:
   1. Minimum 2” thick at 1 pound per cubic foot, Minimum Value of R-6.0

B. Material:
   1. Fiberglass insulation with factory-applied FSK vapor retarding facing complying with ASTM C 1136. Fiberglass bonded with a bio-based thermosetting binder.
   2. Flexible Blanket Duct Wrap insulation, complying with ASTM C 553, Type I, II, and III; ASTM C 1136 Type II; and ASTM C 1290, Type III. UL/ULC Classified per UL 723 for FSK; NFPA 90A and 90B.
   3. Thermal conductivity (k-value) at 75 degrees F mean temperature is 0.27 Btu x in. /h x sq. ft. x degrees F, or less. Maximum service temperature of 250 degrees F with FSK facing, 350 degrees F for un-faced material.
   4. Flame spread/Smoke-developed rating (ASTM E84) of 25/50.
   5. Must be UL Environment GREENGUARD Gold certified and UL Validated Formaldehyde-free.

2.4 INTERNAL DUCT LINER

A. Use only where specifically noted, or with written approval of Engineer.

B. Install internal duct liner that extends no more than 2’-0” below roof deck at each rooftop unit.

C. Thickness:
   1. Minimum 1½ inch thick, Minimum Value R-6.0

D. Material:
   1. Rigid Plenum and Duct Liner
      a. Fiberglass complying with ASTM C 1071 Type II, ASTM 1338, ASTM G21/G22, NFPA 90A and 90B, ASTM C 1104, and NAIMA AH124, "Fibrous Glass Duct Liner Standard". Fiberglass bonded with a bio-based thermosetting binder, having a bonded, black mat-faced airstream surface and factory-applied edge coating.
      b. Thermal conductivity (k-value) at 75 degrees F mean temperature is 0.23 Btu x in. /h x sq. ft. x deg. F., or less. Maximum service temperature of 250 degrees F. UL/ULC Classified per UL 723.
      c. Flame spread/Smoke-developed rating (ASTM E84) of 25/50.
      d. Must be UL Environment GREENGUARD Gold certified and UL Validated Formaldehyde-free.
   2. Flexible Duct Liner
      a. Fiberglass complying with ASTM C1071 Type I, ASTM C 1338, NFPA 90A and 90B, and NAIMA AH124, "Fibrous Glass Duct Liner Standard". Rotary

glass fibers bonded with bio-based thermosetting binder, having a bonded, black mat-faced airstream surface and factory-applied edge coating.

b. Must be UL Environment certified GREENGUARD Gold and UL Validated Formaldehyde-free.
c. Surface Burning Characteristics: ASTM E84, UL 723 – Flame spread less than 25 and Smoke developed less than 50.
d. Maximum Rated Air Velocity: ASTM C 1071 – 6,000 ft. /min. (30.5 m/sec.).
e. Maximum Thermal Conductivity: ASTM C 177, C518, C1114 - 0.24 Btu / (ft² x hr. x °F) @ 75°F mean temperature.
f. Water Vapor Sorption: ASTM C 1104 – Not exceeding 3 percent by weight.
g. Antimicrobial Agent: Compound shall be tested for efficacy by an NRTL, and registered by the EPA for use in HVAC systems. Mold & Mildew Growth/Fungi Resistance: ASTM C 1338, ASTM G21/G22 – Pass.
h. Corrosiveness/Corrosion: ASTM C 665 / C 1617 - Does Not Accelerate / Pass.
i. Required Markings: EI rating, UL label, duct liner thickness, and other markings required by UL 181 on each full roll of duct liner.
j. Duct liner adhesive shall be applied to the sheet metal with a minimum coverage of 90%. Adhesive shall meet the requirements of ASTM C916.
k. Noise Reduction Coefficient (NRC): ASTM C 423, Type “A” Mounting
    1) 1.5 PCF Density: 1”=.70, 1-1/2”=.80, 2”=.95
    2) 2.0 PCF Density: 1/2”=.50, 1”=.70, 1-1/2”=.85

PART 3 EXECUTION

3.1 DUCT WRAP INSTALLATION

A. To ensure that it will achieve its highest possible performance and serve its intended purpose, install all insulation materials and accessories in accordance with manufacturer’s published instructions (latest edition) and industry practices detailed by the North American Commercial and Industrial Insulation Standards (latest edition).

B. Wrap insulation on the ductwork with all circumferential joints butted and longitudinal joints overlapped a minimum of 3 inches. Do not over stretch, or compress more than 25%, during installation process.

C. On circumferential joints, secure the 2-inch flange of the facing and tape with a minimum of 3 inch wide foil-scrim-Kraft tape (FSK).

D. On longitudinal joints, secure the overlap using 1/2 inch outward clinch staples applied 6 inches on centers and taped with minimum 3 inch wide foil-scrim-Kraft tape (FSK).

E. Tape all pin penetrations or punctures in facing.

F. The duct wrap insulation on all rectangular/square ducts 24-inch or wider shall be additionally secured to the bottom of the duct with mechanical fasteners such as pins and speed clip washers. Spacing at 18-inch on center each direction to prevent sagging.

G. Duct wrap should be attached and sealed to grilles, registers and diffusers in the same manner as used for duct.

H. Extend insulation 1 inch beyond each outer surface of diffuser, grille, and register.

3.2 INTERNAL DUCT LINER

A. Provide internal duct liner as indicated on the plans.

B. Install internal duct liner on rooftop unit supply and return ducts no more than 2’-0” below roof deck.

C. To ensure that it will achieve its highest possible performance and serve its intended purpose, install Duct Liner insulation and all accessories in accordance with manufacturer’s published instructions (latest edition) and industry practices detailed by the NAIMA FGDLS (North American Insulation Manufacturers Association, Publication AH-124 Fibrous Glass Duct Liner Standard) or SMACNA HVAC DCS (Sheet Metal and Air Conditioning Contractors’ National Association, Publication HVAC Duct Construction Standards – Metal & Flexible.

D. Apply the liner to the inside of the duct with heavy density side to the air stream and secure to the duct with adhesive Insul-Coustic No. 225 or equal meeting ASTM C916, providing a minimum of 90% coverage of clean sheet metal.

E. Do not use duct liner in kitchen or other areas that may have excess moisture present.

F. Mechanical fasteners shall be used to secure the duct liner to the sheet metal, spaced in accordance with NAIMA FGDLS or SMACNA HVAC DCS. Fasteners may be either impact-driven, weld-secured, or adhesively secured.

G. Accurately cut the liner and thoroughly coat the ends with adhesive to make a firmly butted and tightly sealed joint.

H. Where ducts are lined, exterior insulation will not be needed except as otherwise specified.

END OF SECTION

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SECTION 23 07 19

HYDRONIC PIPING INSULATION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions, Division 1 Specifications, and Section 23 00 00, apply to this Section.

1.2 SECTION INCLUDES

A. Hydronic Piping Insulation
   1. The work covered by this specification consists of furnishing all labor, equipment, materials, and accessories, and performing all operations required, for the correct fabrication and installation of thermal insulation applied to the following piping systems:
      a. Chilled water systems from 35°F (2°C) to 65°F (18°C) valves and appurtenances.
      b. Space heating systems (hot water), ambient up to 250°F (121°C) valves, and appurtenances.
      c. EPDM Closed-cell flexible elastomeric foam pipe insulation (Armaflex or Aeroflex). For ease of installation, EPDM closed cell structure insulation to be installed within 36” of coil connections, valve connections, and pump connections.
      d. Condenser water systems from 65°F (18°C) to 95°F (35°C) valves and appurtenances. Exterior condenser water piping with heat trace tape.

1.3 RELATED SECTIONS

A. Section 22 07 20 - Piping Insulation

B. Section 23 00 00 - Basic Mechanical Requirements

C. Section 23 07 21 - Refrigerant Piping Insulation

D. Section 23 21 13 - Hydronic Piping, Valves, and Appurtenances

1.4 REFERENCES

A. Refer to Section 23 00 00 for complete names of references identified in this section.
   1. ASTM E84 - Fire and Smoke Ratings
   2. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements & Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus
   3. ASTM C547 - Specification for Mineral Fiber Pipe
   4. ASTM C585 - Standard Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System)
   5. ASTM C795 - Standard Specifications for Thermal Insulation for Use in Contact with Austenitic Stainless Steel

6. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation
7. NFPA 255 - Surface Burning Characteristics of Building Materials
8. UL 723 - Composite Surface Burning Characteristics
9. NACIIS - North American Commercial & Industrial Insulation Standards

1.5 SUBMITTALS

A. Product Data:
   1. Provide submittal data on all equipment specified in this section in accordance with Section 23 00 90, General Conditions, and Division 1.

B. Submit product data indicating typical catalog of information.

C. Submit product data sheets indicating dimensions, general assembly, and ratings.

D. Submit manufacturer`s installation instructions and method of application.

E. Submit piping insulation summary sheet, which includes at least the following: type of pipe and pipe thickness, type of insulation and insulation thickness, and jacketing material.

1.6 DEFINITIONS

A. Concealed: Hidden from sight as in trenches, chases, furred spaces, walls, pipe shafts, or hung ceilings.

B. Exposed: Not "concealed" as defined above. Normally open and visible to building occupants (such as gymnasiums, mechanical rooms, etc.).

C. Crawlspace: Under the building slab in an unconditioned space that is exposed to ambient conditions.

1.7 QUALITY ASSURANCE

A. Fire Hazard Rating:
   1. All insulation used on the project 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. Bear UL label. All insulation must meet ASTM C553.
   2. These ratings must be tested on the composite of insulation, jacket or facing, and adhesive.
   3. Components such as adhesives, mastics, and cements must meet the same individual ratings as minimum requirements.

B. Quality Controls:
   1. All insulation shall be the product of reputable manufacturers.
   2. All insulation shall be applied by licensed mechanics skilled in the use of various insulations, adhesives, and jacketing materials. Submit qualifications of insulator with insulation submittals.
   3. The materials shall be applied in accordance with the special materials as required by these specifications and by the manufacturer's standards.
   4. Poor workmanship or appearance will be cause for rejection.
   5. Insulation materials that have become wet or contaminated shall not be installed.

C. Insulations shall not contain formaldehyde, asbestos, lead, mercury, mercury compounds, or poly-brominated diphenyl ether fire retardants.

D. Fiberglass insulations shall have recycled glass content; certified and UL Validated.

E. Fiberglass insulations shall have a bio-based, formaldehyde-free binder and be UL GREENGUARD Gold certified.

PART 2 PRODUCTS

2.1 GENERAL

A. Molded pipe insulation shall be manufactured to meet ASTM C585 for sizes required in the particular system. It shall be of a type suitable for installation on piping systems as defined in section above.

B. Molded fibrous glass pipe insulation shall comply with the requirements of ASTM C547.

C. Insulation materials furnished and installed hereunder shall meet the fire hazard requirements of applicable building codes when tested in composite form per one of the following nominally equivalent test methods:
1. American Society for Testing of Materials - ASTM E84
2. Underwriters` Laboratories, Inc. - UL 723
3. National Fire Protection - NFPA 255

2.2 ABOVE GROUND PIPE INSULATION

A. Manufacturers:
1. Owens/Corning
2. Knauf Insulation
3. Manson Insulation
4. Johns Manville

B. Types:
1. Fiberglass insulation; pipe, tank, and rolls.

C. Fiberglass Construction:
1. Fiberglass preformed pipe covering insulation complying with ASTM C547, Type I (850 degrees F) or Type IV (1000 degrees F); ASTM C585, ASTM C411, ASTM C795, and UL/ULC Classified. Fiberglass shall be bonded with a bio-based, thermosetting resin binder.
2. Provide insulation with factory applied, white ASJ SSL, vapor retarder jacket complying with ASTM C1136.
3. Thermal conductivity ASTM C 335 (k-value) at 75 degrees F mean temperature shall be 0.23 Btu x in. /h x sq. ft. x degrees F, or less. Service temperature range of 0 degrees F minimum to 1000 degrees F maximum.
4. Flame spread/Smoke-developed Rating (ASTM E84) of 25/50. Must be UL Environment GREENGUARD Gold certified and UL Validated Formaldehyde-free.

D. Minimum Pipe Insulation Thickness:
1. Chilled water piping systems (Fiberglass Insulation):
a. Indoor Applications (above ceilings, mechanical rooms):

1) All pipe sizes - 1 1/2” insulation thickness.
b. Outdoor Applications:
1) All pipe sizes - 2" insulation thickness
c. Crawlspace Applications:
1) All pipe sizes - 2” insulation thickness
2. Hot water piping systems (Fiberglass Insulation):
a. Indoor Applications (above ceilings, mechanical rooms):
1) 1 1/2” Diameter piping and less - 1 1/2" insulation thickness
2) All piping greater than 1 1/2" Diameter - 2” insulation thickness.
b. Outdoor Applications:
1) All pipe sizes - 2" insulation thickness
c. Crawlspace Applications:
1) All pipe sizes - 2” insulation thickness
3. Condenser water piping systems:
a. Indoor Applications (above ceilings, mechanical rooms):
1) Insulation is not required.
b. Outdoor Applications:
1) All pipe sizes - 2" insulation thickness with electric heat trace tape.

2.3 JACKETING MATERIALS

A. Manufacturers:
1. 3M/Venture Clad
2. Polyguard
3. RPR Products
4. Foster Childers
5. Ideal Products

B. Indoor Applications:
1. Flexible, zero permeability, absolute vapor barrier of 5-ply cold weather acrylic adhesive construction by Venture Tape VentureWrap 1579GCW, or equal with 3-inch butt strips. Meets or exceeds ASTM C1775.

C. Outdoor Applications:
1. Flexible, zero permeability, absolute vapor barrier of 5-ply cold weather acrylic adhesive construction by Venture Tape VentureClad 1577CW, or equal with 3-inch butt strips. Meets or exceeds ASTM C1775.
2. Metal jacketing shall be 0.016-inch minimum aluminum or stainless steel with moisture barrier, secured in accordance with jacket manufacturer`s recommendations. Use bands and seals of the same material. Use preformed fitting covers matching jacket used on straight pipe, with all joints weather sealed with metal sealant. RPR Products or equal.

D. Mechanical Rooms and Exposed Indoor Applications:
1. Flexible, zero permeability, absolute vapor barrier of 5-ply cold weather acrylic adhesive construction by Venture Tape VentureWrap 1579GCW or equal with 3-inch butt strips. Meets or exceeds ASTM C1775.
2. PVC jacketing secured in accordance with jacket manufacturer’s recommendations. Use preformed fitting covers matching jacket used on straight pipe with all joints sealed.

E. Crawlspace Applications:

1. Flexible, zero permeability, absolute vapor barrier of 5-ply cold weather acrylic adhesive construction by Venture Tape VentureClad 1577CW, or equal with 3-inch butt strips. Meets or exceeds ASTM C1775.
2. PVC jacketing secured in accordance with jacket manufacturer's recommendations. Use bands and seals of the same material. Use preformed fitting covers matching jacket used on straight pipe with all joints sealed.

F. Direct Buried Condenser Water Piping:
1. Cathodic protection shall be applied to all steel condenser water piping that is directly buried below grade. Cathodic protection is a method of corrosion prevention for steel piping buried below grade.

2.4 FLANGE, VALVE AND FITTING INSULATION

A. Manufacturers:
1. Zeston PVC
2. Proto PVC

B. Insulate fittings and valves with Hi-Lo temp fiberglass insulation inserts covered with molded fitting PVC jacket covers. PVC - UV resistant and secured and sealed with tape. Equal to Zeston 2000 by Johns Manville.

C. On all chilled water lines the insulation system shall be completely vapor sealed before weather-resistant jacket is applied. Coat all flanges, valves, and fittings with Foster 30-35 or Childers CP-30LO vapor barrier coating and reinforcing mesh. Lines shall have properly constructed vapor dams or vapor stops installed per NACIIS manual.

D. Valves:
1. All valves are to have insulated extension handles.

2.5 SEALANT AND COATING

A. Joint Sealant:
1. Shall be a high solids containing non-setting butyl rubber product.

B. Manufacturers:
1. Foster Flextra Sealant 95-50
2. Childers Chil Byl CP-76
3. Vimasco equivalent
4. Mon-Eco equivalent

C. Usage:
1. Valve covers, anchors, and hangers
   a. Longitudinal laps of the vapor barrier jacket
   b. Butt joint covers.

D. Direct Buried Condenser Water Piping:
1. Cathodic protection shall be applied to all steel condenser water piping that is directly buried below grade. Cathodic protection is a method of corrosion prevention for steel piping buried below grade.

2.6 VAPOR BARRIER COATING

A. Manufacturers:

1. Foster 30-35
2. Childers CP-30LO

B. Usage:
1. On all elbows/fittings on below ambient piping. Used in conjunction with reinforcing mesh.

2.7 METAL JACKET SEALANT

A. Manufacturers:
1. Foster 95-44
2. Childers CP-76
3. Vimasco equivalent
4. Mon-Eco equivalent

B. Usage
1. Seal metal jacketing overlaps and at flashing penetrations.
2. Vapor stops
3. Completing factory installed vapor retarders like ASJ and FSK.

2.8 WEATHER BARRIER MASTIC

A. Manufacturers:
1. Foster 46-50
2. Childers CP-10
3. Vimasco equivalent
4. Mon-Eco equivalent

B. Usage
1. Used on piping to protect insulation from weather. Used in conjunction with reinforcing mesh.

2.9 PIPE SUPPORTS

A. Pipe supports to be polyisocyanurate (PIR) insulation or equal, full circumference high density insulation that can withstand bearing load from the pipe.

2.10 INSULATION SHIELD

A. Field-fabricated:
1. Construction:
a. Insulation to support the bearing area at hangers and supports with a shield of galvanized metal extending not less than 4 inches on either side of the support bearing area, covering at least half of the pipe circumference. When pipe is guided at top and bottom, metal shields should cover the whole pipe circumference. Adhere metal shield to insulation so that metal will not slide with respect to insulation.

B. Schedule:
1. 3-inch and smaller pipe diameter: 12-inch insulated section, 18 gauge metal shield
2. Greater than 3-inch pipe diameter: 12-inch insulated section, 16 gauge metal shield

C. Factory-made:

1. Manufacturer:
   a. Pipe Shields, Inc.
   b. Buckaroos
   c. Equivalent
2. Type:
   a. Proper shield for service and pipe span.
3. Construction:
   a. Extend insulation at least 1 inch beyond metal.
   b. Insulation shall not compress at hanger.

2.11 ELASTOMERIC CLOSED-CELL STRUCTURE INSULATION

A. Manufacturers:
   1. Armacell
   2. Aeroflex

B. Usage:
   1. May be installed within 3 ft of chilled water coils, hot water coils, and on pump bodies. Size equal to or greater than fiberglass insulation thickness.

C. Construction:
   1. EPDM Closed cell elastomeric insulation
   2. Resistant to ultraviolet and biological degradation as demonstrated by ASTM G7 and ASTM G90.
   3. Temperature Range: -297ºF to 220ºF
   4. Water Vapor Permeability (Dry Cup): Less than 0.03 per inch when measured by ASTM E96/E96M.
   5. Thermal Conductivity: 0.245 - 0.28 BTU-IN/HR-F2-ºF or less at 75ºF mean temperature
   6. Maximum water vapor transmission of 0.08 perm-inches in accordance with ASTM E96/E96M.

D. Adhesives: Armaflex 520 BLV or equivalent

PART 3 EXECUTION

3.1 SITE INSPECTION

A. Before starting work under this section, carefully inspect the site and installed work of other trades and verify that such work is complete to the point where installation of materials and accessories under this section can begin.

B. Verify that all materials and accessories can be installed in accordance with project drawings and specifications and material manufacturers` recommendations.

C. Verify, by inspecting product labeling, submittal data, and/or certifications which may accompany the shipments, that all materials and accessories to be installed on the project comply with applicable specifications and standards and meet specified thermal and physical properties.

3.2 PREPARATION

A. Ensure that all pipe and fitting surfaces over which insulation is to be installed are clean, dry, free from dirt, scale, moisture, oil, and grease prior to installing insulation.

Remove materials that will adversely affect insulation application.

B. Ensure that insulation is clean, dry, and in good mechanical condition with all factory-applied vapor or weather barriers intact and undamaged. Wet, dirty, or damaged insulation shall not be acceptable for installation.

C. Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follow:
   1. Carbon Steel: Coat carbon steel piping operating at a service temperature between 32°F and 300°F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

D. Complete pressure testing of piping and fittings prior to installing insulation.

3.3 INSTALLATION

A. To ensure that it will achieve its highest possible performance and serve its intended purpose, install all insulation materials and accessories in accordance with manufacturer's published instructions (latest edition) and industry practices detailed by the North American Commercial and Industrial Insulation Standards Manual (latest edition).

B. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, piping, fittings, valves, specialties, etc.

C. Install insulation materials, forms, vapor barriers, jackets, etc. to the thicknesses required for each item and equipment.

D. All penetrations of the jacket and exposed ends of insulation shall be sealed with vapor barrier coating. The jacket shall be protected with the specified vapor retarding outer jacket. Vapor dam/stop at butt joints shall be applied at every fourth pipe section joint and at each fitting to provide isolation of water incursion. Mark each joint so that Engineer can verify.

E. Install insulation on piping subsequent to installation of heat tracing, painting, and acceptance tests.

F. Do not install insulation on any pipe if chiller is operating.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with the least number of joins practical.

3.4 INDOOR PIPE

A. Insulation to be continuous through wall and ceiling penetrations.

B. Insulation to be continuous over all valves and appurtenances.

C. Insulation shall be applied to piping with all joints tightly fitted to eliminate voids. For systems operating at or below 35 degrees, all joints must be sealed full depth with sealant. Do not install insulation on cold or wet pipes.

D. Sealant shall not be used to fill voids or cracks.

E. Insulation sections shall be secured with aluminum bands. Two strips of reinforced tape may be used in place of bands if exterior bands are used with jacketing. The tape shall overlap itself by 50%.

F. Apply zero-perm vapor barrier jacketing in accordance with manufacturer's instructions, ensuring a minimum 3-inch lap at all longitudinal joints. All circumferential joints should butt as close as possible. A 3-inch wide butt strip shall be applied over the circumferential joints. All laps and butt strips shall be adhesive-faced (self-seal).

3.5 VALVES, FLANGES, AND FITTINGS

A. Insulate all valves, flanges, and fittings with covers secured with Velcro with equivalent thickness and composition installation on straight pipes.

B. Finish with 1/4 inch layer of Foster 30-35 or Childers CP-30LO reinforced with reinforced mesh.

C. Factory made covers equal to Proto Corporation or Johns Manville Zeston are acceptable

3.6 CONTROL VALVE COVERS

A. Fabricate special covers, complete with troweled-on vapor seal, shaped to accommodate the valve stem. Insulation thickness shall be same thickness as adjoining pipe.

B. Seal covers to valve insulation properly with adhesive so that the seal may be broken with a knife blade without damage to either part. Arrange so that cover can be removed and replaced as necessary for operation of the valve.

C. Finish valve cover with glass cloth and two coats of vapor barrier coating.

D. Factory made covers are acceptable. Provide submittal.

3.7 REPAIRS AND REPLACEMENT

A. Replace any insulation that has ever been wet.

B. Repair any damage caused by condensation due to improper insulating.

3.8 INDOOR EXPOSED PIPING

A. Insulate piping exposed to view with a PVC jacket to present a smooth finished look.

B. Install PVC jacketing with 1-inch overlap at longitudinal seams and end joints.

C. PVC jacketing color to be coordinated with architect/ engineer. PVC jacketing to be colored at the factory. Do not field paint PVC jacketing.

3.9 CRAWLSPACE PIPING

A. Insulate piping with a PVC jacket to present a smooth finished look.

B. Install PVC jacketing with 1-inch overlap at longitudinal seams and end joints.

C. PVC jacketing color to be coordinated with architect/ engineer. PVC jacketing to be colored at the factory. Do not field paint PVC jacketing.

3.10 OUTDOOR PIPING

A. Aluminum jacketing shall be applied with all laps positioned to shed water. All laps shall be a minimum of 2-inch.

B. Metal jacketing shall be 0.016" minimum aluminum or stainless steel.

C. Jacketing shall have moisture barrier, secured in accordance with jacket manufacturer's recommendations. Moisture barrier layer shall be polykraft of polysurlyn.

D. Aluminum jacketing shall be secured using bands and seals as specified. Band spacing shall be two bands equally spaced per section of insulation. This will usually mean 9-inch or 12-inch on center. Seal all jacketing overlaps with metal jacketing sealant with 1/8” bead under each lap.

E. Do not field paint aluminum jacketing.

3.11 SHIELDS AND HANGERS

A. Where piping hangers or anchors must be in direct contact with pipe, seal off the pipe insulation on both sides of the hanger by carrying the vapor seal down to the bare pipe.

B. At the location of hangers or supports for pipes run above ground and finished with a vapor seal insulation, provide rigid sections of insulation the same thickness as adjacent insulating material to adequately support the pipe without compression of the insulating material and cover with a vapor seal that is bonded to the adjacent insulation as described for fittings in the lines. Wood inserts shall not be allowed. Hangers and supports for piping insulation to receive a vapor barrier shall be installed exterior to the insulation.

C. Material Changes:
   1. Wherever there is a change in materials on lines that are vapor sealed, apply a suitable adhesive that is compatible with both materials, tapes, etc., as required to maintain the vapor barrier.

D. Apply insulation around the hanger ring or anchor and pipe and carry vapor barrier upward and outward along the hanger rod or anchor members to a point not less than 12 inches from the adjacent pipe.

E. Take care to avoid puncturing the vapor seal.

F. Finish insulation as specified for flanges, and seal over adjacent vapor barrier jacket.

3.12 FIELD QUALITY ASSURANCE

A. Upon completion of all insulation work covered by this specification, visually inspect the work and verify that it has been correctly installed. This may be done while work is in progress, to assure compliance with requirements herein to cover and protect insulation materials during installation.

3.13 PROTECTION

A. Replace damaged insulation which cannot be satisfactorily repaired, including insulation with vapor barrier damage and moisture-saturated insulation.

B. The insulation contractor shall advise the general and/or the mechanical contractor as to requirements for protection of the insulation work during the remainder of the construction period, to avoid damage and deterioration of the finished insulation work.

END OF SECTION

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SECTION 23 07 21

REFRIGERANT PIPING INSULATION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions, Division 1 Specifications, and Section 23 00 00, apply to this Section.

1.2 SECTION INCLUDES

A. Elastomeric closed-cell structure insulation

B. Applications - Refrigerant suction lines serving cooling units

1.3 RELATED SECTIONS

A. Section 23 00 00 - Basic Mechanical Requirements

B. Section 23 23 00 - Refrigerant Piping

1.4 SUBMITTALS

A. Product Data:
   1. Provide submittal data on all equipment specified in this section in accordance with Section 23 00 90, General Conditions, and Division 1.
   2. Submit product data indicating typical catalog of information.
   3. Submit product data sheets indicating dimensions, general assembly, and ratings.
   4. Submit manufacturer`s installation instructions.

1.5 SHOP DRAWINGS

A. Submit 1/4" per foot shop drawing(s) showing all piping and equipment shown by plans and specifications. The drawings shall be coordinated with structural, electrical, and fire sprinkler drawings.

1.6 REFERENCES

A. Refer to Section 23 00 00 for complete names of references identified in this section.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials

C. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials

1.7 QUALITY ASSURANCE

A. Fire Endurance Rating: The composite classifications shall be listed and labeled to not exceed 25 flame spread rating and 50 smoke development rating as outlined by NFPA 255/ ASTM E84/ UL 723 for the basic material, the finishes, adhesives, etc.,

specified for each system, and shall be such when completely assembled.

B. Components such as adhesives, mastics, and cement must meet the same requirement.

PART 2 PRODUCTS

2.1 PIPE INSULATION

A. Type: Closed-Cell Flexible Elastomeric Foam Pipe Insulation w/dual-tape overlap self seal lip closure.

B. Performance Criteria: Resistant to ultra-violet and biological degradation.

C. Temperature Range: -297°F to 220°F

D. Water Vapor Permeability (Dry Cup): Less than 0.03 per inch when measured by ASTM E96.

E. Thermal Conductivity: 0.24 - 0.27 BTU-IN/HR-FT2-°F.

F. Refrigerant Suction Lines Insulation thickness - 1½ inches

G. Manufacturer/Model:
1. Armacell
2. Aeroflex

2.2 SEALANT & ADHESIVE

A. Manufacturer/Model:
1. Therma-Cel
2. Armacell
3. Aeroflex

2.3 FINISHES

A. Manufacturers:
1. Armacell WB Finish - White
2. Aeroflex Aerocoat
3. VentureClad

PART 3 EXECUTION

3.1 PIPE

A. To ensure that it will achieve its highest possible performance and serve its intended purpose, install all insulation materials and accessories in accordance with manufacturer’s published instructions (latest edition) and industry practices detailed by the North American Commercial and Industrial Insulation Standards Manual (latest edition).

B. Where straps or hangers are used, provide insulating pipe support insert and insulation shield.

C. Apply insulation to clean, dry pipes.

D. Butt insulation joints firmly together.

E. Seal butt seams with sealant. Duct tape or electrical tape will not be permitted.

F. Insulation without proper sealing of butt ends and longitudinal seams and/or not neat in appearance will be rejected by the Engineer.

G. Do not stretch insulation around elbows. All fittings must be factory-fabricated or site-fabricated from same materials as straight pipe insulation.

H. When possible, install insulation on piping prior to final connection.

I. Longitudinal joints installed after pipe is assembled are not acceptable.

J. Do not allow liquid lines to come in contact with any structural members or steel stubs. Use plastic ties to secure liquid lines to insulation on vapor line. Do not crush insulation.

3.2 FINISH

A. All insulation to be painted with Aeroflex Aerocoat Finish, or equivalent. Apply as recommended by the manufacturer, to protect the insulation on exterior of building. Apply above 50°F. Apply to dry insulation only.

3.3 VALVES, FLANGES & FITTINGS

A. Insulate all valves, flanges, and fittings in a neat manner.

3.4 REPAIRS AND REPLACEMENT

A. Replace any insulation that has ever been wet.

B. Repair any damage caused by condensation due to improper insulating.

C. Replace any insulation which is cut or torn during construction.

END OF SECTION

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SECTION 23 09 23

ENERGY MANAGEMENT CONTROL SYSTEM (BACNET)

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions, Division 1 Specifications, and Section 23 00 00, apply to this Section.

1.2 SUMMARY

A. It is the intent of this specification to describe the basic architecture and performance requirements of the Energy Management Control System (EMCS). The turn-key EMCS shall include Control Units, Distributed Controllers, Unitary Controllers, Local Area Networks (LANs), sensors, modems, wiring, connectors, control devices, actuators, installation and calibration, supervision, adjustments, and fine tuning necessary for a complete and fully operational system.

B. A distributed logic control system complete with all software and hardware functions shall be provided and installed. System shall be completely based on ANSI/ASHRAE Standard 135-2001, BACnet. This system is to control all mechanical equipment, including all unitary equipment such as VAV boxes, heat pumps, fan-coils, AC units, etc. and all air handlers, boilers, chillers, and any other listed equipment using Native BACnet-compliant components.

C. All systems shall be complete true stand-alone systems.

D. LonWorks or proprietary protocol software is not allowed.

E. Everything shall be reprogrammed through software without change of any hardware. The owner shall have all the tools necessary to reprogram without any additional costs.

F. EMCS shall have backward and forward compatibility.

G. Systems shall be furnished and installed complete in all respects, including any and all equipment, controls, wiring, instrumentation, enclosures, labor, engineering, training, commissioning, programming, supervision, calibration, coordination with other trades, etc. No information given in (or omitted from) these specifications shall relieve the contractor of this absolute requirement. Include all associated electrical work except as noted. Work includes furnishing of all labor, superintendence, materials, tools, equipment and sources necessary for the complete installation or modification of the following systems as herein specified. It is the intent of these specifications that the Contractor shall furnish and install the systems complete in every respect and ready to operate. All equipment, miscellaneous items and accessories required for such installation and for the correct and convenient operation of the entire installation whether or not each such item or accessory is shown on the plans or mentioned in these specifications shall be furnished and installed.

H. Bidders shall take into account that projects require verification of existing conditions that are not described in these specifications. Bids shall include, at Bidder`s

discretion, costs related to site verifications for renovation projects. No additional costs shall be allowed for such items.

I. Should discrepancies or ambiguities arise within these specifications, the most stringent condition with regard to cost shall govern the bid. Obtain clarification from the Engineer prior to purchasing equipment and proceeding with the work.

J. Where drawings are provided as part of or supplement to these specifications, such drawings are inherently schematic only and not intended to convey all controls, wiring, installation, details, etc. It shall be the responsibility of the EMCS contractor to verify that control approaches presented are appropriate for the HVAC systems involved, and that bids include all work described, specified, or otherwise necessary for a complete and functioning system.

K. Schedule: Contractor acknowledges that submission of bid constitutes agreement with and conformance to the completion dates.

L. Codes, Permits, and Fees: This contractor shall comply with all local, state and national codes, and shall secure and pay all applicable costs, fees, permits, and licenses. No additional costs shall be allowed for these items.

M. Other Conditions:
   1. Safety: Execute all work with the highest regard to safety. Comply with all laws governing safety, including the "Occupational Safety and Health Standards" and the "Safety and Health Regulations for Construction", State and federal. All applicable power tools used during construction shall have current approval under an approved Equipment Grounding Program, and shall bear the tag relating such. Contractor is solely responsible for all means and methods.
   2. Coordination and Supervision: Each bid shall include the necessary detail and interconnection work to coordinate his work with the work of other trades. Contractor shall keep competent supervisory personnel on the job whenever work is being performed which affects his trade.
   3. Storage of Materials: Each Contractor shall provide temporary storage facilities suitable for equipment stored at the job site. Storage facilities shall be weatherproof and lockable as required.
   4. Protection of Building and Materials: Each Contractor shall take necessary precautions to prevent damage to existing buildings and to work of other trades.
   5. Observations: Site observation by Owner or Engineer is for express purpose of verifying compliance by Contractor with Contract Documents, and shall not be construed as construction supervision nor indication of approval of manner or location in which work is being performed as being safe practice or place.
   6. Contractor is reminded that he shall also comply with all respects to the Invitation to Bid, General Conditions, Supplementary Conditions, Notice of Bidders, Instructions to Bidders, and all other governing parts of these specifications and the contract documents. These sections are included as part of the contract.
   7. Where the term "Contractor" is used within these specifications, it shall be understood to mean an approved controls manufacturer/contractor, and facility management systems contractor.

N. The entire system shall be approved and listed by Underwriters Laboratories, Inc., under UL 916 for energy management systems and FCC-Part 15 Subparagraph J Class A Emissions Requirements.

O. Equipment and Software Updates/Upgrades:

1. Equipment: All equipment, components, parts, materials, etc. provided throughout the period of Work (as governed in the Agreement) shall be fully compatible with all other equipment, etc. provided at any other time throughout the period of Work. Should updated versions of equipment be provided which are not fully compatible with earlier equipment provided, Contractor shall replace earlier equipment with the later version at no cost to Owner.
2. Software: All software upgrades applicable to system and offered by the manufacturer/contractor for this system shall be provided at no cost to the Owner throughout the period of work. This no cost upgrade shall include installation, programming, modifications to field equipment, data base revisions, training, etc. as appropriate.

P. The Engineer shall reserve all authority regarding approval, conditional approval, or rejection of systems not fully complying with these specifications.

1.3 WORK INCLUDED

A. Existing control system is Alerton controls by Climatec. All new equipment to be connected to the existing EMCS. All programming, software upgrades, controllers, etc. necessary to connect new equipment to existing control system shall be verified and provided by Climatec.

B. The EMCS shall be a totally Native BACnet-based system based on a distributed control system in accordance with this specification. The workstation, all building controllers, application controllers, and all input/output devices shall communicate using the protocols and network standards as defined by ANSI/ASHRAE Standard 135-2001, BACnet. In other words, all workstations and controllers, including unitary controllers, shall be Native BACnet devices. No gateways shall be used for communication to controllers installed under this section. Gateways may be used for communication to existing systems or to systems installed under other sections.

C. The installing contractor shall provide the new web-based software and software updates required for this project. Additionally, the installing contractor shall provide all computer related components (BAS Web server) for the new software platform to function in a peer-to-peer environment.

D. The owner will provide reserved DHCP addresses and any other network configuration information necessary to each control contractor for the purpose of configuring each building controller and/or server on the owner’s network. The controls contractor shall coordinate the IP address for each building controller and/or server. It shall be the responsibility of each control contractor to coordinate with the owner for network connectivity.

E. The Energy Management and Control System (EMCS) application program shall be written to communicate specifically utilizing BACnet protocols. Software shall include password protection, alarming, logging of historical data, full graphics including animation, full suite of field engineering tools including graphical programming and applications. Systems using operating systems other than that described above are strictly prohibited.

F. Building controllers shall include complete energy management software, including scheduling building control strategies and logging routines. All energy management software and firmware shall be resident in field hardware and shall not be dependent on the operator’s terminal. Operator’s terminal software is to be used for access to

field-based energy management functions only. Provide zone-by-zone direct digital logic control of space temperature, scheduling, runtime accumulation, equipment alarm reporting, and override timers for after-hours usage.

G. All application controllers for every terminal unit (VAV, HP, UV, etc.) air handler, all central plant equipment, and any other piece of controlled equipment shall be fully programmable. Application controllers shall be mounted next to controlled equipment and communicate with building controller via BACnet LAN.

H. Provide all necessary BACnet-compliant hardware and software to meet the system's functional specifications. Provide Protocol Implementation Conformance Statement (PICS) for Windows-based control software and every controller in system, including unitary controllers.

I. Prepare individual hardware layouts, interconnection drawings, and software configuration from project design data.

J. Implement the detailed design for all analog and binary objects, system databases, graphic displays, logs, and management reports based on control descriptions, logic drawings, configuration data, and bid documents.

K. Design, provide, and install all equipment cabinets, panels, data communication network cables needed, and all associated hardware.

L. Provide and install all interconnecting cables between supplied cabinets, application controllers, and input/output devices.

M. Provide and install all interconnecting cables between all operator's terminals and peripheral devices (such as printers, etc.) supplied under this section.

N. Provide complete manufacturer's specifications for all items that are supplied. Include vendor name of every item supplied.

O. Provide supervisory specialists and technicians at the job site to assist in all phases of system installation, startup, and commissioning.

P. Provide a comprehensive operator and technician training program as described herein.

Q. Provide as-built documentation, operator's terminal software, diagrams, and all other associated project operational documentation (such as technical manuals) on approved media, the sum total of which accurately represents the final system.

R. Provide new sensors, dampers, valves, and install only new electronic actuators. No used components shall be used as any part or piece of installed system.

S. Unless otherwise specified, all products shall be of single manufacturer where possible with substitutions approved by Engineer/Owner.

T. Provide all indicating devices, interface equipment, and other apparatus required to operate mechanical system and to perform functions specified and to operate other items specified.

U. Provide protective devices to prevent damage to the EMCS as a result of lightning.

V. The Energy Management Control system shall allow full user operation with minimum of training. It shall have an English language display, with both user prompts and a "help" user tutorial. It shall contain management reports for the monitoring of both current and historical energy usage, heating and cooling degree day, building status and after hours occupancy information.

W. All applications programs shall be pre-engineered and pretested. Program entries shall utilize graphical templates.

X. Workmanship:
1. Contractor shall use only thoroughly trained and experienced workmen completely familiar with the items required and with the manufacturers recommended methods of installation. In all respects, the workmanship shall be of the highest grade, and all construction shall be done according to the best practice of the trade. Unless otherwise noted, conduit shall be concealed and installed square to the building lines. Any work not meeting these requirements shall be replaced or rebuilt without extra expense to the Owner

1.4 RELATED SECTIONS

A. Section 23 00 00 - Basic Mechanical Requirements

B. Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC

C. Section 23 81 26 - Split System HVAC Units

D. Section 26 00 00 - Basic Electrical Requirements

1.5 DEFINITIONS

A. Energy Management Control System, Facility Management System, and Control System are to be considered the same.

1.6 REFERENCES

A. The latest edition of the following standards and codes in effect and amended as of supplier`s proposal date, and any applicable subsections thereof, shall govern design and selection of equipment and material supplied:
1. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE).
2. ANSI/ASHRAE - Standard 135-2001, BACnet.
3. Uniform Building Code (UBC), including local amendments.
4. UL 916 - Underwriters Laboratories Standard for Energy Management Equipment. Canada and the US.
5. National Electrical Code (NEC).
6. FCC Part 15, Subpart J, Class A.
7. EMC Directive 89/336/EEC (European CE Mark).
8. City, county, state, and federal regulations and codes in effect as of contract date.
9. Except as otherwise indicated the system supplier shall secure and pay for all permits, inspections, and certifications required for his work and arrange for necessary approvals by the governing authorities.

1.7 SPECIFICATION NOMENCLATURE

EMCS	Energy Management and Control System
WAN	Wide Area Network
RWS	Remote Work Station
HHI	Hand Held Interface
LAN	Local Area Network

1.8 QUALITY ASSURANCE

A. Responsibility:
   1. The supplier of the EMCS shall be responsible for inspection and Quality Assurance (QA) for all materials and workmanship furnished.

B. Component Testing:
   1. Maximum reliability shall be achieved through extensive use of high-quality, pre-tested components. Each and every controller, sensor, and all other DDC components shall be individually tested by the manufacturer prior to shipment.

C. Tools, Testing and Calibration Equipment:
   1. The EMCS supplier shall provide all tools, testing, and calibration equipment necessary to ensure reliability and accuracy of the system.

1.9 SUBMITTALS

A. Drawings
   1. The system supplier shall submit detailed complete, engineered drawings, control sequence, and bill of materials for approval.
   2. The contractor shall supply one electronic copy of the submittal.
   3. The electronic files will either be e-mailed to the architect or posted to a project management and information exchange website, depending on the architect’s requirements. The architect and contractor can distribute copies of the files as desired.
   4. The engineer will retain an electronic copy of the submittal and all responses.

B. System Documentation
   1. Include the following in submittal package:
      a. Data sheets for all pieces of equipment.
      b. System configuration diagrams in simplified block format.
      c. All input/output object listings and an alarm point summary listing.
      d. Electrical drawings that show all system internal and external connection points, terminal block layouts, and terminal identification.
      e. Complete bill of materials, valve schedule, and damper schedule.
      f. Manufacturer`s instructions and drawings for installation, maintenance, and operation of all purchased items.
      g. Overall system operation and maintenance instructions including preventive maintenance and troubleshooting instructions.

C. For all system elements - operator’s workstation(s), building controller(s), application controllers, routers, and repeaters, provide BACnet Protocol Implementation Conformance Statements (PICS) as per ANSI/ASHRAE Standard 135-2001.

D. Provide complete description and documentation of any proprietary (non-BACnet) services and/or objects used in the system.

E. A list of all functions available and a sample of function block programming that shall be part of delivered system.
   1. Scheduling
      a. The vendor shall provide a detailed project design and installation schedule with time markings and details for hardware items and software development phases. Schedule shall show all the target dates for transmission of project information and documents and shall indicate timing and dates for system installation, debugging, and commissioning.
   2. Drawings and Manuals:
      a. Upon completion of the work, the Contractor shall provide the Owner with "record" layouts for the system. Layouts shall indicate all equipment and the function of each item shall be indicated.
   3. Operating instructions and as-built system flow diagrams and drawings shall be prepared, bound, and delivered to the Owner. Each sensor, relay, switch, motor, controller, indicator (when inside panel), and item of equipment, etc., shall be identified with a number or mark identical to one which shall be tagged on each item. Large items of equipment may be identified by a suitable symbol listed in a legend on the control diagram.

1.10 EMCS CONTRACTOR QUALIFICATION REQUIREMENTS

A. The Energy Management Control System Manufacturer/Contractor, to be acceptable to this project, must have had an established engineering and service office serving the Owner`s area for a minimum of five years prior to bid date of this project and be the authorized installing contractor for the manufacturer of the BACnet components. This office shall have a staff of factory trained technicians fully capable of rendering training, instruction, calibration procedures, and routine and emergency maintenance service on all system components furnished.

B. Installers shall have not less than five years' experience with electronic and pneumatic controls.

C. The entire system shall be provided by a qualified and approved Controls Manufacturer/Contractor. It shall be designed by engineers and installed by competent technicians, all of which are regularly employed by the manufacturer of the control equipment. The Manufacturer/Contractor shall maintain permanent local facilities for engineering, installation, and 24-hour maintenance and service. Submit required Qualifications Form as specified. The manufacturer shall provide evidence of the ability to support and service the work in the Owner`s facilities.

D. The Bidder/Contractor shall be certified by the manufacturer of the equipment and have factory trained installers

E. Equipment and performance are intended as a standard of quality, but not as a means of excluding other approved Manufacturers/Control Contractors.

1.11 WARRANTY

A. The temperature control contractor shall guarantee all workmanship and material in the installed temperature regulation system for a period of one (1) year, such

guarantee dating from the date of final acceptance of the entire air conditioning system by the Architect/Engineer.

B. This warranty shall cover the repair or replacement without additional costs to the Owner of any defective materials, parts, etc. of facility workmanship.

C. During the warranty period, the temperature controls contractor shall respond to calls for warranty service within eight (8) working hours. Emergency service shall be obtainable within four (4) hours of notification by the Owner. Emergency service shall be obtainable on a 24-hour basis, seven (7) days per week.

D. The temperature control contractor`s office shall be within a 150-mile radius of the job site.

E. Warranty Access:
1. The Owner shall grant to the Contractor, reasonable access to the EMCS system during the warranty period. The owner shall provide, at no cost to the contractor, remote software access to an on-site computer or VPN access for the following functions:
   a. Access to the entire facility control system by the contractor to provide service and diagnostic support.

F. Service:
1. All service of the system shall be furnished by the Contractor, at no cost to the Owner, for a period of one (1) year, concurrent with the warranty period specified above.

PART 2 PRODUCTS

2.1 ACCEPTABLE EMCS VENDORS

A. Alerton - Climatec

B. The Engineer and Owner shall reserve all authority regarding approval, conditional approval, or rejection of systems not fully complying with these specifications

2.2 MATERIALS

A. General: All materials and equipment used shall be standard components, of regular manufacture for this application. All systems and components shall have been thoroughly tested and proven in actual use.

B. Exceptions to the specification will qualify bid as unacceptable.

2.3 OPERATOR’S WORKSTATION

A. This system is an addition to the existing control system and shall be connected to the existing local area network (LAN) and computer. No additional workstation is required.

B. The new graphics software shall be fully integrated to the owners existing front end software and existing workstation. Floor plan and interactive color graphics shall be provided for the school with each zone providing color indication of the zone comfort level. In addition to the floor plan graphic, each piece of controlled equipment shall be represented by a graphic that is accessible by clicking on the zone or indicated piece

of equipment. All points shall be available on the graphic.

2.4 BUILDING CONTROLLER

A. This system is an addition to the existing control system and shall be connected to the existing building controller if feasible. Field verify if existing building controller can be expanded or if additional building controller(s) is necessary.

2.5 WEB BROWSER CLIENTS

A. The system shall be capable of supporting an unlimited number of clients using a standard Web browser such as Internet Explorer™ or Mozilla Firefox™. Systems requiring additional software (to enable a standard Web browser) to be resident on the client machine, or manufacture-specific browsers shall not be acceptable.

B. The Web browser software shall run on any operating system and system configuration that is supported by the Web browser. Systems that require specific machine requirements in terms of processor speed, memory, etc., to allow the Web browser to function with the EMCS shall not be acceptable.

C. The Web browser shall provide the same view of the system, in terms of graphics, schedules, calendars, logs, etc., and provide the same interface methodology as is provided by the Graphical User Interface. Systems that require different views or that require different means of interacting with objects such as schedules, or logs, shall not be permitted.

D. The Web browser client shall support at a minimum, the following functions:
   1. User log-on identification and password shall be required. If an unauthorized user attempts access, a blank web page shall be displayed. Security authentication and encryption techniques to prevent unauthorized access shall be implemented.
   2. 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 interface.
   3. HTML programming shall not be required to display system graphics or data on a Web page. HTML editing of the Web page shall be allowed if the user desires a specific look or format.
   4. Storage of the graphical screens shall be in the Network Area Controller (NAC), without requiring any graphics to be stored on the client machine. Systems that require graphics storage on each client are not acceptable.
   5. Real-time values displayed on a Web page shall update automatically without requiring a manual “refresh” of the Web page.
   6. Users shall have administrator-defined access privileges. Depending on the access privileges assigned, the user shall be able to perform the following:
      a. Modify common application objects, such as schedules, calendars, and set points in a graphical manner.
         1) Schedule times will be adjusted using a graphical slider, without requiring any keyboard entry from the operator.
         2) Holidays shall be set by using a graphical calendar, without requiring any keyboard entry from the operator.
      b. Commands to start and stop binary objects shall be done by right-clicking the selected object and selecting the appropriate command from the pop-up menu. No entry of text shall be required.

c. View logs and charts
d. View and acknowledge alarms

7. The system shall provide the capability to specify a user's (as determined by the log-on user identification) home page. Provide the ability to limit a specific user to just their defined home page. From the home page, links to other views, or pages in the system shall be possible, if allowed by the system administrator.
8. Graphic screens on the Web Browser client shall support hypertext links to other locations on the Internet or on Intranet sites, by specifying the Uniform Resource Locator (URL) for the desired link.

2.6 TERMINAL UNIT APPLICATION CONTROLLERS (ROOFTOPS, HEAT PUMPS, AC UNITS, FAN COILS)

A. General:
1. Provide one Native BACnet application controller for each piece of unitary mechanical equipment that adequately covers all objects listed in object list for unit. All controllers shall interface to building controller via MS/TP LAN using BACnet protocol. No gateways shall be used. Controllers shall include input, output, and self-contained logic program as needed for complete control of unit.

B. BACnet Conformance:
1. Application controllers shall as a minimum support MS/TP BACnet LAN types. They shall communicate directly via this BACnet LAN at 9.6, 19.2, 38.4, and 76.8 Kbps, as a Native BACnet device. Application controllers shall be of BACnet conformance class 3 and support all BACnet services necessary to provide the following BACnet functional groups:
a. Files Functional Group
b. Reinitialize Functional Group
c. Device Communications Functional Group
2. Refer to section 22.2, BACnet Functional Groups in the BACnet standard for a complete list of the services that must be directly supported to provide each of the functional groups listed above. All proprietary services, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.
3. Standard BACnet object types supported shall include as a minimum-Analog Input, Analog Output, Analog Value, Binary Input, Binary Output, Binary Value, Device, File and Program Object Types. All proprietary object types, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.
4. Application controllers shall include universal inputs with 10-bit resolution that can accept 3K and 10K thermistors, 0-5 VDC, 4-20 mA, dry contact signals and a minimum of 3 pulse inputs. Any input on controller may be either analog or digital. Controller shall also include support and modifiable programming for interface to intelligent room sensor. Controller shall include binary outputs on board with analog outputs as needed.
5. All program sequences shall be stored on board controller in EEPROM. No batteries shall be needed to retain logic program. All program sequences shall be executed by controller 10 times per second and shall be capable of multiple PID loops for control of multiple devices. Programming of application controller shall be completely modifiable in the field over installed BACnet LANs or remotely via modem interface. Operator shall program logic sequences by

graphically moving function blocks on screen and tying blocks together on screen. Application controller shall be programmed using same programming tools as building controller and as described in operator workstation section. All programming tools shall be provided and installed as part of system.

6. Application controller shall include support for intelligent room sensor (see Section 2.9.B.). Display on room sensor shall be programmable at controller and include an operating mode and a field service mode. All button functions and display data shall be programmable to show specific controller data in each mode based on which button is pressed on the sensor. See sequence of operation for specific display requirements at intelligent room sensor.

C. Smoke Detectors:
   1. Smoke detectors (duct and area type) shall be provided, installed, and wired into the Fire Alarm System by the Electrical Contractor. The Controls Contractor shall be responsible for interlock wiring between duct smoke detectors and control relays, and starter safety circuits.

2.7 ELECTRONIC ACTUATORS

A. General:
   1. Shall be Electric unless otherwise specified.
   2. Shall be manufactured by Belimo. **Equal substitutions allowed with written approval by owner prior to bid.**
   3. Five-year manufacturer's warranty. Two-year unconditional and three-year product defect from date of installation.
   4. Furnish a Freeze-stat and install "Hard Wire" interlock to disconnect the mechanical spring return actuator power circuit for fail-safe operation. Use of the control signal to drive the actuators closed is not acceptable.
   5. VAV box damper actuation shall be Floating type or Analog (2-10vdc, 4-20ma) and provide to VAV box manufactured for factory installation.
   6. Booster-heat valve actuation shall be Floating type or Analog (2-10vdc, 4-20ma).
   7. Primary valve control shall be Analog (2-10vdc, 4-20ma).
   8. UL Listed Standard 873 and Canadian Standards Association Class 481302 shall certify Actuators.
   9. Mechanical spring shall be provided when specified. Capacitors or other non-mechanical forms of fail-safe are not acceptable.
   10. Position indicator device shall be installed and made visible to the exposed side of the Actuator. For damper short shaft mounting, a separate indicator shall be provided to the exposed side of the Actuator.
   11. Overload Protection: Actuators shall provide protection against actuator burnout by using an internal current limiting circuit or digital motor rotation sensing circuit. Circuit shall insure that actuators cannot burn out due to stalled damper or mechanical and electrical paralleling. End switches to deactivate the actuator at the end of rotation are acceptable only for Butterfly Valve actuators.
   12. A push button gearbox release shall be provided for all non-spring actuators.
   13. Modulating actuators shall be 24VAC and consume 10VA power or less.
   14. Conduit connectors are required when specified and when code requires it.

B. Damper Actuators:
   1. **All damper actuators shall be provided and installed by EMCS contractor.**
   2. Electronic damper actuators shall be direct-coupled rotary type, suitable for mounting directly on the damper end shaft. Electronic damper actuators shall be properly sized to provide sufficient torque to position the damper throughout its

operating range. Damper actuators used on economizer and/or outside air dampers shall be spring return.

3. Terminal unit damper actuators shall be electric, low voltage, utilizing floating control.
4. Outside Air and Exhaust Air Damper Actuators shall be Mechanical Spring Return. Capacitors or other non-mechanical forms of fail-safe are not acceptable. The actuator mounting arrangement and spring return feature shall permit normally open or normally closed positions of the damper as required.
5. **Economizer Actuators shall be provided and installed by EMCS contractor. Actuators shall utilize Analog control 2-10 VDC and shall give position feedback for Fault Detection and Diagnostics (FDD) monitoring. Floating control is not acceptable. Actuators shall be Mechanical Spring Return. Equal to Belimo LF-24-SR.**
6. Electric damper actuators (including VAV box actuators) shall be direct shaft mounted and use a V-bolt and toothed V-clamp causing a cold weld effect for positive gripping. Single bolt or setscrew type fasteners are not acceptable.
7. One electronic actuator shall be direct shaft mounted per damper section. No connecting rods or jackshafts shall be needed. Small outside air and return air economizer dampers may be mechanically linked together if one actuator has sufficient torque to drive both and damper drive shafts are both horizontal installed.
8. Multi-section dampers with electric actuators shall be arranged so that each damper section operates individually. One electronic actuator shall be direct shaft mounted per damper section. (See below execution section for more installation details.)

2.8 DAMPERS AND VALVES

A. Control Dampers:

1. Control air dampers shall be parallel blade for two-position control and opposed blade for modulating control applications. Dampers shall be galvanized with nylon bearings. Blade edge and tip seals shall be included for all dampers. Leakage through the damper shall not exceed **4 CFM per square foot at 1" w.c.** Blades shall be 16-gauge minimum and 10" wide maximum and frame shall be of welded channel iron. Dampers over 48" wide shall be equipped with a jackshaft to provide sufficient force throughout the intended operating range.
2. All dampers used for modulating service shall be opposed blade type arrange for normally open or normally closed operation as required. The damper is to be sized so that when wide open the pressure drop is a sufficient amount of its close-off pressure drop for effective throttling.
3. All dampers used for two-position or open-close control shall be parallel blade type arranged for normally open or closed operation as required.
4. Damper linkage hardware shall be constructed of aluminum or corrosion resistant zinc & nickel-plated steel and furnished as follows:
    a. Bearing support bracket and drive blade pin extension shall be provided for each damper section. Sheet metal contractor shall install bearing support bracket and drive blade pin extension. Sheet metal contractor shall provide permanent indication of blade position by scratching or marking the visible end of the drive blade pin extension.
    b. Drive pin may be round only if V-bolt and toothed V-clamp is used to cause a cold weld effect for positive gripping. For single bolt or set-screw type actuator fasteners, round damper pin shafts must be milled with at least one

side flat to avoid slippage.

B. Actuator mounting for damper and valve arrangements shall comply to the following:
   1. Damper Actuators: Shall not be installed in the air stream
   2. A weather shield shall be used if actuators are located outside. For Damper Actuators use clear plastic enclosure.
   3. Damper or valve actuator ambient temperature shall not exceed 122°F through any combination of medium temperature or surrounding air. Appropriate air gaps, thermal isolation washers or spacers, standoff legs, or insulation shall be provided as necessary.
   4. Actuator cords or conduit shall incorporate a drip leg if condensation is possible. Water shall not be allowed to contact actuator or internal parts. Location of conduits in temperatures dropping below dew point shall be avoided to prevent water from condensing in conduit and running into actuator.
   5. Damper mounting arrangements shall comply to the following:
      a. The ventilation subcontractor shall furnish and install damper channel supports and sheet metal collars.
      b. No jack shafting of damper sections shall be allowed.
      c. Multi-section dampers shall be arranged so that each damper section operates individually. One electronic actuator shall be direct shaft mounted per section.

2.9 ENCLOSURES

A. NEMA 2 rated enclosures for inside mounting, provide with weather shield for outside mounting.

B. All controllers, power supplies, and relays shall be mounted in enclosures.

C. Enclosures may be NEMA 1 when located in a clean, dry, indoor environment. Indoor enclosures shall be NEMA 12 when installed in other than a clean environment.

D. Enclosures shall have hinged, locking doors.

E. Provide laminated plastic nameplates for all enclosures in any mechanical room or electrical room. Include location and unit served on nameplate. Laminated plastic shall be 1/8” thick sized appropriately to make label easy to read.

F. All direct digital controllers located indoors shall be installed in NEMA 1 enclosures. All direct digital controllers located outdoors shall be installed in NEMA 3R enclosures. Enclosures shall be of suitable size to accommodate all power supplies, relays, and accessories required for the application. Each enclosure shall include a perforated subpanel for direct mounting of the enclosed devices. Include matched key locks for all enclosures provided.

2.10 SENSORS, SWITCHES, CONTROLLERS, TRANSDUCERS, AND MISCELLANEOUS DEVICES

A. Temperature Sensors:
   1. All temperature sensors to be solid state electronic, factory-calibrated to within 0.5°F, totally interchangeable with housing appropriate for application. Wall sensors to be installed as indicated on drawings. Mount 48 inches above finished floor. Duct sensors to be installed such that the sensing element is in the main air stream. Immersion sensors to be installed in wells provided by control

contractor, but installed by mechanical contractor. Immersion wells shall be filled with thermal compound before installation of immersion sensors. Outside air sensors shall be installed away from exhaust or relief vents, not in an outside air intake and in a location that is in the shade most of the day.

B. Intelligent Room Sensor with LCD Readout:
   1. Sensor shall contain a backlit LCD digital display and user function keys along with temperature sensor. Controller shall function as room control unit, and shall allow occupant to raise and lower setpoint, and activate terminal unit for override use all within limits as programmed by building operator. Sensor shall also allow service technician access to hidden functions as described in sequence of operation.
   2. The Intelligent Room Sensor shall simultaneously display room setpoint, room temperature, outside temperature, and fan status (if applicable) at each controller. This unit shall be programmable, allowing site developers the flexibility to configure the display to match their application. The site developer should be able to program the unit to display time-of-day, room humidity, and outdoor humidity. Unit must have the capability to show temperatures in Fahrenheit or Centigrade.
   3. Override time may be set and viewed in half-hour increments. Override time count down shall be automatic, but may be reset to zero by occupant from the sensor. Time remaining shall be displayed. Display shall show the word “OFF” in unoccupied mode unless a function button is pressed.
   4. See sequence of operation for specific operation of LCD displays and function keys in field service mode and in normal occupant mode. Provide intelligent room sensors as specified in point list.
   5. Field service mode shall be customizable to fit different applications. If intelligent room sensor is connected to VAV controller, VAV box shall be balanced and all airflow parameters shall be viewed and set from the intelligent room sensor with no computer or other field service tool needed.

C. Field Service Tool:
   1. Field service tool shall allow technician to view and modify all setpoints and tuning parameters stored in application controller. In addition, technician shall be able to view status of all inputs and outputs on digital readout. Each piece of data shall have a data code associated with it that is customizable.
   2. Field service tool shall plug into wall sensor and provide all the functionality specified. Operator workstation shall include the capability to disable operation of the field service tool.
   3. Provide Field Service Tool(s) for this project.

D. Network Connection Tool:
   1. Network connection tool shall allow technician to connect a laptop to any MS/TP network or at any MS/TP device and view and modify all information throughout the entire BACnet network. Laptop connection to tool shall be via Ethernet or PTP.
   2. Provide quick connect to MS/TP LAN at each controller. Tool shall be able to adjust to all MS/TP baud rates specified in the BACnet standard.
   3. Proved 1 Network Connection Tool for this project.

E. Differential Pressure Switches (Air):
   1. Provide differential pressure switches across fans and filters for status indication. Differential pressure switches shall have an adjustable setpoint from 0.05” w.c.

to 2” w.c. with a switch differential that progressively increases from 0.02” w.c. at minimum to 0.8” w.c. at maximum. Switch shall be SPDT rated for 15A (non-inductive) at 277VAC.

F. Float Switches:
1. Provide float switches in condensate drain pans as required by code. Float switches shall utilize a magnetically actuated dry reed switch. Float shall be constructed of seamless polypropylene. Switch shall be SPDT rated for 16A (non-inductive) at 120VAC.

G. Mixed Air Low Limit Controllers (Freezestats):
1. Mixed air low limit controllers shall be manual reset, adjustable setpoint with 20-foot element serpentined across the entering air face of center cooling coil. Control shall be responsive only to the lowest temperature along the element.

H. Static High Limit Controllers:
1. Discharge static high limit controllers shall be provided on all VAV AHU systems. When discharge static pressure exceeds setpoint, the supply fan shall be de-energized. Manual reset shall be required.

I. Static Pressure Transducers (Air):
1. Provide static pressure transducers for monitoring supply duct static pressure. Static pressure transducers shall be 100% solid state and shall include glass on silicon, ultra stable capacitance sensors. Each static pressure transducer shall incorporate short circuit and reverse polarity protection. Transmitter output shall be either 0-10VDC or 4-20mA. Static pressure transducers are to be provided in an enclosure that is suitable for duct mounting. The desired setpoint is to be in the top 50% of the transmitter’s operating range.

J. Differential Pressure Transducers (Air):
1. Provide differential pressure transducers for monitoring air system and airflow measuring station differential pressures. Differential pressure transducers shall be 100% solid state and shall include glass on silicon, ultra stable capacitance sensors. Each differential pressure transducer shall incorporate short circuit and reverse polarity protection. Transducer output shall be either 0-10VDC or 4-20mA. Differential pressure transducers are to be provided in an enclosure that is suitable for duct mounting. The desired setpoint is to be in the top 50% of the transducer’s operating range.

K. Current Sensing Relays:
1. Provide current switches for indication of equipment status. Amperage ratings shall be adjustable with the desired setpoint to be in the top 50% of the current relay’s operating range. Current sensing relays shall incorporate trip indication LED’s and shall be sized for proper operation with the equipment served.

L. Relative Humidity Sensors:
1. Relative humidity sensors shall have an accuracy of +/- 2% from 5 to 95% RH. Output signal shall be either be 0-10VDC or 4-20mA. Humidity transmitters shall be factory calibrated and require no field setting.

M. Duct/Well Sensors:
1. Sensors for duct and water temperature sensing shall incorporate either RTD or Thermistor sensing devices. Sensing element accuracy shall be 0.1% over the sensor span or better. Where the element is being used for sensing mixed air or

coil discharge temperatures and/or the duct cross sectional area is in excess of 14 square feet, the element shall be of the averaging type. Averaging duct sensors shall utilize a 6, 12, or 24 foot sensing element. Immersion sensors shall use matched 316 stainless steel bulb wells. All duct and immersion sensors shall be provided with conduit connection housings. Sensors shall be provided with adequate standoffs for insulation installation.

N. Selector Switches:
   1. Selector switches shall be 2 or 3-position, knob, or key type as required by the sequence of operation. Selector switches shall feature oil tight construction and be fitted with snap-fit contact blocks rated for 10A, 600VAC/DC operation. Labels shall be provided indicating switch position.

O. Pushbutton Switches:
   1. Pushbutton switches shall be either maintained or momentary as required by the sequence of operation. Pushbutton switches shall feature oil tight construction and be fitted with snap-fit contact blocks rated for 10A, 600VAC/DC operation. Labels shall be provided indicating switch function.

PART 3 EXECUTION

3.1 EXAMINATION

A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence.

B. Notify the owners` representative in writing of conditions detrimental to the proper and timely completion of the work.

C. Do not begin work until all unsatisfactory conditions are resolved.

D. Each bid must include all costs associated with providing wiring, conduit, concrete trenching, and earth trenching.

3.2 OPERATION

A. BACnet Object List:
   1. The following points as defined for each piece of equipment are designated as follows:
      a. Binary Out (BO) - Defined as any two-state output (start/stop) (enable/disable), etc.
      b. Binary In (BI) - Defined as any two-state input (alarm, status), etc.
      c. Analog In (AI) - Defined as any variable input (temperature) (position), etc.
      d. Analog Out (AO) - Defined as any electrical variable output. 0-20mA, 4-20mA, and 0-10VDC are the only acceptable analog outputs. The driver for analog outputs must come from both hardware and software resident in the controllers. Transducers will not be acceptable under any circumstance.
   2. Each and every point will be checked out by the Contractor and the Owner`s Representative will inspect each point with the bidder prior to acceptance. Provide complete written documented inspections, test, and checkout report. Calibrate all equipment.

B. DDC Object Type Summary:

1. Provide all database generation.
2. Displays:
    a. System displays shall show all analog and binary object types within the system. They shall be logically laid out for easy use by the owner. Provide outside air temperature indication on all system displays associated with economizer cycles.
3. Run Time Totalization:
    a. At a minimum, run time totalization shall be incorporated for each monitored supply fan, return fan, exhaust fan, hot water and chilled water pumps. Warning limits for each point shall be entered for alarm and or maintenance purposes.
4. Trendlog:
    a. All binary and analog object types (including zones) shall have the capability to be automatically trended.
5. Alarm:
    a. All analog inputs (High/Low Limits) and selected binary input alarm points shall be prioritized and routed (locally or remotely) with alarm message per owner`s requirements.
6. Database Save:
    a. Provide backup database for all stand-alone application controllers on disk.

3.3 INSTALLATION

A. General:
1. Install in accordance with manufacturer`s instructions.
2. Provide all miscellaneous devices, hardware, software, interconnections installation, and programming required to ensure a complete operating system in accordance with the sequences of operation and point schedules.
3. Provide a complete and operational temperature control and building automation system based on the following points and sequence of operation. The system shall be complete as to sequences and standard control practices. The determined point list is the minimum amount of points that are to be provided. If additional points are required to meet the sequence of operation, they will be provided.

B. Location and Installation of Components:
1. Locate and install components for easy accessibility; in general, mount 48 inches above floor with minimum 3`-0" clear access space in front of units. Obtain approval on locations from owner’s representative prior to installation.
2. Enclosures and hardware or wiring shall not block or limit accessibility to service compartments of any other equipment.
3. The work shall be coordinated fully, as it pertains to the fire protection system, fire alarm system, and electrical power system. All items shall be terminated in the DDC controllers in a predetermined order as indicated in the submittal drawings.
4. All instruments, switches, transmitters, etc., shall be suitably wired and mounted to protect them from vibration, moisture, and high or low temperatures.
5. Identify all equipment and panels. Provide permanently mounted tags for all panels.
6. Provide stainless steel or brass thermowells suitable for respective application and for installation under other sections - sized to suit pipe diameter without restricting flow.

C. Interlocking and Control Wiring:
   1. Provide all interlock and control wiring. All wiring shall be installed neatly and professionally, in accordance with Specification Division 26 and all national, state, and local electrical codes.
   2. Provide wiring as required by functions as specified and as recommended by equipment manufacturers, to serve specified control functions. Provide shielded low capacitance wire for all communications trunks.
   3. Control wiring shall not be installed in power circuit raceways. Magnetic starters and disconnect switches shall not be used as junction boxes. Provide auxiliary junction boxes as required. Coordinate location and arrangement of all control equipment with the owner`s representative prior to rough-in.
   4. Provide auxiliary pilot duty relays on motor starters as required for control function.
   5. Provide power for all control components from nearest electrical control panel or as indicated on the electrical drawings. Coordinate with electrical contractor.
   6. All control wiring in the mechanical, electrical, telephone and boiler rooms to be installed in conduit. All other wiring to be installed neatly and inconspicuously per local code requirements. If local code allows, control wiring above accessible ceiling spaces may be run with plenum rated cable (without conduit).

D. Installation Requirements:
   1. Any panels associated with the control system shall be furnished and installed under this section of the work. Panel wiring shall be terminated by connecting to numbered terminals strips. Wire nut connections shall not be allowed. All wiring shall be color coded and shall be tagged for future identification.
   2. Unless otherwise specified, all devices, panels, etc., furnished and/or installed by the Contractor shall be located where they can be calibrated and maintained from the floor without use of a ladder. These items shall be identified by means of plates made of plastic suitably engraved, embossed, or punched, plastic tape will not be acceptable. At completion of job, the Contractor shall submit record drawings of any changes made during construction. This submittal shall be a condition of final payment.
   3. Any conduit on roof shall be absolute minimum and shall have prior written approval.
   4. All conduit used indoor and outdoor shall be metal and shall be of type and fittings to minimize corrosion and moisture entry.

E. Cable Installation and Attachments:
   1. Control System wiring and equipment installation shall be in accordance with good engineering practices as established by the TIA/EIA and the NEC. Wiring shall meet all state and local electrical codes. All wiring shall test free from all grounds and shorts. All cable shall be supported from the building structure and bundled.
   2. The support system shall provide a protective pathway to eliminate stress that could damage the cabling. The cable shall not be crushed, deformed, skinned, crimped, twisted, or formed into tight radius bends that could compromise the integrity of the cabling. Controls cables shall not be run loose on ceiling grid or ceiling tiles. Support shall be provided by mounting appropriate fasteners which may be loaded with multiple cables. Provided that the weight load is carried by the support rod or wire, the support assembly may attach to the ceiling grid for lateral stabilization. The required support wires for the ceiling grid or light fixtures shall not be utilized. Any fastener attached to the ceiling grid shall not interfere

with inserting or removing ceiling tiles. All cabling and supports must be positioned at least 12 inches above the ceiling grid.

3. Controls cables shall be run in bundles above accessible ceilings and supported from building structure. Cabling shall be loosely bundled with wire wraps randomly spaced at 30 to 48 inches on center, wire wraps shall not be tight enough to deform cabling and shall not be used to support the cabling.
4. Attachments for cabling support shall be spaced at 48 to 60 inches on center. The cable bundle shall not be allowed to sag more than 12 inches mid-span between attachments. Attachments shall be sized as follows:

Bundles up to 1/2" dia. (Ten 1/4" cables)	2" bridle ring, Caddy #4BRT32 or equivalent
Bundles up to 3/4" dia. (Sixteen 1/4" cables)	3/4" J-Hook, Caddy #CAT12 or equivalent
Bundles up to 1-5/16" dia. (Fifty 1/4" cables)	1-5/16" J-Hook, Caddy #CAT21 or equivalent
Bundles up to 2" dia. (Eighty 1/4" cables)	2" J-Hook, Caddy #CAT21 or equivalent

   Split bundles greater than 2" dia. or provide cable tray.
5. Do not mix different signal strength cables on the same J-Hook (i.e. fire alarm, 25 volt speaker cable). Multiple J-Hooks can be on the same attachment point up to the rated weight of the attachment device.
6. Controls cables shall be run in conduit stubs, where stubs are provided, from wall mounted devices to above accessible ceilings. Conduit shall be required only within walls and concealed spaces to provide access. Provide a plastic snap bushing or sleeve on the end of each conduit stub such as Thomas & Betts Catalog no. 443 - 3/4", 424 - 1", 425 - 1 1/4", 427 - 2" or equivalent.
7. Conduit, duct, or track shall be used for controls cable in exposed areas.
8. All conduit, ducts, track and raceways shall be supported from the structure at industry standard intervals for the size specified, utilizing proper anchoring devices and techniques for each type of cable used.
9. All penetrations through fire rated walls or floors shall feature a short length of metal conduit. The hole shall be neatly cut, not oversize or irregular. Seal the interior of the conduit sleeve around the cables and around the outside of the sleeve on each side of the penetration with fire-stop caulk or putty, such as Minnesota Mining & Mfg. Co. (3M) - CP 25WB+ caulk, MPS-2+ putty, or equivalent. Install according to the manufacturers` instructions.
10. All cable shall have a label on both ends utilizing self-laminating, flexible vinyl film, and non-smear nylon marking pens. Utilize Tyton Corporation Part No. RO175 Rite-On labels and Part No. FTP1 nylon marking pens or equivalent.
11. Each cable run shall include a three foot service loop with wire tie located in the ceiling above the control unit panel. This is to allow for future re-termination or repair.
12. No terminations or splices shall be installed in or above ceilings. Cable shall be continuous from one device termination to the next.
13. Mount all equipment firmly in place. Route cable in a professional, neat, and orderly installation.
14. All cabling shall be placed with regard to the environment, EMI/RFI (interference) and its effect on communication signal transmission.
15. Do not route any controls cable within two feet of any light fixture, HVAC unit service access area, electric panel, or any device containing a motor or transformer.

16. Low voltage controls cable will not be installed in the same conduit, duct or track with line voltage electrical cable.
17. Maximum pulling tension should not exceed 25 lb/ft. or manufactures recommendation, whichever is less.
18. Any pulling compounds utilized must be approved by the cable manufacturer and shall not degrade the strength or electrical characteristics of the cable.
19. Cable bends shall not exceed the manufacturers` suggested bend radius.
20. Provide for adequate ventilation in all equipment panels.
21. Provide wiremold where wiring must run exposed. Obtain advance approval from Architect and Owner before running exposed. Coordinate with Owner and Architect.
22. For all wiring, provide numbering on all terminations (both ends).
23. Label all panels, cans, enclosures, controllers and correlate with air conditioning units served. Labeling shall relate to shop drawings and equipment served. Provide wiring diagram inside each enclosure.
24. Provide a rain-tight enclosure for each rooftop unit controller.
25. Locate outdoor air sensors shielded and on northern exposure.

F. Termination practices:
   1. Strip back only as much cable jacket as required to terminate.
   2. Preserve wire twists as closely as possible to point of termination (0.5" maximum) to keep signal impairment to a minimum.
   3. Avoid twisting cable during installation.
   4. Electrical Interlocks:
      a. All electrical interlocks shall be provided as specified. All electrical interlocks shall be made by means of motor starters or shall be accomplished by separate relays. No motor power lead shall be utilized in an interlock circuit.

3.4 SERVICES

A. Field Services:
   1. Prepare and start logic control system under provisions of this section.
   2. Start-up and commission systems. Allow sufficient time for start-up and commissioning prior to placing control systems in permanent operation.
   3. Provide the capability for off-site monitoring at control contractor`s local or main office. At a minimum, off-site facility shall be capable of system diagnostics and software download. Owner shall provide phone line for this service for 1 year or as specified.
   4. Provide Owner`s Representative with spare parts list. Identify equipment critical to maintaining the integrity of the operating system.

B. HVAC Training:
   1. Provide application engineer to instruct owner in operation of systems and equipment.
   2. Provide system operator’s training to include (but not limited to) such items as the following: modification of data displays, alarm and status descriptors, requesting data, execution of commands, and request of logs. Provide this training to a minimum of 3 persons.
   3. Provide on-site training above as required, up to 16 hours as part of this contract.

C. Demonstration:
   1. Provide systems demonstration under provisions of Section 23 00 00.

2. Demonstrate complete operating system to owner`s representative.
3. Provide certificate stating that control system has been tested and adjusted for proper operation.

D. Programming:
1. Prior to completion of the control installation, schedule time with Owner`s designated representatives to evaluate and select programming options and requirements. Contractor shall provide engineer for such meetings and consultations on an as-needed basis. Preparation time for the conference shall be in addition to the "in conference" time, and shall be provided on an as-needed basis without additional cost to the Owner.
2. The Contractor shall also provide additional coordination as needed with the Owner`s representative and Engineer to formulate and determine functions, reports, graphics, and alarms most desirable and suitable for the school district and writing the software capability. Programming of these items shall be provided. The Contractor shall program the system using coordinated Owner provided schedules for time of day and holidays.
3. No hardware change shall be required for program changes.

E. Documentation:
1. The Contractor shall provide a complete documentation package to the owner which shall include floor plans indicating location of EMCS equipment, wiring diagrams, bill of materials, data base information, and sequences of operation. The sequences of operation shall be submitted and approved by the owner in writing prior to installation and programming.

F. Coordination:
1. For construction project installations where electrical and mechanical contractors are responsible for their respective trade, the electrical contractor is to provide line voltage to required equipment and the mechanical contractor is to install any devices that are to be included in systems. It is the controls contractor’s responsibility to provide all devices with diagrams for location and coordinate with mechanical contractor prior to mechanical contractor starting installations. Controls contractor shall coordinate and provide all required work and wiring for duct mounted smoke detectors, control relays for unit shutdown, and interface with any fire alarm system. For installations where controls only work is provided, all necessary work shall be performed by the controls contractor.

PART 4 SEQUENCE OF OPERATION

4.1 SEQUENCE OF OPERATION

A. The following are sequences of operations which will be accomplished by the EMCS. Coordinate with Owner in operating equipment to maximize comfort and economy. All points required to accomplish the sequences will be provided and connected to the EMCS.

B. DDC Control - Rooftop Units, Split Systems, DX Units, and Heat Pumps: Each unit shall be started and stopped by the EMCS. Automatic override during low or high ambient temperatures shall be provided. Provide one outdoor air sensor per school. Provide an indoor air space sensor for every unit to monitor space temperature, and be capable of remote resetting space temperature by Owner.

C. Provide one outside air relative humidity sensor and temperature sensor per campus. It is also acceptable to obtain outside air ambient conditions from a nearby weather station.

D. Acronyms:

EMCS - Energy Management Control System. The EMCS controls all of the HVAC functions as well as lighting schedules and lawn sprinkler schedules.
TCS - Temperature Control Sensor. This is the device that controls the temperature in the space.
VFD - Variable Frequency Drive.
DDC - Direct Digital Control.
OAU - Outside Air Unit.
CO2 - Carbon Dioxide.
CFM - Cubic Feet per Minute
GPM - Gallons Per Minute
A/H - Air Handler
F/C - Fan Coil Unit
CHW - Chilled Water
HW - Hot Water
VAV - Variable Air Volume
UCP - Unit Control Panel
ppm - Parts Per Million - A measurement of the concentration of one substance within another. In this case, it is the number of CO2 particles in a sample of one million air particles.
Adj - Adjustable - All set points are assumed to be adjustable whether specified or not. The set points specified are values that should be programmed initially but can be changed if necessary.

E. Definitions:
1. Occupancy Period:
   a. The period of the day that the owner wants the environmental conditions acceptable for occupancy. Outside air ventilation may not be enabled at all times during the occupancy period. This schedule will be defined for each component of the HVAC system and will not be the same for all components.
2. Outside Air Schedule:
   a. The period of the day that outside air ventilation is enabled. This schedule will be defined for each component of the HVAC system.
3. Warm-up Mode:
   a. The time between the end of the unoccupied and start of the occupied period during which the space temperature is increased (night setback) to the normal occupancy temperature.
4. Cool-down Mode:
   a. The time between the end of the unoccupied and start of the occupied period during which the space temperature is lowered (night setup) to the normal occupied temperature.
5. Unoccupied Period:
   a. The period of the day that the temperature control setting is lowered (heating) or raised (cooling) to conserve on the amount of energy required to condition the building. The fans are also turned “OFF” to conserve energy.

F. Documentation:
   1. The Contractor shall provide a complete documentation package to the owner which shall include floor plans indicating location of EMCS equipment, wiring diagrams, bill of materials, database information, and sequences of operation. The sequences of operation shall be submitted and approved by the owner in writing prior to installation and programming.

END OF SECTION

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SECTION 23 09 23A

SEQUENCE OF OPERATIONS GENERAL

PART 1 GENERAL

1.1 NOT APPLICABLE

PART 2 PRODUCTS

2.1 NOT APPLICABLE

PART 3 EXECUTION

3.1 CONTROL

A. Domestic Water Heater:
1. General:
   a. The domestic hot water heater(s) and associated circulating pump(s) shall be disabled/enabled by the EMCS based on a time schedule. The domestic hot water supply for the hot water heater shall be monitored and shall generate an alarm upon exceeding above or dropping below its assigned alarm limits (adj.). The points required to accomplish this sequence shall be connected to the nearest available EMCS controller.
2. Control Points:

Description	Type
Loop Hot Water Supply Temperature (Each Water Heater)	AI
Water Heater Amps/Status (Each Water Heater)	AI
Circulation Pump Amps/Status (Each Pump)	AI
Water Heater Start/Stop Command (Each Water Heater)	DO
Circulation Pump Start/Stop Command (Each Pump)	DO

Description	Type
Local HVAC Override Pushbutton	DI

B. Ambient Conditions:
1. General:
   a. The EMCS shall monitor the ambient outside conditions at the building. Sensors shall be located outside the building for northern exposure.
2. Control Points:

Description	Type
Outside Temperature	AI
Outside Humidity	AI
Outside CO2	AI

C. Gang Toilet Exhaust Fans:
   1. General:
      a. Fans to be disabled/enabled by the EMCS based on a time schedule.
   2. Control Points:

Description	Type
Fan Amps/Status (Each Fan)	AI
Fan Start/Stop Command (Each Fan)	DO

END OF SECTION

SECTION 23 09 23C

SEQUENCE OF OPERATIONS BOILER SEQUENCES

PART 1 GENERAL

1.1 NOT APPLICABLE

PART 2 PRODUCTS

2.1 NOT APPLICABLE

PART 3 EXECUTION

3.1 CONDENSING PRIMARY/SECONDARY HEATING WATER SYSTEM (OEM BOILER SEQUENCER)

A. General:
1. There are two boilers with circulating primary pumps and two building hot water pumps.

B. Heating System Enabling/Disabling:
1. The occupied/unoccupied mode of operation shall be defined by the EMCS optimum start/stop schedule.
2. The EMCS shall enable the hot water system based on an ambient temperature below 60° F (adj.) and requests for heating. The number of requests shall be adjustable. This system enable will enable the boiler sequencer that is provided by boiler manufacturer. Building pumps will operate on a lead-lag and equal run time basis.

C. Hot Water Pumping:
1. Building Pumping System:
a. One variable building pump will be started when system is enabled. If lead pump fails to start and flow not proven, system shall be able to auto rotate and start lag pump.
b. The pump VFD will be controlled by differential pressure transducer (s) across the supply and return piping at locations as shown on the drawings or as directed by the engineer. If the pressure is below setpoint, the pump speed will be increased. If the differential pressure is above setpoint, the pump speed will be decreased.
c. The lag pump will activate whenever the speed of the first pump is at or above 90% (adj.) for 15 minutes (adj.). The lag pump shall turn on and operate in unison with the lead pump to maintain building load. Once both pumps are operating at 40% (adj.), for 15 minutes (adj.) the lag pump shall turn off and the lead pump shall remain on to maintain building load.
d. The differential pressure setpoint for the pumping system shall be reset based on maximum hot water valve position. If the maximum valve position is above 90% (adj.), then the differential set point will be set to maximum pressure as determined by TAB contractor. If the maximum valve position is below 50% (adj.), then the differential pressure setpoint will be set to

minimum pressure as determined by TAB contractor. If the maximum valve position is between 90%-50% (adj.), then the differential pressure setpoint will modulate linearly between the minimum and maximum pressure setpoints.

D. Boiler Control:
   1. Sequencing:
      a. The EMCS will enable the manufacturer provided boiler sequencer. The sequencer will modulate boilers.
   2. Primary Circulating Pumps:
      a. Primary circulating pumps shall be hardwired interlocked with boiler.
      b. Primary circulating pumps shall run continuously anytime there is a call for its associated boiler.

E. Hot Water Temperature Control:
   1. The hot water setpoint will be sent by EMCS to sequencer and sequencer will modulate boilers to meet setpoint.
   2. There shall be a linear hot water supply temperature reset algorithm in between:
      a. 100°F (adj.) hot water supply when outside air temperature is at or above 60°F (adj.)
      b. 130°F (adj.) hot water supply when outside air temperature is at or below 45°F (adj.)

F. Safeties:
   1. Freeze Protection:
      a. When the outside air (OA) temperature drops below 36°F (adj.), a building pump will be started. All building hot water valves will be open to 20%.
      b. When the OA temperature rises 2°F above freeze protection setpoint for one hour, the reverse shall occur.
   2. CO Monitoring:
      a. A carbon monoxide sensor shall be installed in boiler room
      b. Carbon monoxide sensor shall be hardwired interlocked with boiler(s) and shutdown boiler(s) when carbon monoxide rises above 50 ppm.
      c. Carbon monoxide alarm shall disable any supply fans in boiler room and enable all exhaust fans in boiler room.

G. Control Points:

Description	Type
Outside Air Temperature	AI
Building Common Hot Water Supply Temperature	AI
Building Common Hot Water Return Temperature	AI
Boiler Supply Water Temperature (Each Boiler)	AI
Boiler Return Water Temperature (Each Boiler)	AI
Building Flow	AI
Makeup Water Flow	AI
Building Hot Water Differential Pressure (Each Sensor)	AI
Boiler Amps/Status (Each Boiler)	AI
Boiler Alarm (Each Boiler)	AI
Circulation Pump Amps/Status (Each Pump)	AI

Description	Type
Building Pump Amps/Status (Each Pump)	AI
CO Monitoring Alarm	DI
Boiler Sequencer System Enable	DO
Boiler Sequencer Hot Water Setpoint	AO
Building Pump Start/Stop Command (Each Pump)	DO
Building Pump VFD Speed (Each Pump)	AO

3.2 NON-CONDENSING PRIMARY/SECONDARY HEATING WATER SYSTEM (OEM BOILER SEQUENCER)

A. General:
1. There are two boilers with circulating primary pumps and two building hot water pumps.

B. Heating System Enabling/Disabling:
1. The occupied/unoccupied mode of operation shall be defined by the EMCS optimum start/stop schedule.
2. The EMCS shall enable the hot water system based on an ambient temperature below 60° F (adj.) and requests for heating. The number of requests shall be adjustable. This system enable will enable the boiler sequencer that is provided by boiler manufacturer. Building pumps will operate on a lead-lag and equal run time basis.

C. Hot Water Pumping:
1. Building Pumping System:
a. One variable building pump will be started when system is enabled. If lead pump fails to start and flow not proven, system shall be able to auto rotate and start lag pump.
b. The pump VFD will be controlled by differential pressure transducer (s) across the supply and return piping at locations as shown on the drawings or as directed by the engineer. If the pressure is below setpoint, the pump speed will be increased. If the differential pressure is above setpoint, the pump speed will be decreased.
c. The lag pump will activate whenever the speed of the first pump is at or above 90% (adj.) for 15 minutes (adj.). The lag pump shall turn on and operate in unison with the lead pump to maintain building load. Once both pumps are operating at 40% (adj.), for 15 minutes (adj.) the lag pump shall turn off and the lead pump shall remain on to maintain building load.
d. The differential pressure setpoint for the pumping system shall be reset based on maximum hot water valve position. If the maximum valve position is above 90% (adj.), then the differential setpoint will be set to maximum pressure as determined by TAB contractor. If the maximum valve position is below 50% (adj.), then the differential pressure setpoint will be set to minimum pressure as determined by TAB contractor. If the maximum valve position is between 90%-50% (adj.), then the differential pressure setpoint will modulate linearly between the minimum and maximum pressure setpoints.

D. Boiler Control:

1. Sequencing:
   a. The EMCS will enable the manufacturer provided boiler sequencer. The sequencer will modulate boilers.
2. Primary Circulating Pumps:
   a. Primary circulating pumps shall be hardwired interlocked with boiler.
   b. Primary circulating pumps shall run continuously anytime there is a call for its associated boiler.
3. Mixing Valve
   a. Each boiler is to have a 3-way mixing valve provided by boiler manufacturer.
   b. Mixing valve is to limit low water temperatures from entering boiler.

E. Hot Water Temperature Control:
1. The hot water setpoint will be sent by EMCS to sequencer and sequencer will modulate boilers to meet setpoint.
2. There shall be a linear hot water supply temperature reset algorithm in between:
   a. 140°F (adj.) hot water supply when outside air temperature is at or above 60°F (adj.)
   b. 160°F (adj.) hot water supply when outside air temperature is at or below 45°F (adj.)

F. Safeties:
1. Freeze Protection:
   a. When the outside air (OA) temperature drops below 36°F (adj.), a building pump will be started. All building hot water valves will be open to 20%.
   b. When the OA temperature rises 2°F above freeze protection setpoint for one hour, the reverse shall occur.

G. Control Points:

Description	Type
Outside Air Temperature	AI
Building Common Hot Water Supply Temperature	AI
Building Common Hot Water Return Temperature	AI
Boiler Supply Water Temperature (Each Boiler)	AI
Boiler Return Water Temperature (Each Boiler)	AI
Building Flow	AI
Makeup Water Flow	AI
Building Hot Water Differential Pressure (Each Sensor)	AI
Boiler Amps/Status (Each Boiler)	AI
Boiler Alarm (Each Boiler)	AI
Boiler Circulation Pump Amps/Status (Each Pump)	AI
Building Pump Amps/Status (Each Pump)	AI
CO Monitoring Alarm	DI
Boiler Sequencer System Enable	DO
Boiler Sequencer Hot Water Setpoint	AO
Building Pump Start/Stop Command (Each Pump)	DO
Building Pump VFD Speed (Each Pump)	AO

3.3 HEATING WATER SYSTEM

A. General:
   1. There are two boilers and two building hot water pumps.

B. Heating System Enabling/Disabling:
   1. The occupied/unoccupied mode of operation shall be defined by the EMCS optimum start/stop schedule.
   2. The EMCS shall enable the hot water system based on an ambient temperature below 60° F (adj.) and requests for heating. The number of requests shall be adjustable. This system enable will enable each boiler and building pump. Equipment will operate on a lead-lag and equal run time basis.

C. Hot Water Pumping:
   1. Building Pumping System:
      a. One variable building pump will be started when system is enabled. If lead pump fails to start and flow not proven, system shall be able to auto rotate and start lag pump.
      b. The pump VFD will be controlled by differential pressure transducer (s) across the supply and return piping at locations as shown on the drawings or as directed by the engineer. If the pressure is below setpoint, the pump speed will be increased. If the differential pressure is above setpoint, the pump speed will be decreased.
      c. The lag pump will activate whenever the speed of the first pump is at or above 90% (adj.) for 15 minutes (adj.). The lag pump shall turn on and operate in unison with the lead pump to maintain building load. Once both pumps are operating at 40% (adj.), for 15 minutes (adj.) the lag pump shall turn off and the lead pump shall remain on to maintain building load.
      d. The differential pressure setpoint for the pumping system shall be reset based on maximum hot water valve position. If the maximum valve position is above 90% (adj.), then the differential set point will be set to maximum pressure as determined by TAB contractor. If the maximum valve position is below 50% (adj.), then the differential pressure setpoint will be set to minimum pressure as determined by TAB contractor. If the maximum valve position is between 90%-50% (adj.), then the differential pressure setpoint will modulate linearly between the minimum and maximum pressure setpoints.

D. Boiler Control:
   1. Sequencing:
      a. The EMCS will enable each boiler as needed to maintain building supply temperature.
      b. One boiler will be started when system is enabled. If lead boiler fails to start, system shall be able to auto rotate and start lag pump.

E. Mixing Valve:
   1. Boiler plant will have a 3-way mixing valve. Mixing valve is to limit low water temperatures from entering boilers. Low limit temperature to be 140°F (adj.)

F. Hot Water Temperature Control:
   1. The hot water setpoint will be sent by EMCS to boilers to meet setpoint.
   2. There shall be a linear hot water supply temperature reset algorithm in between:

a. 140°F (adj.) hot water supply when outside air temperature is at or above 60°F (adj.)
b. 160°F (adj.) hot water supply when outside air temperature is at or below 45°F (adj.)

G. Safeties:
1. Freeze Protection:
a. When the outside air (OA) temperature drops below 36°F (adj.), a building pump will be started. All building hot water valves will be open to 20%.
b. When the OA temperature rises 2°F above freeze protection setpoint for one hour, the reverse shall occur.
2. CO Monitoring:
a. A carbon monoxide sensor shall be installed in boiler room.
b. Carbon monoxide sensor shall be hardwired interlocked with boiler(s) and shutdown boiler(s) when carbon monoxide rises above 50 ppm.
c. Carbon monoxide alarm shall disable any supply fans in boiler room and enable all exhaust fans in boiler room.

H. Control Points:

Description	Type
Outside Air Temperature	AI
Building Common Hot Water Supply Temperature	AI
Building Common Hot Water Return Temperature	AI
Boiler Supply Water Temperature (Each Boiler)	AI
Boiler Return Water Temperature (Each Boiler)	AI
Building Flow	AI
Makeup Water Flow	AI
Building Hot Water Differential Pressure (Each Sensor)	AI
Boiler Amps/Status (Each Boiler)	AI
Boiler Alarm (Each Boiler)	AI
Building Pump Amps/Status (Each Pump)	AI
CO Monitoring Alarm	DI
Boiler Enable (Each Boiler)	DO
Boiler Hot Water Setpoint (Each Boiler)	AO
Building Pump Start/Stop Command (Each Pump)	DO
Building Pump VFD Speed (Each Pump)	AO
Mixing Valve	AO

3.4 CONDENSING PRIMARY/SECONDARY HEATING WATER SYSTEM

A. General:
1. There are two boilers with circulating primary pumps and two building hot water pumps.

B. Heating System Enabling/Disabling:
1. The occupied/unoccupied mode of operation shall be defined by the EMCS optimum start/stop schedule.

2. The EMCS shall enable the hot water system based on an ambient temperature below 60° F (adj.) and requests for heating. The number of requests shall be adjustable. This system enable will enable each boiler and building pump. Equipment will operate on a lead-lag and equal run time basis.

C. Hot Water Pumping:
   1. Building Pumping System:
      a. One variable building pump will be started when system is enabled. If lead pump fails to start and flow not proven, system shall be able to auto rotate and start lag pump.
      b. The pump VFD will be controlled by differential pressure transducer (s) across the supply and return piping at locations as shown on the drawings or as directed by the engineer. If the pressure is below setpoint, the pump speed will be increased. If the differential pressure is above setpoint, the pump speed will be decreased.
      c. The lag pump will activate whenever the speed of the first pump is at or above 90% (adj.) for 15 minutes (adj.). The lag pump shall turn on and operate in unison with the lead pump to maintain building load. Once both pumps are operating at 40% (adj.), for 15 minutes (adj.) the lag pump shall turn off and the lead pump shall remain on to maintain building load.
      d. The differential pressure setpoint for the pumping system shall be reset based on maximum hot water valve position. If the maximum valve position is above 90% (adj.), then the differential setpoint will be set to maximum pressure as determined by TAB contractor. If the maximum valve position is below 50% (adj.), then the differential pressure setpoint will be set to minimum pressure as determined by TAB contractor. If the maximum valve position is between 90%-50% (adj.), then the differential pressure setpoint will modulate linearly between the minimum and maximum pressure setpoints.

D. Boiler Control:
   1. Sequencing:
      a. The EMCS will enable each boiler as needed to maintain building supply temperature. If lead boiler fails to start, system shall be able to auto rotate and start lag boiler.
   2. Primary Circulating Pumps:
      a. Primary circulating pumps shall be hardwired interlocked with boiler.
      b. Primary circulating pumps shall run continuously anytime there is a call for its associated boiler.

E. Hot Water Temperature Control:
   1. The hot water setpoint will be sent by EMCS and will modulate boilers to meet setpoint.
   2. There shall be a linear hot water supply temperature reset algorithm in between:
      a. 100°F (adj.) hot water supply when outside air temperature is at or above 60°F (adj.)
      b. 130°F (adj.) hot water supply when outside air temperature is at or below 45°F (adj.)

F. Safeties:
   1. Freeze Protection:

a. When the outside air (OA) temperature drops below 36°F (adj.), a building pump will be started. All building hot water valves will be open to 20%.
b. When the OA temperature rises 2°F above freeze protection setpoint for one hour, the reverse shall occur.

2. CO Monitoring:
a. A carbon monoxide sensor shall be installed in boiler room.
b. Carbon monoxide sensor shall be hardwired interlocked with boiler(s) and shutdown boiler(s) when carbon monoxide rises above 50 ppm.
c. Carbon monoxide alarm shall disable any supply fans in boiler room and enable all exhaust fans in boiler room.

G. Control Points:

Description	Type
Outside Air Temperature	AI
Building Common Hot Water Supply Temperature	AI
Building Common Hot Water Return Temperature	AI
Boiler Supply Water Temperature (Each Boiler)	AI
Boiler Return Water Temperature (Each Boiler)	AI
Building Flow	AI
Makeup Water Flow	AI
Building Hot Water Differential Pressure (Each Sensor)	AI
Boiler Amps/Status (Each Boiler)	AI
Boiler Alarm (Each Boiler)	AI
Boiler Circulation Pump Amps/Status (Each Pump)	AI
Building Pump Amps/Status (Each Pump)	AI
CO Monitoring Alarm	DI
Boiler Enable (Each Boiler)	DO
Boiler Hot Water Setpoint (Each Boiler)	AO
Building Pump Start/Stop Command (Each Pump)	DO
Building Pump VFD Speed (Each Pump)	AO

3.5 CONDENSING VARIABLE PRIMARY HEATING WATER SYSTEM

A. General:
1. There are two boilers with motorized isolation valves. The pumping system will be variable primary type with two pumps. There will also be a bypass line with an automated control valve to prevent the pumps from dead heading and to relieve system pressure based on differential pressure.

B. Heating System Enabling/Disabling:
1. The occupied/unoccupied mode of operation shall be defined by the EMCS optimum start/stop schedule.
2. The EMCS shall enable the hot water system based on an ambient temperature below 60° F (adj.) and requests for heating. The number of requests shall be adjustable. This system enable will enable each boiler and building pump. Equipment will operate on a lead-lag and equal run time basis.

3. The lead boilers slow stroking, motorized isolation valve (120 seconds) shall open.
4. After a time delay allowing the lead motorized isolation valve to fully open, the lead hot water pump shall start. If lead pump fails to start and flow not proven, system shall be able to auto rotate and start lag pump.
5. Once a hot water pump has started and water flow has been proven, the lead boiler shall be enabled. If lead boiler fails to start, system shall be able to auto rotate and start lag boiler. The motorized isolation valve shall be opened/closed with the enabling/disabling of its corresponding boiler.
6. Upon each start of the hot water system, it will activate a lag boiler enable delay of 1 hour (adj.) in order for the system loop and the lead boiler to stabilize.

C. Hot Water Pumping:
   1. Variable Primary Hot Water Pumping System:
      a. One variable building pump will be started when system is enabled. If lead pump fails to start and flow not proven, system shall be able to auto rotate and start lag pump.
      b. The pump VFD will be controlled by differential pressure transducer (s) across the supply and return piping at locations as shown on the drawings or as directed by the engineer. If the pressure is below setpoint, the pump speed will be increased. If the differential pressure is above setpoint, the pump speed will be decreased.
      c. The lag pump will activate whenever the speed of the first pump is at or above 90% (adj.) for 15 minutes (adj.). The lag pump shall turn on and operate in unison with the lead pump to maintain building load. Once both pumps are operating at 40% (adj.), for 15 minutes (adj.) the lag pump shall turn off and the lead pump shall remain on to maintain building load.
      d. The differential pressure setpoint for the pumping system shall be reset based on maximum hot water valve position. If the maximum valve position is above 90% (adj.), then the differential setpoint will be set to maximum pressure as determined by TAB contractor. If the maximum valve position is below 50% (adj.), then the differential pressure setpoint will be set to minimum pressure as determined by TAB contractor. If the maximum valve position is between 90%-50% (adj.), then the differential pressure setpoint will modulate linearly between the minimum and maximum pressure setpoints.

D. Boiler Control:
   1. Sequencing:
      a. The EMCS will enable each boiler as needed to maintain building supply temperature. If lead boiler fails to start, system shall be able to auto rotate and start lag boiler.
      b. The EMCS will enable each boiler as needed to maintain building supply temperature. If lead boiler fails to start, system shall be able to auto rotate and start lag boiler.
      c. When the hot water supply temperature is below the setpoint by 2°F (adj.) and has at least a 30°F differential from return water temperature for a 15 minute period (adj.). the EMCS will enable the second/lag boiler.
      d. When the hot water supply temperature is at or above the setpoint and there is at least a 20°F differential from return water temperature for a 15 minute period (adj.). the EMCS will disable the second/lag boiler.

E. Hot Water Temperature Control:
   1. The hot water setpoint will be sent by EMCS to boiler control panel.
   2. There shall be a linear hot water supply temperature reset algorithm in between:
      a. 100°F (adj.) hot water building supply when outside air temperature is at or above 60°F (adj.)
      b. 130°F (adj.) hot water building supply when outside air temperature is at or below 45°F (adj.)

F. Hot Water Bypass:
   1. High Differential Pressure:
      a. The hot water bypass valve shall be initially closed and open as necessary to relieve pressure in the building loop.
      b. Pump VFDs shall be ramped down to minimum before bypass valve is sequenced to open.
      c. Bypass valve shall monitor hot water differential pressure to ensure pressure in system is less than the high limit alarm differential setpoint (adj.).
      d. Initial default high limit alarm differential setpoint is 30 psi (adj.).

G. Safeties:
   1. Freeze Protection:
      a. When the outside air (OA) temperature drops below 36°F (adj.), a building pump will be started and all associated isolation valves opened. All building hot water valves will be open to 20%.
      b. When the OA temperature rises 2°F above freeze protection setpoint for one hour, the reverse shall occur.
   2. CO Monitoring:
      a. A carbon monoxide sensor shall be installed in boiler room.
      b. Carbon monoxide sensor shall be hardwired interlocked with boiler(s) and shutdown boiler(s) when carbon monoxide rises above 50 ppm.
      c. Carbon monoxide alarm shall disable any supply fans in boiler room and enable all exhaust fans in boiler room.

H. Control Points:

Description	**Type**
Description	Type
Outside Air Temperature	AI
Building Common Hot Water Supply Temperature	AI
Building Common Hot Water Return Temperature	AI
Boiler Supply Water Temperature (Each Boiler)	AI
Boiler Return Water Temperature (Each Boiler)	AI
Building Flow	AI
Makeup Water Flow	AI
Building Hot Water Differential Pressure (Each Sensor)	AI
Boiler Amps/Status (Each Boiler)	AI
Boiler Alarm (Each Boiler)	AI
Building Pump Amps/Status (Each Pump)	AI
Motorized Valve Feedback Position (Each Valve)	AI
CO Monitoring Alarm	DI

Description	Type
Boiler Enable (Each Boiler)	DO
Boiler Hot Water Setpoint (Each Boiler)	AO
Building Pump Start/Stop Command (Each Pump)	DO
Building Pump VFD Speed (Each Pump)	AO
Boiler Isolation Valve (Each Boiler)	AO
Hot Water Bypass Valve	AO

3.6 NON-CONDENSING PRIMARY/SECONDARY HEATING WATER SYSTEM

A. General:
   1. There are two boilers with circulating primary pumps and two building hot water pumps.

B. Heating System Enabling/Disabling:
   1. The occupied/unoccupied mode of operation shall be defined by the EMCS optimum start/stop schedule.
   2. The EMCS shall enable the hot water system based on an ambient temperature below 60° F (adj.) and requests for heating. The number of requests shall be adjustable. This system enable will enable each boiler and building pump. Equipment will operate on a lead-lag and equal run time basis.

C. Hot Water Pumping:
   1. Building Pumping System:
      a. One variable building pump will be started when system is enabled. If lead pump fails to start and flow not proven, system shall be able to auto rotate and start lag pump.
      b. The pump VFD will be controlled by differential pressure transducer (s) across the supply and return piping at locations as shown on the drawings or as directed by the engineer. If the pressure is below setpoint, the pump speed will be increased. If the differential pressure is above setpoint, the pump speed will be decreased.
      c. The lag pump will activate whenever the speed of the first pump is at or above 90% (adj.) for 15 minutes (adj.). The lag pump shall turn on and operate in unison with the lead pump to maintain building load. Once both pumps are operating at 40% (adj.), for 15 minutes (adj.) the lag pump shall turn off and the lead pump shall remain on to maintain building load.
      d. The differential pressure setpoint for the pumping system shall be reset based on maximum hot water valve position. If the maximum valve position is above 90% (adj.), then the differential setpoint will be set to maximum pressure as determined by TAB contractor. If the maximum valve position is below 50% (adj.), then the differential pressure setpoint will be set to minimum pressure as determined by TAB contractor. If the maximum valve position is between 90%-50% (adj.), then the differential pressure setpoint will modulate linearly between the minimum and maximum pressure setpoints.

D. Boiler Control:
   1. Sequencing:

a. The EMCS will enable each boiler as needed to maintain building supply temperature. If lead boiler fails to start, system shall be able to auto rotate and start lag boiler.

2. Primary Circulating Pumps:
   a. Primary circulating pumps shall be hardwired interlocked with boiler.
   b. Primary circulating pumps shall run continuously anytime there is a call for its associated boiler.
3. Mixing Valve
   a. Each boiler is to have a 3-way mixing valve provided by boiler manufacturer.

E. Hot Water Temperature Control:
1. The hot water setpoint will be sent by EMCS and will modulate boilers to meet setpoint.
2. There shall be a linear hot water supply temperature reset algorithm in between:
   a. 140°F (adj.) hot water supply when outside air temperature is at or above 60°F (adj.)
   b. 160°F (adj.) hot water supply when outside air temperature is at or below 45°F (adj.)

F. Safeties:
1. Freeze Protection:
   a. When the outside air (OA) temperature drops below 36°F (adj.), a building pump will be started. All building hot water valves will be open to 20%.
   b. When the OA temperature rises 2°F above freeze protection setpoint for one hour, the reverse shall occur.
2. CO Monitoring:
   a. A carbon monoxide sensor shall be installed in boiler room.
   b. Carbon monoxide sensor shall be hardwired interlocked with boiler(s) and shutdown boiler(s) when carbon monoxide rises above 50 ppm.
   c. Carbon monoxide alarm shall disable any supply fans in boiler room and enable all exhaust fans in boiler room.

G. Control Points:

Description	Type
Outside Air Temperature	AI
Building Common Hot Water Supply Temperature	AI
Building Common Hot Water Return Temperature	AI
Boiler Supply Water Temperature (Each Boiler)	AI
Boiler Return Water Temperature (Each Boiler)	AI
Building Flow	AI
Makeup Water Flow	AI
Building Hot Water Differential Pressure (Each Sensor)	AI
Boiler Amps/Status (Each Boiler)	AI
Boiler Alarm (Each Boiler)	AI
Boiler Circulation Pump Amps/Status (Each Pump)	AI
Building Pump Amps/Status (Each Pump)	AI
CO Monitoring Alarm	DI
Boiler Enable (Each Boiler)	DO
Boiler Hot Water Setpoint (Each Boiler)	AO

Description	Type
Building Pump Start/Stop Command (Each Pump)	DO
Building Pump VFD Speed (Each Pump)	AO

END OF SECTION

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SECTION 23 09 23H

SEQUENCE OF OPERATIONS SPLIT SYSTEM SEQUENCES

PART 1 GENERAL

1.1 NOT APPLICABLE

PART 2 PRODUCTS

2.1 NOT APPLICABLE

PART 3 EXECUTION

3.1 HEAT PUMP SPLIT SYSTEM - DX AND HEAT AND IONIZER

A. General:
1. The heat pump unit shall be provided with a filter, supply fan, cooling/heating coil, auxiliary heat, and outside air damper. The control system contractor shall provide a dedicated stand-alone DDC controller for each unit.

B. Unit Enabling/Disabling:
1. The occupied/unoccupied mode of operation shall be defined by the EMCS optimum start/stop schedule.
2. During unoccupied times, as required to maintain the unoccupied heating and cooling setpoints 55°F (adj.) heating and 85°F (adj.) cooling as sensed by the space temperature sensor.
3. When the override pushbutton is depressed, the unit shall be indexed to the occupied mode for an adjustable period of time (initially 1 hour). After the override time period has expired, the unit shall revert back to the unoccupied mode.

C. Fan Control:
1. Fan speed shall be controlled by the unit’s internal controls.

D. Outside Air Damper Control:
1. Warm-up or Cool-down:
   a. The outside air damper shall be closed.
2. Occupied Mode:
   a. The outside air damper shall be at the minimum position (adj.) as set by TAB.
3. Unoccupied Mode:
   a. The outside air damper shall be closed.

E. Temperature Control:
1. Warm-up or Cool-down:
   a. The EMCS shall determine the required warm-up or cool-down period based on the optimized start algorithm.
   b. Upon enabling the unit, the unit shall heat and cool as required to maintain the occupied heating and cooling setpoints (initially 70°F heating, 74°F cooling) as sensed by a space temperature sensor.

c. Once the occupied setpoint temperature has been reached, the EMCS shall switch the unit to the occupied mode.

2. Occupied Mode:
   a. Space setpoint shall be user adjustable within ±2°F (adj.).
   b. In the occupied mode of operation, the unit supply fan shall cycle with a call for heating or cooling.
   c. The unit shall heat and cool as required to maintain the occupied heating and cooling setpoints (initially 70°F heating, 74°F cooling) as sensed by a space temperature sensor.
   d. When space temperature rises above occupied cooling setpoint, the DDC controller shall energize the first stage of mechanical cooling. First stage cooling shall have a 20-minute (adj.) runtime before allowing second stage to engage. When space temperature continues to rise 2°F (adj.) above occupied cooling setpoint, the DDC controller shall energize the second stage of mechanical cooling.
      1) First stage cooling - Low speed supply CFM and first stage of compressor(s).
         (a) Second stage cooling - High speed supply CFM and second stage of compressor(s).
         (b) Unit shall run in second stage cooling until space temperature drops to occupied space cooling setpoint. Unit shall then run in first stage of cooling until space temperature drops 1°F (adj.) below space temperature setpoint and then cycle off.
   e. When space temperature drops below occupied heating setpoint, the DDC controller shall energize the first stage of heat. When space temperature continues to drop 2°F (adj.) below occupied heat setpoint, the DDC controller shall energize the second stage of heat.
      1) First stage heating - Low speed supply CFM and first stage of heat.
      2) Second stage heating - High speed supply CFM and second stage of heating
         (a) Unit shall run in second stage heating until space temperature rises to occupied space heating setpoint. Unit shall then run in first stage heating until space temperature rises 1°F (adj.) above space temperature setpoint and then cycle off.
3. Unoccupied Mode:
   a. The EMCS shall enable the unit as required to maintain the unoccupied heating and cooling setpoints (initially 55°F heating and 85°F cooling) as sensed by the space temperature sensor.
   b. When override button is pushed, the unit shall index to occupied mode for one (1) hour (adj.). After the override time has expired, the unit shall revert to unoccupied mode.

F. Dry Bulb Economizer Mode:
1. In occupied or unoccupied mode, when space temperature is above space setpoint, outside air temperature is 60°F (adj.) or below and there is a call for cooling, the unit shall be in economizer mode. Outside air damper is to open 100% and to provide free cooling to the space until the space temperature setpoint is satisfied. If space is not satisfied within 10 min (adj.), mechanical cooling will be enabled.
2. All sensors necessary for economizer mode operation and FDD shall be provided and fully controlled by EMCS contractor.

G. Fault Detection and Diagnostics (FDD):
   1. Each DX unit shall have its economizer status monitored by the EMCS. The unit's fault detection and diagnostics shall be capable of generating a visible alarm to be seen by the EMCS should the unit be in economizer when conditions are not met, or vice versa.

H. Control Points:

Description	Type
Fan Amps/Status	AI
Compressor Amps/Status (Each Compressor)	AI
Mixed Air Temperature	AI
Supply Air Temperature	AI
Outside Air Temperature (Global)	AI
Space Temperature	AI
Bipolar Ionization Status	AI
Outside Air Damper Feedback	AI
Compressor Command (Each Stage)	DO
Reversing Valve	DO
Auxiliary Heat (Each Stage)	DO
Fan Start/Stop Command	DO
Outside Air Damper	AO

END OF SECTION

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SECTION 23 21 13

HYDRONIC PIPING, VALVES, AND APPURTENANCES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions, Division 01 Specifications, and Section 23 00 00, apply to this Section.

1.2 SECTION INCLUDES

A. Hot and Chilled water piping

B. Condenser water piping

C. Chilled, hot, and condenser water valves

D. Piping accessories and equipment

1.3 RELATED SECTIONS

A. Section 22 05 24 - Valves

B. Section 22 05 30 - Pipe and Pipe Fittings

C. Section 23 00 00 - Basic Mechanical Requirements

D. Section 23 05 19 - Meters and Gauges for HVAC Piping

E. Section 23 05 93 - Testing, Adjusting and Balancing for HVAC

F. Section 23 07 19 - Hydronic Piping Insulation

G. Section 23 09 23 - Energy Management Control System

H. Section 23 21 23 - Hydronic Pumps

I. Section 23 33 33 - Access Doors

J. Section 23 52 33 - Water Tube Boilers

K. Section 23 64 16 - Centrifugal Water Chillers

L. Section 23 64 23 - Air-Cooled Scroll Compressor Chillers

M. Section 23 64 26 - Air-Cooled Screw Compressor Chillers

1.4 REFERENCES

A. ASTM - American Society of Testing and Materials

B. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Casting

C. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings

D. ASTM A536 - Standard Specification for Ductile Iron Castings

E. ASTM B148-97 e1 - Standard Specification for Aluminum-Bronze Sand Castings

F. ASTM B584 - Standard Specifications for Copper Alloy Sand Castings for General Applications

G. ASTM A844-09/A844M-09 - Standard Specification for Steel Plates, 9% Nickel Alloy, for Pressure Vessels, Produced by the Direct Quenching Process

1.5 SUBMITTALS

A. Provide submittal data on all items specified in this section in accordance with Specification Section 23 00 00, General Conditions, and Division 1.

B. Submit product data on all piping materials, valves, piping accessories, and equipment.

1.6 QUALITY ASSURANCE

A. All welders are to have certification. Furnish welder’s certification prior to performing work.

PART 2 PRODUCTS

2.1 PIPING MATERIAL

A. Chilled and Hot Water Piping:
1. ½" through 2" - Type L hard drawn copper
2. 2½" and larger - Standard black steel pipe

B. Condenser Water Piping:
1. All condenser water piping to be schedule 40 black steel.

C. All piping to meet ASTM 536-84.

2.2 FITTINGS

A. Chilled and Hot Water Piping:
1. ½" through 2" - Wrought copper sweat fittings.
2. 2½" and larger - Welded long-turn fittings and flanged connections.

B. 150 lb. ASA forged.

C. Dissimilar Metals require di-electric unions

2.3 TRIPLE DUTY VALVES

A. Type:
1. Combination non-slam valve, throttling valve, shut-off valve and calibrated balancing valve, back seating valve stem, NPT & flanged connections.

B. Materials:

1. Body:
   a. NPT & flanged models - cast iron
   b. Grooved models - ductile iron
2. Seat - Brass
3. Disc - Bronze with EPDM seat insert
4. Stem - Flanged & grooved models - stainless steel
5. Spring - Stainless steel
6. Packing - Teflon-Graphite

C. Operating Pressure:
   1. Maximum working pressure:
      a. Cast iron models - 175 PSIG
      b. Ductile iron models - 300 PSIG
   2. Maximum operating temperature:
      a. 250°F

D. Maximum Pressure Drop:
   1. 2 PSIG across valve

E. Manufacturers:
   1. Bell & Gossett
   2. Armstrong
   3. Meuller

F. Application:
   1. Discharge side on all pumps

G. Tri-Service Valve Assembly: Combination shut-off, throttling, and non-slam check valve. Butterfly valve with memory stop feature with Venturi Check. Check valve with venturi like taps for flow measurement. Working pressures to 300 psi.

2.4 SUCTION DIFFUSERS

A. Type:
   1. Straight or angle fitting, with pipe support foot, strainer orifice cylinder with start-up strainer (#16 MESH Bronze) and permanent strainer, permanent magnet, horizontal service only.

B. Materials:
   1. Body - NPT & Flanged Models - cast iron. Meets ASTM A126 or ASTM A536.
   2. Cover - Grooved models - ductile iron
   3. Straightening - X Models - Steel
   4. Vanes - Z & Grooved Models - Stainless steel
   5. Orifice - X Models - Steel
   6. Cylinder - Z & Grooved Models - Stainless steel
   7. Start-Up Strainer - X, Z & Grooved Models - 16 Mesh Bronze
   8. O Ring Seal - All Models - EPDM

C. Operating Pressures:
   1. Maximum Working Pressure:
      a. Cast iron models - 175 PSIG
      b. Ductile iron models - Grooved system with flanged pump connection - 175 PSIG

D. Manufacturers:
   1. Armstrong
   2. Bell & Gossett

E. Application:
   1. Suction side on all pumps. Install such that strainer is serviceable from horizontal position.

2.5 CHECK VALVES

A. 2-inch diameter pipe and smaller:
   1. Type:
      a. 300-pound CWP/150-pound SWP horizontal swing
   2. Material:
      a. Body - Bronze Y-Pattern
      b. Seat - Bronze or TFE
      c. Cap - Screwed
      d. Connection - Screwed
   3. Manufacturer/Model:
      a. Nibco T-433-B
      b. Crane 141-TF
      c. Jenkins 4092-J
      d. Milwaukee 508

B. Larger than 2 inch diameter:
   1. Type:
      a. No slam globe style check.
      b. 200-pound CWP
   2. Material:
      a. Body - Cast iron
      b. Hanger, disc, and seat ring - Cast bronze
      c. Seat and disc - Renewable
      d. Connection - Flanged
   3. Manufacturer/Model:
      a. Nibco F-910-B
      b. APCO Series 600
      c. Combination Pump & Valve # 20-D
      d. Milwaukee 1800

2.6 GATE VALVES

A. Larger than 2 inch diameter:
   1. Type:
      a. 200-pound CWP OS & Y design
   2. Material:
      a. Body and bonnet - Cast iron
      b. Wedge bushing, seat ring, and wedge face ring - Cast bronze
      c. Bonnet - Bolted
      d. Wedge - Solid
      e. Connections - Flanged
   3. Manufacturer/Model:

a. Nibco F-617-0
b. Crane 465 1/2
c. Jenkins 454-J
d. Milwaukee 2885-A

4. Application:
a. ON/OFF

B. All valves are to have insulated extension handles.

2.7 BALL VALVES

A. 2 Inch and smaller.
1. Type:
a. 150-pound CWP two piece design, full port
2. Material:
a. Body - ASTM B584, Alloy 844, Bronze. Yellow brass with more than 15% zinc not acceptable
b. Seat - TFE
c. Stem - Blowout-proof
d. Handle - 1/4 turn lever
e. Memory stop
3. Manufacturer/Model:
a. Nibco T-585-70-M
b. Apollo 77-150 Series
c. Milwaukee BA-400
4. Application:
a. ON/OFF

B. Where piping is insulated, ball valves shall be equipped with 2-inch extended handles of non-thermal conductive material. Also, provide a protective sleeve that allows operation of the valve without breaking the vapor seal or disturbing the insulation. Supply with memory stops which are fully adjustable after insulation is applied. Equal to Nibco Nib Seal handle.

2.8 CHEMICAL POT FEEDER (CLOSED SYSTEM FILTER FEEDER)

A. Type: Neptune DBF-5HP or equivalent

B. Stainless steel basket

C. 30-micron polypropylene felt filter bag

D. Filtered rate 100 GPM

E. 5-gallon capacity

F. Construction:
1. SAE 1020 stainless
2. Finished 20 coat epoxy
3. 150 PSI, 200°F

G. Furnish 6 extra bags per feeder provided.

H. Manufacturers:

1. Neptune
2. Efficiency Dynamics
3. Claypool Pump & Machinery Co.
4. Newton Chemical Pump Co.
5. Wingert

I. Location:
1. Across pumps and as recommended by manufacturer

2.9 BUTTERFLY VALVES

A. 2" - 12" diameter:
1. 200 PSI
2. Ductile iron - ASTM A536
3. Full lug body or grooved ends

B. Disc:
1. Aluminum Bronze - ASTM B-148
2. Stainless Steel - ASTM A351/A351M
3. Coated ductile iron - ASTM A536

C. Stem and body seal:
1. 410SS and EPDM Rubber rated at 225°F.

D. Collar bushing:
1. Brass

E. Connection:
1. Flanged

F. 6” & smaller with 10 degree notched lever handle; 8” & larger with cast iron weatherproof gear operator.

G. All valves shall be certified for bi-directional dead-end service without a downstream flange.

H. Manufacturers:
1. NIBCO #LD-2000 Series
2. DeZurik # BRS-C1-EPDM-BZ-S4 Series
3. Demco 2’-12” NE Series; 14” & larger NF-C Series
4. Victaulic Vic-300 MasterSeal

I. Application:
1. ON/OFF

2.10 CIRCUIT BALANCING VALVES

A. Type: Automatic flow control valve and accessories.

B. General:
1. Valve to have internal cartridge(s) that is preset to specific GPM flow rate. Body to have arrow indicating flow direction. Accuracy to be ± 5%.
2. Operating range to be 2-45 PSI, 175 PSI working pressure, 250ºF.
3. Provide pressure/temperature ports for flow verification rating.
4. Provide ID tag with model number, GPM, spring range, and location.

5. Body to be brass or ductile iron. Valves 2-inch and smaller to be brass Y-body type screwed ends, union, ball valve. Valves 2½- inch and larger to be flanged end, ductile iron.

C. Manufacturers:
1. Nexus
2. Flo Design
3. Hays
4. Tour
5. Anderson
6. Griswall
7. Belimo

2.11 STRAINERS

A. Type:
1. 150-pound W.O.G., "Y" type, Mueller, Nibco

B. Material:
1. ASTM B62 Bronze
2. ASTM A126, Class B cast iron

C. Connection:
1. Screwed

D. Screen:
1. Mesh size:
a. 20 by 20 or 0.045-inch perforation
b. Up to 2": #20 mesh screw
c. 2½" - .63
d. 5" and up: 0.125

E. Material:
1. Brass or stainless steel

F. Application:
1. At coils, pumps, heating/cooling equipment
2. Automatic flow-control valves shall not be used on equipment where pressure independent control valves are installed. Coordinate with control valve provider.

2.12 TEST PLUGS

A. Provide where indicated for temperature and/or pressure measurement.

B. Furnish Owner with 2 sets of suitable pressure and temperature gauges.

C. Solid brass with cap and gasket.

D. Provide 6 extra plugs located by Test & Balance Contractor. Coordinate these with Test and Balance Contractor.

2.13 COMBINATION AIR ELIMINATOR AND DIRT SEPARATOR

A. Automatic, full flow coalescing type combination air eliminator and dirt separator shall be fabricated steel, rated for 150 psig working pressure, stamped and registered in accordance with ASME Section VIII, Division 1 for unfired pressure vessels, and

include two equal chambers above and below the inlet/outlet nozzles.

B. Unit shall be based upon system flow with pipe size as a minimum. In no case, shall entering velocity exceed 10 feet per second.

C. Unit shall include internal structured elements filling the entire vessel to suppress turbulence and provide air elimination efficiency of 100% free air, 100% entrained air, and 99.6% dissolved air at the installed location. Dirt separation efficiency shall be a minimum of 80% of all particles 30 micron and larger within 100 passes. The elements must be fabricated by the manufacturer and consist of a copper core tube with continuous wound copper wire medium permanently attached and followed by a separate continuous wound copper wire permanently affixed.

D. Each unit shall have a separate venting chamber to prevent system contaminants from harming the float and venting valve operation. At the top of the venting chamber, shall be an integral full port float actuated brass venting mechanism.

E. Units shall include a side tap valve to flush floating dirt or liquids and for quick bleeding of large amounts of air during system fill or refill.

F. Working Temperature:
   1. Up to 240°F.

G. Manufacturer/Model:
   1. Spirotherm
   2. Armstrong
   3. Thrush
   4. Elbi
   5. Wessels
   6. Bell & Gossett
   7. American Wheatley

H. Location:
   1. A straight run of horizontal piping on the suction side of pumps.

2.14 EXPANSION TANKS

A. Material:
   1. Shell: Steel ASME Rated with Seal

B. Manufacturers:
   1. Armstrong
   2. Thrush
   3. Elbi
   4. Wessels
   5. Bell & Gossett
   6. American Wheatley

C. Types:
   1. Hanging: Armstrong AX Horizontal Diaphragm or equivalent
   2. Floor Mount: Armstrong L Vertical Replaceable Bladder or equivalent

D. Location:
   1. As shown on schematic and recommended by manufacturer

2.15 DUAL CONTROL VALVES

A. Type:
   1. Reducing (fast-fill) valve and pressure relief valve in one pre-assembled unit.

B. Material:
   1. Cast iron

C. Inlet & outlet size:
   1. 1/2 inch diameter

D. Pressure:
   1. Relief valve:
      a. Factory preset: 30 psi
      b. Delivery: 12 psi
   2. Filling valve:
      a. Initial: 45 psi

E. Features:
   1. Adjustable filling valve pressure setting.
   2. Built-in strainer.
   3. Built-in back pressure check.
   4. Time-saving thumbscrew adjustment.

F. Manufacturer/Model:
   1. Amtrol 67F.

2.16 BACKFLOW PREVENTER

A. Material:
   1. Bronze.

B. Connections:
   1. Screwed.

C. Equip with standard gate valves.

D. Manufacturer/Model:
   1. Watts 909.

E. Provide access for testing all ports 6’-0” or lower AFF.

2.17 HEATING CABLES

A. 8 Watts per linear foot, UL Listed

B. Manufacturers
   1. Chromalox SRL with DL Series Thermostat
   2. Raychem XL-Trace with Thermostat
   3. Equivalent manufacturer must be approved 10 days prior to bid.

PART 3 EXECUTION

3.1 EQUIPMENT INSTALLATION

A. Provide valves, strainers, expansion tanks, air separators, air eliminators, and other equipment shown on the plans, and as otherwise necessary for a complete operational, maintainable, and reliable system.

B. Installation shall be in accordance with the plans, specifications, and manufacturer`s instructions.

C. Install one chemical/filter feeder per system.

3.2 ARRANGEMENT

A. All piping shall be run parallel to building lines and shall be arranged so as not to interfere with removal of other equipment or devices nor to block access to doors, windows, manholes, or other access openings.

B. Piping shall be arranged so as to facilitate removal of tube bundles.

C. Piping shall be placed and installed so that there will be no interference with the installation of the equipment, ducts, etc.

D. All piping shall be installed to ensure noiseless circulation.

E. All valves and specialties shall be placed to permit easy operation, maintenance and access.

F. All piping shall be erected and pitched to ensure proper draining.

G. All backflow preventers shall be installed with test ports lower than 6’-0” AFF.

H. Piping shall be installed so as to avoid liquid or air pockets throughout the piping system.

I. Eccentric reducers with flat side up shall be used wherever changes in pipe size would cause an air trap.

J. Manual air vents shall be installed at all high points in chilled water and hot water heating systems with piping to drains.

K. Drain valves - Install in all low points or traps in the piping system.

L. Expansion and contraction of piping shall be provided by expansion loops, bends, or expansion joints to prevent injury to connections, piping, equipment, or the building.

3.3 SLOPE

A. Minimum slope of piping shall be in accordance with the following unless otherwise specifically shown on the drawings or specified.

Type of Piping or Fluid Conveyed	Length for System Component	One Inch Fall	Direction of Fall

Chilled Water	Runouts to Equipment or Risers	4 feet	Back to Mains
Chilled Water	Supply and Return Mains	40 feet	To Nearest Drain Valve

3.4 CLEANING AND FLUSHING OF PIPING SYSTEM

A. Remove all labels, dirt, paint, grease, and stains from all piping and accessories installed under this Contract.

B. A temporary flushing connection shall be arranged for each section of piping.

C. Water required for flushing shall be furnished by the Contractor.

D. All temporary cross connections for flushing and drainage connection shall be furnished, installed, and subsequently removed by the Contractor.

E. Flush the entire system of all cutting oil, slag, and pipe debris using a 1-2% solution of sodium triphosphate for a minimum of forty-eight (48) hours under pressure. Repeat if necessary. Flush with clean water until clear.

F. Contact Owner to coordinate with Owner`s chemical treatment contractor to verify that the system has been properly cleaned. Contract with Owner’s chemical treatment to add required chemicals to system to prevent corrosion, etc.

G. All fan coil units and air handlers shall be connected such that flow bypasses the cooling and heating coils, automatic flow control valves, and control valves during this process.

H. After the system is properly cleaned, the Contractor shall properly connect the fan coil units and air handlers.

I. After system cleaning, open all strainers, remove screen and clean strainers and re-install.

J. Remove all air from system.

K. In filling the systems, be sure to vent in such a manner that the control valves cannot backfill, thus causing foreign matter to be introduced into the valve body.

3.5 WATER TREATMENT

A. None of the systems shall be operated during construction without water treatment. Chemicals shall be introduced into the system within 8 hours of filling. The treatment shall be by the Owner's Contractor. The Contractor shall notify and coordinate with the Owner when the piping systems are complete and ready for treatment.

3.6 HEATING CABLE

A. Provide and install heating cable on all piping installed outside. Install heating cable on bottom of pipe using plastic wire ties every 5 feet and within 6-inches of any turn in pipe. Install thermostat on top of pipe.

3.7 TESTING

A. Apply a hydraulic pressure 1-1/2 times the operating pressure, 150 psig minimum, and carefully check for leaks.

B. Repair all leaks and retest the system until proved watertight.

C. Clean strainers after start-up and before test and balance agency perform their work.

END OF SECTION

SECTION 23 21 15

GROUND LOOP HEAT PUMP PIPING AND WELLS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions, Division 1 Specifications, and Section 23 00 00, apply to this Section.

1.2 RELATED SECTIONS

A. Section 23 00 00 - Basic Mechanical Requirements

B. Section 23 05 53 - Identification for HVAC Piping and Equipment

C. Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC

D. Section 23 09 23 - Energy Management Control System

E. Section 23 33 33 - Access Doors

F. Section 23 81 46 - Water Source Heat Pump Units

1.3 SECTION INCLUDES

A. Boring of wells.

B. Closed loop piping in wells to/from and inside Building and to heat pump units.

C. Well group header system for well groups.

D. Testing and purging of well-piping and well group headers.

E. GPS surveying of well and header locations and documentation.

1.4 REFERENCES

A. ASTM D1693 - Standard Test Method for Environmental Stress-Cracking of Ethylene Plastics

B. ASTM D2657 - Standard Specification for Heat Fusion Joining of Polyolefin Pipe and Fittings

C. ASTM D3035 - Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter

D. ASTM D3261 - Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing

E. ASTM D3350 - Standard Specification for Polyethylene Plastics Pipe and Fitting Materials

F. ASTM F1055 - Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing

G. ASTM D1056 - Standard Specification for Socket Fusion Tools for Use in Socket Fusion Joining Polyethylene Pipe or Tubing and Fittings

1.5 QUALITY ASSURANCE

A. Pipe Manufacturers:
   1. Firms regularly engaged in manufacture of products of this type, and whose products have been in satisfactory use in similar service for not less than 5 years. Comply with ASTM D3035 and ASTM D3350.

B. Installers:
   1. Firms regularly engaged in installations of systems of this type, and whose products have been in satisfactory use in similar service for not less than 5 years.

C. Warranty:
   1. Provide manufacturer`s 20-year warranty on polyethylene (PE) well loop piping.
   2. Provide installer`s 5-year warranty on the piping installation.
   3. Neither Final Payment nor any provisions in Contract Documents shall relieve the Contractor of the responsibility for faulty materials or workmanship.
   4. Contractor shall remedy any defects due thereto, and pay for any damage to other work resulting therefrom, which shall appear within a period of five years from the date of acceptance of the entire project (substantial completion).
   5. The Owner shall give notice of observed defects with reasonable promptness.
   6. This Guarantee shall not be construed to include the normal maintenance of the various components of the system covered by these specifications.

D. Project Record Documents:
   1. The Contractor shall keep a set of plans on the job, noting daily all changes made in connection with the final installation including exact dimensioned locations of all new and uncovered existing utility piping outside the Building.
   2. Upon submitting request for Final Payment, Contractor shall turn over to the Architect/Engineer, for subsequent transmittal to the Owner, clean, neatly marked set of reproducible plans showing "as installed" work.
   3. In addition to the above, the Contractor shall accumulate during the Job`s progress the following data, in multiple duplication (three each), prepared in 3-ring binders of sufficient size, black in color, neat in appearance, and turned over to the Architect/Engineer for checking and subsequent delivery to the Owner:
      a. All warranties, guarantees, and manufacturer`s direction on equipment and material covered by the Contract
      b. Approved fixture/equipment brochures
      c. Copies of approved Shop Drawings
      d. Set of operating instructions. Operating instructions shall also include recommended maintenance and seasonal changeover procedures.
      e. Any and all data and/or plans required during construction.
      f. Repair parts lists of all major items and equipment including name, address, and telephone number of the local supplier or agent.
      g. The first page or pages shall have the name, addresses, and telephone numbers of the following: General Contractor and all sub-contractors, Major Equipment Suppliers.

E. Training:

1. Upon completion of the work and at a time designated by the Owner`s representative, provide a formal training session for the Owner`s operating personnel to include location, operation, and maintenance of all the mechanical, electrical, and plumbing equipment and systems.
2. Before proceeding with instruction, prepare a typed outline in triplicate listing the subjects that will be covered. Submit the outline for review by the Owner`s representative one week prior to training session.
3. At the conclusion of the instruction, obtain signatures of the attendees on each copy of the outline to signify that they have proper understanding of the operation and maintenance of the systems. Submit the signed outlines to the Owner`s representative and Engineer as a condition of final acceptance.

F. Plans and Specifications:
1. The plans show diagrammatically the locations of the various lines, ducts, conduits, fixtures, and equipment and the method of connecting and controlling them. It is not intended to show every connection in detail and all fittings required for a complete system.
2. The Systems shall include but are not limited to, the items shown on the plans.
3. Exact locations of these items shall be determined by reference to the general plans and measurements of the Building and in cooperation with other Contractors, and in all instances, shall be subject to the approval of the Architect/Engineer.
4. The Architect/Engineer reserves the right to make any reasonable change in the location of any part of this work without additional cost to the Owner.

G. Utilities, Locations, and Elevations:
1. Locations and elevations of the various utilities within this scope of work have been obtained from the City, Owner, and/or other substantially reliable sources and are offered separately from the Contract Documents, as a general guide only, without any guarantees as to the accuracy.
2. The Contractor shall examine the site, shall verify to his own satisfaction the locations, elevations, and the availability characteristics (voltage/phase/pressure/capacity) of all utilities and services required, and shall adequately inform himself as to their relation to the work: the submission of bids or proposals shall be deemed evidence thereof.
3. The Contractor shall coordinate all services with the respective Utility Company or Agency during construction; coordinate changes made by Utility Companies or Agencies to the design of the project, and coordinate with the Owner, Architect/Engineer, and Utility the scheduling of any shutdowns or delays that may occur in providing service.
4. The Contractor shall verify location, depth, direction of flow, conduct all necessary tests, inspections, coordinate with Owner`s representatives and Utilities, and check for existing underground utilities before ditching, trenching, and drilling.
5. The Contractor shall be responsible for repair of any cut of damaged lines or utilities he uncovers and disrupts. There are lines and utilities not shown on the plans.

H. Quality Control Test Data: Submit data taken from testing at the time of manufacture verifying the following:
1. Pipe and Fittings: Material complies with the requirements of ASTM D3350 as a PE3408 cell class 355434C, except the environmental stress crack resistance shall have zero failures (FO) after 5,000 hours of testing in accordance with

Condition C, ASTM D1693 using 100% Igepal CO-630 at 100EC.
2. PE 3608 and 4710 pipe complies with the requirements of ASTM D3035.
3. PE 3608 and 4710 fittings comply with the requirements of ASTM D3261 for butt fusion type, ASTM F1055 for electrofusion type.

I. Jointing Polyethylene Piping:
1. Provide joining by performance-qualified joiners using qualified procedures in accordance with AGA-01.
2. Use manufacturer`s pre-qualified joining procedures.
3. Owner`s Testing Laboratory representative will inspect the joining procedures being used in accordance with AGA-01.
4. Use joiners who have been qualified by a person who has been trained and certified by the manufacturer of the pipe to train and qualify joiners in each joining procedure to be used on the job.
5. Training: Include use of equipment, explanation of the procedure, and successfully making joints which pass tests specified in AGA-01.
6. Submit a copy of the training procedure and qualification of the trainer for approval.
7. Notify the Owner`s Testing Laboratory representative at least two (2) working days in advance of the date to qualify joiners.
8. Before proceeding with installation, provide written certification of joiners instructor and written identification of qualified joiners.

J. Bore Hole Driller: A State of Texas currently licensed well driller.

1.6 SUBMITTALS

A. Submit list of and Product Data on all products incorporated into the Work.

B. Submit well driller’s license and list of projects completed.

C. Submit Shop Drawings of well headers and pit headers.

D. Submit Record Drawings showing:
1. Well locations, instrument shot after installation, and testing of well loop piping, including abandoned boreholes. (Using GPS Surveying Instrument to locate wells)
2. Header locations and orientation. (Using GPS Surveying Instrument to locate headers and header routing)
3. Submit reports and other documents as required.

E. Manufacturer`s Certification:
1. Submit manufacturer`s certifications as described in Section: GENERAL REQUIREMENTS, MECHANICAL.

PART 2 PRODUCTS

2.1 PIPING

A. Piping (PE): (Interior and Exterior)
1. ¾” through 1" Piping: SDR 11 PE3608 and 4710 (High-density polyethylene with high resistance to environmental stress cracking), ASTM D3350, with minimum cell classification PE3408 and 4710 355464C per ASTM D3350 "Standard Specification for Polyethylene Plastics Pipe and Fittings Materials"; Driscopipe

5300 Climate Guard.

2. Testing: Provide pipe with testing experience of zero failures (FO) after 5,000 hours under condition "C" (100% reagent @ 100°C) when tested in accordance with ASTM D1693, Standard Test Method for Environmental Stress-Cracking of Ethylene Plastics.
3. 1-1/4" and Larger Piping: SDR 11 PE3608 (high-density polyethylene with high resistance to environmental stress cracking) with minimum cell classification 355434C per ASTM D3350 "Standard Specification for Polyethylene Plastics Pipe and Fittings Materials"; Driscopipe 5300 Climate Guard.

2.2 WELL LOOP

A. Unicoil: with Unibend, Perfused shop fabricated, joined, and tested. Provided with Polywing anti-buoyancy attachment port.
   1. Pipe: Use continuous coils; do not install joints in the well loop except for the U-bend.

2.3 WELL HEADER

A. Multi-outlets of, length, size, and number of outlets indicated on Drawings, shop fabricated of PE; McElroy 1 B0370-3009.

2.4 FITTINGS

A. PE3608 and 4710, ASTM D3261 butt fusion type, and PE3608 ASTM F1055 electrofusion type; Driscopipe 5300 Climate Guard.

PART 3 EXECUTION

3.1 INSTALLATION

A. Complete structural, mechanical, and electrical connections in accordance with manufacturer`s installation instructions and with the Drawings. Fasten each unit securely to the building structure.

B. Do not fasten piping or conduit to any removable panel on a unit.

C. Install piping and other connections in a manner to prevent conduction of sound to the framing and structural elements of the building.

D. Hangers: Vee Bottom Clevis Hanger, adjustable or provided with turnbuckles, B-Line Systems with Plastic Pipe Support Channel.

E. Provide approved Firestop method for all rated wall penetrations. Provide collars and sleeves per UL requirements and per details.

F. Provide purge ports for each well field; refer to drawings for details.

G. Provide Metallic Locator Tape for all piping outside of Building; refer to drawings for details.

H. Provide “as built” drawings GPS coordinates of all corners of well field.

I. Provide geothermal water piping labeling as specified in section 23 05 54.

J. All trenches shall be backfilled per directions provided by the Testing Lab and Architect.

K. Complete the start-up procedures recommended by the manufacturer.

L. All piping under building to be supported from slab in crawlspace with hangers.

3.2 BORE HOLES

A. Bore Holes and Headers:
1. Notify Owner`s Testing Laboratory seven (7) calendar days in advance of boring schedule.
2. Do not conduct boring operation except in the presence of the Owner`s Testing Laboratory representative.
3. Minimum Bore Hole Diameter and Spacing: 4".
4. Minimum Bore Hole Depth and Spacing: As indicated on Drawings.
5. Bore Hole Voids and Caverns: Abandon these holes in compliance with State and Local requirements for plugging and abandoning procedures for wells.
6. Install well loop piping promptly after borehole is completed; do not leave boreholes open overnight.
7. Bore Hole Group (Well Group): Complete drilling, pipe insertion, backfilling, and testing prior to trenching for headers.
8. Bore Hole Backfilling: Fill with a High-Solids Bentonite Grout as manufactured by one of the following:
   a. Trade Name: Manufacturer/Supplier:
   b. Volclay GroutAmerican Colloid Company, Arlington Heights, Illinois
   c. Aqua-Grout/Benseal Baroid Drilling Fluids, Denver, Colorado
   d. Black Hills GroutBlack Hills Bentonite Company, Mills, Wyoming
   e. Enviroplug GroutWyo-Ben, Inc., Billings, Montana
   f. Econoplug GroutEconomy Mud Products, Houston, Texas
   g. PDS Co. BentonitePolymer Drilling Systems, El Dorado, Arkansas
9. Conduct backfilling in accordance with State and Local requirements for well backfilling.
10. Use the "Tremie" Method for backfilling with grout pumping rates as follows:
    a. Pipe SizeGrout Pumping Rate
    b. (inches I.D.) GPM
    c. 1"5 - 8
    d. 1-3"8 - 20
11. The grout shall be introduced into hole in one continuous operation by pumping, beginning at the bottom of the hole. The bottom end of the grout pipe shall be kept full of grout and remain submerged during the procedure.
12. In the event of interruption of the grouting due to pumping problems or when mixing several batches, the bottom of the grout pipe should be raised above the level of the grout. A volume of freshwater that exceeds the volume of the pump, hoses, and grout pipe should then be pumped to flush the grout from the system.
13. The grout pipe may then be resubmerged in the grout when pumping is resumed and after any air or water in the lines is flushed out.
14. The grout pipe may then be gradually withdrawn as the grout fills the annular space, or it may remain until the grout appears at the surface and be pulled afterward. Grout shall be pumped until it appears at ground surface.

B. Approved bentonite mix equal to one of the above-indicated backfills may be used.

C. Approval must be obtained in writing prior to installation.

3.3 WELL PIPING (INTERIOR AND EXTERIOR)

A. General:
1. Install in accordance with the Closed-Loop Ground Coupled Heat Pump System Installation Guide of the International Ground Source Heat Pump Association.
2. Conform to ASHRAE standard GCHP, Design/Data Manual GL/GC Heat Pump Systems.
3. Provide geothermal water piping labeling as specified in section 23 05 54.

B. Piping:
1. U-type Fittings: Shop fabricate under quality-controlled conditions of the same material designation.

C. Joining:
1. Butt fusion or saddle (sidewall) fusion method in accordance with the manufacturer's Heat Fusion Qualification Guide.
2. Use only operators that have been properly trained and have executed quality fusion joints in the presence of the Owner`s testing laboratory, and have identified their respective test samples.
3. Jointing Procedures and Practices: Comply with ASTM D2657, Heat-Joining Polyolefin Pipe and Fittings, ASTM F1056, Socket Fusion Tools for Use in Socket Fusion Joining Polyethylene Pipe or Tubing and Fittings, and ASTM F1290, Electrofusion Joining Polyolefin Pipe and Fittings.

D. Provide Fusion machine with the following features:
1. Guide Rods: In a plane that passes through the centerline of the pipe thus canceling the bending forces in the machine caused by the fusion forces.
2. Mechanical Advantage of the Combination Butt-Saddle Machine: Minimum 5.5 to 1 in the butt fusion mode, and 2.5 to 1 in saddle fusion mode.
3. Mechanical Advantage of Butt Fusion Machine: Minimum 10 to 1 and a saddle fusion only machine must be capable of applying at least 600 lbs. of thrust.
4. Mechanical Advantage of Saddle Fusion Machine: Capable of applying minimum of 600 lbs. of thrust.
5. Pipe Clamps: Strength to "round-up" the pipe close to the fusion joint, adjustable for removal of high-low mismatch of pipe walls, capable of clamping each piece on continuing straight centerline.
6. Pipe Facing Device: Capable of rapid facing of the pipe ends to a perfectly flat surface, so when the ends are brought together, there is 100% plastic contact.
7. Facer: Precisely machined stops to lock the facer squarely between the clamping jaws at the end of face-off.
8. Heater Plate:
    a. Electrically heated and thermostatically controlled.
    b. Smooth surface with a high quality non-stick coating.
    c. Heater: Capable of quick heat-up and maintaining a constant surface temperature in the desired temperature range even in inclement weather conditions.
    d. Equipped with a thermometer to indicate drastic temperature change.
    e. Periodically test for proper temperature with a surface pyrometer.

E. Installation:

1. Maintain the bores or holes clean and of sufficient diameter to facilitate the installation of the U-tube assembly.
2. Use drillers mud, steel casing, or PVC casing to keep holes clean.
3. Do not install crushed, cut, abraded, or kinked pipe.

3.4 TESTING AND CLEANING

A. Cleanliness:
   1. Keep trash, soil, and small animals out of the pipe.
   2. Weld caps on the ends of the polyethylene pipe until the pipe is joined to the circuit.

B. Testing and Filling Wells Loops:
   1. Before Insertion into Bore Hole: Fill each well loop individually with water and pressure test individually to 100 PSI times normal operating pressure for 2 hours.
   2. After Insertion into Bore Hole: Test at 100 PSI pressure for one hour.
   3. Well Leads and Well Header Leads:
      a. Before Headered Well Group is Finished: Fill with water and pressure-test to 100 PSI for 2 hours as each headered well group is completed and prior to backfilling of the trenches.
      b. After Headered Well Group is finished: Test to 100 PSI pressure for one hour.

C. Flushing:
   1. Start flushing gradually, venting entrapped air, preventing water hammer; do not exceed pressure rating of the pipe.
   2. Flush the well group`s supply and return system of well loop, well leads, well header, and well header leads.
   3. Flush no more than one related pair of supply and return well groups of 10 wells at one time.
   4. Provide a special pump and tank arrangement or use the system pump.
   5. Flush each well group`s piping thoroughly.
   6. When clean, fill with potable water and weld caps to the open ends or complete the connection to the pit headers.
   7. Provide adequate flow and pressure for flushing as determined by methods described in the reference under “Design” above.

3.5 START-UP AND TESTING

A. Put system into operation.

B. Test equipment performance.

C. Adjust unit for correct capacities.

D. See also Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC.

END OF SECTION

SECTION 23 21 23

HYDRONIC PUMPS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions, Division 1 Specifications, and Section 23 00 00, apply to this Section.

1.2 SCOPE

A. Pumps for use in distributing hot and chilled water for space heating and cooling.

1.3 RELATED SECTIONS

A. Section 22 05 24 - Valves

B. Section 22 05 30 - Pipe and Pipe Fittings

C. Section 23 00 00 - Basic Mechanical Requirements

D. Section 23 05 19 - Meters and Gauges for HVAC Piping

E. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment

F. Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC

G. Section 23 09 23 - Energy Management Control System

H. Section 23 21 13 - Hydronic Piping, Valves, and Appurtenances

1.4 REFERENCES

A. HI - Hydraulic Institute.

B. ANSI - American National Standards Institute.

C. OSHA - Occupational Safety & Health Administration.

D. ASHRAE - American Society of Heating, Refrigeration and Air-Conditioning Engineers.

E. NEMA - National Electrical Manufacturers Association.

F. UL - Underwriters Laboratories.

G. ETL - Electrical Testing Laboratories.

H. NEC - National Electric Codes.

I. ISO - International Standards Organization.

J. IEC - International Electrotechnical Commission.

K. ASME - American Society of Mechanical Engineers

1.5 SUBMITTALS

A. Provide submittal data on all items specified in this section in accordance with Specification Section 23 00 00, General Conditions, and Division 1.

1.6 QUALITY ASSURANCE

A. All equipment or components of this specification section shall meet or exceed the requirements and quality of the items herein specified, or as denoted on the drawings.

B. Ensure pump operation at specified system fluid temperatures without vapor binding and cavitation is non-overloading in parallel or individual operation and operates to ANSI/HI 9.6.3.1 standard for Preferred Operating Region (POR) unless otherwise approved by the engineer. The pump NPSH shall conform to the ANSI/HI 9.6.1-2012 standards for Centrifugal and Vertical Pumps for NPSH Margin.

C. Ensure pump pressure ratings are at least equal to system’s maximum operating pressure at point where installed but not less than specified.

D. Equipment manufacturer shall be a company specializing in manufacture, assembly, and field performance of provided equipment with a minimum of 20 years.

E. Equipment provider shall be responsible for providing certified equipment start-up. New pump start-up shall be for the purpose of determining pump alignment, lubrication, voltage, and amperage readings. All proper electrical connections, pump’s balance, discharge and suction gauge readings, and adjustment of head, if required. A copy of the start-up report shall be made and sent to both the contractor and to the Engineer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the site in such a matter as to protect the materials from shipping and handling damage. Provide materials on factory provided shipping skids and lifting lugs if required for handling. Materials damaged by the elements should be packaged in such a manner that they could withstand short-term exposure to the elements during transportation.

B. Store materials in clean, dry place and protect from weather and construction traffic. Handle carefully to avoid damage.

C. Use all means necessary to protect equipment before, during, and after installation.

D. All scratched, dented, and otherwise damaged units shall be repaired or replaced as directed by the Architect/ Engineer.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Armstrong

B. Bell & Gossett

C. Paco

D. Taco

E. Grundfos

F. Aurora

2.2 GENERAL

A. Furnish and install as scheduled and shown on plans, centrifugal pumps.
   1. Motor:
      a. Premium efficiency motors shall be of the horsepower and speed shown in the pump schedule. Pumps requiring larger horsepower shall not be acceptable. Motor shall be premium efficiency and totally non-overloading on the pump curve.
      b. Motor shall meet NEMA specifications and shall be of the size, voltage, and enclosure called for on the plans.
      c. Pump and motors shall be factory aligned.
      d. It shall have heavy-duty grease-lubricated ball bearings, completely adequate for the maximum load for which the motor is designed.
         1) Acceptable Motors: Century E-Plus 3, US Premium Efficiency, Reliance XE, Baldor Super E, or approved equivalent.
   2. Base:
      a. Entire pumping unit shall be mounted on a cast iron drip rim base using cap screws. Pumps shall not be secured with floor studs.
   3. Efficiency:
      a. Pump(s) shall meet or exceed the efficiency shown in the pump schedule.
   4. NPSHR:
      a. To ensure cavitation-free operation, each pump`s NPSH Requirement must be low enough to permit stable, continuous operation at 120% or greater of best design point.
   5. Noise:
      a. Each pump shall be capable of continuous operation without producing noise in excess of Hydraulic Institute and OSHA guidelines.
   6. Test:
      a. Each pump shall be factory hydraulically tested. It shall then be thoroughly cleaned and painted with at least one coat of high-grade machinery enamel prior to shipment.

2.3 CENTRIFUGAL PUMPS

A. Split Coupled End-Suction Pumps:
   1. Furnish and install pumps with capacities as shown on plans. The pumps shall be long coupled, base mounted, single stage, end suction, vertical split case design, in cast iron and stainless steel fitted, and specifically designed for quiet operation. Suitable standard operations at 225°F and 175 PSIG working pressure or optional operations at up to 250°F and 250 PSIG working pressures. Working pressures shall not be de-rated at temperatures up to 250°F. The pump internals shall be capable of being serviced without disturbing piping connections, electrical motor connections, or pump to motor alignment.

2. The pumps shall be composed of three separable components: a motor, bearing assembly, and pump end (wet end). The motor shaft shall be connected to the pump shaft via a replaceable flexible coupling.
3. A bearing assembly shall support the shaft via two heavy-duty re-greaseable ball bearings. Bearing assembly shall be replaceable without disturbing the system piping and shall have foot support at the coupling end. Pump bearings shall be re-greaseable without removal of the bearings from the bearing assembly. Thermal expansion of the shaft toward the impeller shall be prevented via an inboard thrust bearing.
4. The bearing assembly shall have a solid SAE1144 steel shaft. A stainless steel shaft sleeve shall be employed to completely cover the wetted area under the seal.
5. Pump shall be equipped with an internally-flushed mechanical seal assembly installed in an enlarged tapered seal chamber. Application of an internally flushed mechanical seal shall be adequate for seal flushing without requiring external flushing lines. Seal assembly shall have Buna bellows and seat gasket, stainless steel spring, and be of a carbon ceramic design with the carbon face rotating against a stationary ceramic face.
6. Bearing assembly shaft shall connect to a bronze impeller. Impeller shall be both hydraulically and dynamically balanced to ANSI/HI 9.6.4-2009, balance grade G6.3, and secured by a bronze locking capscrew or nut.
7. Pump should be designed to allow for true back pull-out allowing access to the pump's working components, without disturbing motor or piping, for ease of maintenance.
8. A center drop-out type coupling, capable of absorbing torsional vibration, shall be employed between the pump and motor. Pumps for variable speed application shall be provided with a suitable coupling sleeve. Coupling shall allow for removal of pump's wetted end without disturbing pump volute or movement of the pump's motor and electrical connections. On variable speed applications, the coupling sleeve should be constructed of a neoprene material to maximize performance life.
9. An ANSI and OSHA rated coupling guard shall shield the coupling during operation. Coupling guard shall be dual rated ANSI B15.1 and OSHA 1910.219 compliant coupling guard and contain viewing windows for inspection of the coupling. No more than .25 inches of either rotating assembly shall be visible beyond the coupling guard.
10. Pump volute shall be of a cast iron design with integrally cast pedestal volute support, rated for 175 PSIG with integral cast iron flanges drilled for 125# ANSI companion flanges. (Optional 250 PSIG working pressures are available and are 250# flange drilled.) Volute shall include gauge ports at nozzles, and vent and drain ports.
11. Base plate shall be of structural steel or fabricated steel channel configuration fully enclosed at sides and ends, with securely welded cross members and fully open grouting area (for field grouting). The minimum base plate stiffness shall conform to ANSI/HI 1.3.8.2.1- 2009 for grouted Horizontal Baseplate Design standards.
12. Pump shall be of a maintainable design and, for ease of maintenance, should use machine fit parts and not press fit components.
13. The pump(s) vibration limits shall conform to Hydraulic Institute ANSI/HI 9.6.4-2009 for recommended acceptable unfiltered field vibration limits (as measured per ANSI/HI 9.6.4-2009 Figure 9.6.4.2.3.1) for pumps with rolling contact bearings.

14. Pump manufacturer shall be ISO-9001 certified.
15. Each pump shall be hydrostatically tested 1.5 times the maximum rated working pressure and name-plated before shipment.
16. Pump shall conform to ANSI/HI 9.6.3.1-2012 standard for Preferred Operating Region (POR) unless otherwise approved by the engineer.

B. Closed Coupled Pumps:
1. Furnish and install pumps with capacities as shown on plans. The pumps shall be close-coupled, foot mounted, single stage, end suction, vertical split case design, in cast iron stainless steel fitted construction specifically designed for quiet operation. Suitable standard operations at 225° F and 175 PSIG working pressure or optional temperatures to 250°F. Working pressures shall not be de-rated at temperatures up to 250°F. The pump internals shall be capable of being serviced without disturbing piping connections.
2. The pumps shall have a solid alloy steel shaft that is integral to the motor. A stainless steel shaft sleeve shall be employed to completely cover the wetted area under the seal.
3. The motor bearings shall support the shaft via heavy-duty grease lubricated ball bearings.
4. Pump shall be equipped with an internally flushed mechanical seal assembly installed in an enlarged tapered seal chamber. Seal assembly shall have Buna bellows and seat gasket, stainless steel spring, and be of a carbon / ceramic design with the carbon face rotating against a stationary ceramic face.
5. Motor shaft shall connect to a bronze impeller. Impeller shall be hydraulically and dynamically balanced to ANSI/HI 9.6.4-2009, ISO 1940 balance grade G6.3, keyed to the shaft, and secured by a bronze locking cap screw.
6. Pump should be designed to allow for true back pull-out access to the pump’s working components for ease of maintenance.
7. Pump volute shall be of a cast iron design for HVAC systems rated for 175 PSIG with integral cast iron flanges drilled for 125# ANSI companion flanges NPT pipe. Volute shall include gauge ports at nozzles, and vent and drain ports.
8. Pumps shall conform to ANSI/HI 9.6.3.1-2012 standard for Preferred Operating Region (POR) unless otherwise approved by the engineer. The pump NPSH shall conform to the ANSI/HI 9.6.1-2012 standards for Centrifugal and Vertical Pumps for NPSH Margin.
9. Pump shall be of a maintainable design and for ease of maintenance should use machine fit parts and not press fit components.
10. Pump manufacturer shall be ISO-9001 certified.
11. Each pump shall be factory tested and name-plated before shipment

2.4 ACCESSORIES

A. Provide one mechanical seal for each model type of primary pump.

B. Pumps shall be provided with internal volute wear rings, galvanized drip pan, or special spacer couplings.

PART 3 EXECUTION

3.1 INSTALLATION

A. All components shall be installed in accordance with manufacturer’s installation instructions.

B. Reduction from line size to pump connection size shall be made with eccentric reducers attached to the pump with tops flat to allow continuity of flow.

C. Furnish and install triple duty valves on the discharge side of all pumps and furnish and install a line size shut-off valve on the suction side of all pumps. Anywhere that 5 straight pipe diameters of pipe cannot be provided on the inlet side of a pump a suction diffuser shall be used to provide appropriate flow distribution into the eye of the pump's impeller.

D. Provide temperature and pressure gauges where and as detailed or directed.

E. On systems where pump seals require flushing water or cooling water for a heat exchanger kit, provide cooling water supply piping and connections as well as the return piping, if required. Piping should be of adequate size to pass required flow rate.

F. Proper access space around a device should be left for servicing the component. No less than the minimum recommended by the manufacturer.

G. Provide an adequate number of isolation valves for service and maintenance of the system and its components.

H. On systems where the final balancing procedure requires the triple duty valve to be throttled more than 25% to attain design flow (on a constant speed pumping system), and no future capacity has been built into the pump, the pump impeller must be trimmed to represent actual system head resistance. The pump provider and engineer of record, based on the balancing contractor's reports, shall determine the final impeller trim diameter.

I. Each pump shall have at minimum a 4" housekeeping pad.

J. Install foot mounted and base mounted pumps on a vibration isolation pad, which will be set on top of the housekeeping pad. Set, level and grout. Install non-shrinking grout under pumps.

K. All piping shall be brought to equipment and pump connections in such a manner so as to prevent the possibility of any loads of stress being applied to the connections or piping. All piping shall be fitted to the pumps even though piping adjustments may be required after the pipe is installed.

L. On components that require draining, contractor must provide piping to and discharging into appropriate drains.

M. Provide drains for bases and seals, piped to and discharging into floor drains.

N. Power wiring, as required, shall be the responsibility of the electrical contractor. All wiring shall be performed per manufacturer's instruction and applicable state, federal, and local codes.

O. Control wiring for remote mounted switches and sensor/transmitters shall be the responsibility of the control's contractor. All wiring shall be performed per manufacturer's instructions and applicable state, federal, and local codes.

P. The pumps shall be installed at the locations shown and as detailed on the plans and in other sections of these specifications.

Q. The mechanical contractor shall clean the strainers and suction diffusers after the system has been flushed and on a regular basis until the pumps are turned over to the Owner.

R. Pump and motor shall be realigned by the contractor according to the standards of the Hydraulic Institute after grouting of base and connection of piping.

S. Each pump shall be checked by the contractor and regulated for proper differential pressure, voltage, and amperage draw. This data shall be noted on a permanent tag or label and fastened to the pump for Owner`s reference.

END OF SECTION

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SECTION 23 23 00

REFRIGERANT PIPING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions, Division 01 Specifications, and Section 23 00 00, apply to this Section.

1.2 SECTION INCLUDES

A. Refrigerant piping for split system (including heat pumps) cooling/heating units.

1.3 RELATED SECTIONS

A. Section 22 05 24 - Valves - General

B. Section 22 05 30 - Pipe and Pipe Fittings - General

C. Section 23 00 00 - Basic Mechanical Requirements

D. Section 23 07 21 - Refrigerant Piping Insulation

E. Section 23 33 33 - Access Doors

1.4 REFERENCES

A. ASTM B280 - Seamless Copper Tube for Air Conditioning & Refrigeration Service

1.5 SUBMITTALS

A. Provide submittal data on all items specified in this section in accordance with Specification Section 23 00 90, General Conditions, and Division 1.

1.6 COORDINATION

A. Coordinate the refrigerant line sizing, lengths, traps, and all other aspects of the refrigerant systems with the air conditioning unit manufacturer to ensure a completely working and reliable system.

B. Submit product data on piping materials and fittings.

C. Provide letter stating air conditioning manufacturer has reviewed refrigerant line design. Provide drawings on any lines that are longer than 80 feet.

D. If units have to be moved due to line lengths, then all associated costs will be at the Contractor`s expense.

PART 2 PRODUCTS

2.1 PIPING

A. ACR hard drawn copper tubing, conform to ASTM B280.

B. ACR soft drawn copper tubing is allowed in concealed locations, such as behind walls. Above ceiling is not considered a concealed location.

2.2 FITTINGS

A. Wrought copper fittings

B. Use silver solder at connections

2.3 VALVES

A. Manufacturers:
   1. Alco Controls
   2. Sporlan Valve Company

PART 3 EXECUTION

3.1 MATERIAL PREPARATION

A. Cut tubing with a sharp pipe cutter.

B. Ream and thoroughly clean to remove all burrs, filings, dirt, and grease before assembly and soldering.

C. Remove oxide and discoloration prior to assembly.

3.2 SLEEVES

A. Sleeve piping as required in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

B. All refrigerant piping passing under slab shall be sleeved.

C. Sleeves shall be of an adequate size to permit removal of the piping at a later date.

3.3 HANGER SUPPORTS

A. Support as required in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

B. Do not fasten liquid and suction lines together unless there is insulation between them. Use wire ties. Duct tape not allowed.

C. Insulate all refrigerant lines from structure.

3.4 INSTALLATION

A. Route with building lines, vertical lines to be plumb, grade horizontal suction lines to compressor.

B. All brazing shall be done with 2-8 psig dry nitrogen purge.

C. Protect all valves and paint from excessive heat.

D. Keep refrigerant lines sealed from atmosphere during construction.

E. All suction lines to receive insulation.

F. No welded or mechanical joints in concealed areas, such as walls. Soft drawn copper is acceptable.

G. Follow A/C manufacturer`s instructions.

END OF SECTION

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SECTION 23 31 13

METAL DUCTWORK

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions, Division 01 Specifications, and Section 23 00 00, apply to this Section.

1.2 SECTION INCLUDES

A. Furnishing and installation of all ductwork as shown on the construction documents. Acoustical and thermal linings and wrappings; flexible ductwork and connections; combination smoke and fire dampers, smoke dampers, and fire dampers; duct access doors; air diffusers, grilles, and registers; air volume control devices; hangers and supports; plenums and casings; turning vanes; air filters; installation of temperature control dampers, and other appurtenances necessary for a complete and operational system.

B. All work shall be preceded by taking measurements at the job site, fully coordinating all work with other disciplines, verifying available spaces for ductwork, and developing shop drawings.

1.3 RELATED SECTIONS

A. Section 23 00 00 - Basic Mechanical Requirements

B. Section 23 05 93 - Testing, Adjusting and Balancing for HVAC

C. Section 23 07 13 - Duct and Grille Insulation

D. Section 23 33 33 - Access Doors

E. Section 23 34 16 - HVAC Fans

F. Section 23 37 13 - Diffusers, Registers, and Grilles

G. Section 23 81 26 - Split System HVAC Units

1.4 REFERENCES

A. AMCA 500 - Test Methods for Louvers, Dampers, and Shutters

B. AMCA 511 - Certified Ratings Program for Air Control Devices

C. ASTM A653/A653M - Sheet Metal, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanized) by the Hot-Dipp Process

D. ASTM A924/A924M - Hot Dip Galvanized Coils & Sheets - Tolerances

E. ASTM A463/A463M - Steel Sheet Aluminum Coated by the Hot-Dip Process

F. NFPA 90A - National Fire Protection Association - Installation of Air Conditioning and Ventilation Systems

G. NFPA 92 - Smoke Control Systems

H. SMACNA - Sheet Metal and Air Conditioning Contractors Association

I. SMACNA HVAC Duct Construction Standards, Latest Edition, for Metal and Flexible Ducts

J. UL - Underwriter`s Laboratories

K. UL 555 - Standard for Safety; Fire Dampers

L. UL 555S - Standard for Safety; Leakage Rated Dampers for Use in Smoke Control Systems

1.5 SYSTEM DESCRIPTION

A. Design static pressure:
   1. 1-inch w.g. minimum for all low-pressure ductwork applications.

1.6 SUBMITTALS

A. Product Data:
   1. Provide submittal data on all equipment specified in this section in accordance with Section 23 00 90, General Conditions, and Division 01.
   2. Submit product data indicating typical catalog of information including arrangements.
   3. Submit product data sheets indicating dimensions, general assembly, and materials used in fabrication.
   4. Indicate mechanical and electrical service locations and requirements of equipment.
   5. Submit manufacturer`s installation instructions.

B. Shop Drawings:
   1. Submit 1/4" per foot shop drawing(s) showing all ducts, piping, and equipment shown by plans and specifications. Submit drawings on all mechanical rooms. The drawings shall be coordinated with structural and electrical. Provide sections for all congested areas and mechanical rooms. Submit prior to construction of ductwork.

1.7 QUALITY ASSURANCE

A. All equipment and materials shall be new and of the quality as specified herein. All work shall comply with the Local Building Code, Mechanical Code, Fire Code, and all other applicable State and Local Codes or ordinances.

B. All equipment and materials shall be installed in a workmanlike manner by trained and experienced sheet metal technicians and mechanics as recommended by the manufacturers of the products installed.

C. All ductwork to be manufactured in accordance with SMACNA standards.

D. Where the standards and requirements of this specification exceed those of SMACNA, the requirements herein shall govern.

E. Except where specified otherwise, all sheet metal used shall be constructed from prime galvanized steel sheets or coils up to 60 inches in width. Each sheet shall be stenciled with manufacturer`s name and gauge. Coils of sheet steel shall be stenciled throughout on 10-foot centers with manufacturer`s name and gauge tolerances in inches.

F. Flexible:
1. The composite assembly including insulation, vapor barrier, and glass scrim shall meet the Class 1 requirements of the latest NFPA 90A and be labeled for a spread rating of 25 or less and a smoke development rating of 50 or under.

1.8 WARRANTY

A. Warranty all ductwork and dampers for 1 year from the date of final acceptance. The warranty will cover workmanship, noise, chatter, whistling, and vibration. Ductwork must be free from pulsation under all conditions of operation.

PART 2 PRODUCTS

2.1 RECTANGULAR AND ROUND RIGID DUCTS

A. Material:
1. New, prime grade sheet or coil steel

B. Gauge:
1. Select gauge in accordance with SMACNA Duct Construction Standards Tables 1-3 to 1-9 and Appendix- page 2.

C. Auditorium and stages:
1. Increase two gauges (heavier) for the first 20 feet of supply and return duct.

D. Coating:
1. Type:
a. Continuous, hot-dip, galvanized coating

E. Application:
1. 1-1/4 ounces per 1 square foot, two-sided sheet
2. Comply with ASTM A653/A653M

F. Identification:
1. Sheet steel:
a. Stencil each sheet with manufacturer`s name and gauge.

G. Coil steel:
1. Stencil coils on 10-foot centers with manufacturer`s name and gauge.

H. Construction:
1. Manufacture in accordance with SMACNA Round Duct Standards, Tables 3-2A, 3-2B, and 3-3, Figures 3-1, 3-2, 3-3, 3-4, and 3-5.
2. Pre-manufactured round duct may be used if approved by the Architect/Engineer.

2.2 ACCESS DOORS

A. Install access doors to facilitate cleaning as required by code.

B. Install access doors as required for access to fire protection devices.

2.3 FLEXIBLE DUCTS

A. Material: In accordance with SMACNA Metal and Flexible Duct Standards, Latest Edition.

B. Construction:
   1. Factory insulate with high-density fiberglass to a minimum R-value of 5.79.
   2. Provide a positive interior air seal permanently bonded to a carbon steel spring helix.
   3. Sheath seal in a Class 1 vapor barrier and factory seal at both ends.
   4. Conform to UL 181, NFPA 90A

C. Manufacturer/Model:
   1. ATCO 30 Series

2.4 VOLUME CONTROL DAMPERS

A. Manufacturer:
   1. Nailor Industries Series 1020, 1021, or equal.

B. Type:
   1. Manually operated single-blade or multi-blade
   2. Conform to SMACNA Duct Standards (Metal & Flexible), Figures 2-12 & 2-13.

C. Application:
   1. Provide in all branches, splits, and taps whether indicated on plans or not.

D. Construction:
   1. Provide an indicating device with lock to hold damper in proper position.
   2. All manual dampers installed above hard ceilings or at other inaccessible areas shall be supplied with a cable operated damper equal to Young Regulator Model 830A-CC. Damper(s) to be opposed blade type constructed of .050 minimum heavy duty extruded aluminum frames and blades. All necessary hardware to ensure compatibility with remote cable control system shall be included. Damper blades to include individual blade bushings for smooth and quiet operation. Damper blades shall rotate between a matched pair of formed and punched 306 stainless steel connecting slide rails which facilitate smooth blade movement and ensure alignment.

2.5 TURNING VANES

A. Provide in all rectangular supply elbows. Turning vanes in return air ductwork is not necessary.

B. Conform to SMACNA Duct Standards, Figures 2-3 and 2-4.

2.6 DUCT SEALANT

A. Equal to Glenkote "Seal-Flex" duct sealer, Hardcast "Irongrip 601", Foster 32-19” or ”Childers CP-146”

2.7 FIRE DAMPERS

A. Manufacturer/Model:
   1. Fire Dampers - Pottorff, Ruskin, Greenheck, National Controlled Air or Nailor
   2. Ceiling Fire Dampers/Thermal Blankets - CK-2000-1 thermal blanket and Model CFSR-2 ceiling damper for supply outlets (round or square) and CFSR-2 for return outlets (square).

B. Type:
   1. 212°F fusible link fire damper.
   2. Fire protection rating: 1.5 hours
   3. Conform to UL 555 and be UL labeled
   4. Tested in accordance with AMCA 500.

C. Application:
   1. Provide at locations shown on plans and where required by Local and State ordinances.

D. Features:
   1. Maximum leakage 8 cfm at 4-inch S.P.
   2. Vertical or horizontal installation
   3. Radiation blanket
   4. Blades 16 gauge galvanized, maximum 6-inch width.
   5. 5-year warranty

E. Manufacturer/Model:
   1. Ceiling Fire Dampers:
      a. Pottorff Ceiling Fire Dampers/Thermal Blankets - Series CFD
      b. Equals by Nailor Industries, NCA, United Air, Ruskin, Greenheck

2.8 FIRE SAFETY FUNCTIONS - DUCT MOUNTED SMOKE DETECTORS, CONTROL RELAYS, AND SMOKE FIRE DAMPER CONTROL

A. At minimum, duct mounted smoke detectors required on all air handlers, fan coil units, fan powered boxes, and packaged rooftop units rated at 2000 CFM or more. Control relays required on all air handlers, fan coil units, fan powered boxes, and packaged rooftop units feeding any path of egress or corridors.

B. The Fire Alarm Contractor shall provide the Duct Mounted Smoke Detectors, Control Modules, Power Relays, and Control Relay devices and perform the final low-voltage hook-up to the fire alarm system.

C. Duct-mounted smoke detector housings and sample tubes shall be furnished by the Fire Alarm Contractor and mounted by the Mechanical Contractor.

D. Line voltage hook-up shall be by the Electrical Contractor.

E. Fire Alarm Safety Control Functions, which may include the operation of fire alarm Control Relays CR associated with duct mounted smoke detector D/air handler shut

down, high volume low speed (HVLS) fan shut down, fire door hold-back and release, smoke fire damper motor control, et cetera, shall be initiated via Control Relays which shall be de-energized under fire alarm conditions. These Control Relays shall be provided and mounted by the Fire Alarm Contractor and located within three feet of the unit. These Control Relays shall be controlled by a fail-safe Fire Safety Control Function circuit. For each controlled device, the contractor providing the device shall wire it internally for fail-safe shut-down and provide a labeled 3` coil of cable outside the unit to allow the fire alarm contractor to make final connection to the Common and N.O. or N.C. dry contacts on the fire alarm SPDT Control Relay. Each Fire Safety Control Function circuit controlled device shall be configured such that when the fire alarm system safety control circuit is re-energized, by the fire alarm control panel, the device shall return to normal operation (e.g. be ready to re-start) without a need for manual or environmental control system intervention.

PART 3 EXECUTION

3.1 INSTALLATION

A. Erect all ductwork in the general locations shown.

B. Conform to all structural and finish conditions of the building.

C. Ductwork shall not be allowed to pass through or over designated electrical rooms.

D. Before fabricating any ductwork, check the physical conditions at the job site and make all necessary changes in cross sections, offsets, and similar items, whether they are specifically indicated or not.

E. Where ductwork is shown to be lined on the inside with duct liner, the sizes shown on the plans are the inside dimensions. Therefore, sheet metal dimensions shall be increased accordingly.

F. Seal all joints both transverse and longitudinal seams, with duct sealant in accordance with Table 1-2 Class B.

G. Install 1” roll type filter media on all return duct openings prior to starting blowers. Leave in place and change as necessary during construction.

H. Before installing grilles, operate air conditioning unit fans and remove all debris or foreign matter.

I. Rectangular ductwork:
   1. Construct in accordance with SMACNA, Duct Construction Standards for the specific duct pressure classification involved (see pressure classification). Do not use radius ells with square throats.

J. Round ductwork:
   1. Connect with slip type joints using a minimum of three sheet metal screws per joint and in accordance with SMACNA Duct Construction Standards.

K. Flexible ductwork:
   1. All flexible ducts shall be demountable and individual lengths shall not be in excess of seven feet. Flexible ducts are not allowed to substitute rectangular return air ductwork unless approved by engineer.
   2. Use only factory-made connectors.

3. Flexible ducts should be installed fully extended, free of sags and kinks.

L. Reinforcement:
1. Reinforce all ducts to prevent buckling, breathing, vibration, or unnecessary noise.
2. Reinforcing shall be in accordance with SMACNA Duct Construction Standards (Metal and Flexible), Tables 1-3, 1-4, 1-5, 1-6, 1-7, 1-8, and 1-9 plus any additional reinforcing to meet job conditions.
3. All ducts shall be supported in accordance with SMACNA Duct Construction Standards (Metal and Flexible), Tables 4-1, 4-2, and 4-3.

M. Flexible Connections:
1. Where ducts connect to fans or air handling units, make flexible airtight connections using "Ventglas" fabric.
2. The fabric must be fire-resistant, waterproof, and mildew resistant with a weight of approximately 30 ounces per square yard.
3. Provide a minimum of 1/2 inch slack in the connections, and a minimum of 2-1/2 inches distance between the edges of the ducts.
4. Provide a minimum of 1-inch slack for each inch of static pressure on the fan system.
5. Securely fasten fabric to apparatus and to adjacent ductwork by means of galvanized flats or draw bands.
6. Do not install outdoors, except where detailed on plans.
7. Where connections are made in outdoor locations, seal fabric to metal with mastic.

N. Access Doors:
1. Install ductwork access doors in structural angle frames and provide with sash locks and hinges arranged for convenient access.
2. Construct doors which occur in insulated ducts with an insulation filler.
3. All access doors shall be appropriately labeled.

O. Flashing and Opening Sealing:
1. Ducts passing through roofs or exterior walls:
   a. Provide suitable flashing to prevent rain or air currents from entering the building as detailed on plans.
   b. The flashing shall be minimum No. 24 gauge galvanized steel.

P. Ducts passing through mezzanine walls:
1. Completely seal the penetration with acoustic sealant and fill all gaps between the ductwork and the wall materials.
2. Sealant must be capable of preventing sound from exiting the mechanical rooms through these openings.

Q. Ducts penetrating the floor:
1. Make the entire penetration watertight by installing appropriate flashing and/or application of G.E. silicone sealant.
2. The penetration must be capable of maintaining standing water in the mechanical area without allowing any water through the opening.

R. Duct Leakage:
1. Seal ductwork in accordance with Table 1-2 of the SMACNA HVAC Duct Construction Standards - Metal and Flexible.

2. Minimal leakage is expected for ductwork constructed to these standards but in no case shall the total leakage exceed 1% of designed CFM.
3. All joints to be sealed with duct sealant.

S. Fire and Smoke Dampers:
1. Install fire and smoke dampers at locations shown on plans, and where required by local and state ordinances.
2. Do not compress or stretch SFD, FD frame into duct or opening.
3. Install dampers square and free from racking with blade running horizontally.
4. Handle damper suing sleeve or frame. Do not lift damper using blades actuator, or jackshaft.
5. Install bracing for multiple section assemblies to support assembly weight and to hold against system pressure. Install bracing as needed.
6. Provide access doors in attached ductwork for inspection.
7. Stencil each door "Fire Damper Access" per UL 555 Standard.
8. Install fire dampers in openings utilizing steel angles, sleeves, and other materials, and practices required to provide an installation equivalent that used by manufacturer when dampers were tested at UL.
9. Install in accordance with damper manufacturer`s published recommendations and instructions and NFPA 90A.

3.2 BALANCING DAMPERS

A. Volume Control Dampers:
1. Install manually operated volume control dampers in all branch ducts, splits, or taps whether indicated on the drawings or not. Install a minimum of 5’-0” from grille/diffuser.
2. Provide indicating device with lock to hold damper in position.

B. Cable Operated Dampers:
1. Install a minimum of 5’-0” from grille/diffuser.
2. Install to facilitate smooth blade movement and ensure alignment.

C. Back Draft Dampers:
1. Install back draft dampers as shown on plans.
2. Manufacturer: Nailor Industries Series 1300 or equal.

D. Air Intake Ducts:
1. Insulate all outside air intake ducts.

3.3 DAMPER IDENTIFICATION

A. Provide a securely attached red band and a label reading "Damper Location" at the location of all concealed manual dampers.

B. All manual dampers which are not readily visible after duct insulation installation shall be identified in this manner.

3.4 DUCTWORK SUPPORT

A. All ducting must be supported from building structure.

B. Duct straps are not allowed to be screwed to roof decks, support from cross bridging, or supported from bottom chord of joists.

C. Do not support from roof or floor deck joist bridging.

D. Support sizes and spacing shall conform to SMACNA Standards.

END OF SECTION

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SECTION 23 33 33

ACCESS DOORS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions, Division 01 Specifications, and Section 23 00 00, apply to this Section.

1.2 SECTION INCLUDES

A. Access doors and their installation requirements.

1.3 RELATED SECTIONS

A. Division 28 - Fire Alarm System

B. Section 22 05 24 - Valves - General

C. Section 22 11 17 - Domestic Water Piping and Appurtenances

D. Section 22 13 17 - Soil, Waste, and Sanitary Drain Piping, Vent Piping, and Appurtenances

E. Section 22 13 18 - Condensate Piping

F. Section 22 16 01 - Natural Gas Piping and Appurtenances

G. Section 22 40 01 - Plumbing Fixtures and Fixture Carriers

H. Section 23 00 00 - Basic Mechanical Requirements

I. Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC

J. Section 23 09 23 - Energy Management Control System

K. Section 23 31 13 - Metal Ductwork

1.4 SUBMITTALS

A. Provide submittal data on all items specified in this section in accordance with Specification Section 23 00 90, General Conditions, and Division 01.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acudor

B. Elmdor

C. Mifab

2.2 ACCESS DOORS

A. Locations requiring access doors:
   1. Concealed valves
   2. Traps
   3. Trap primers
   4. Controls
   5. Cleanouts
   6. Dampers
   7. Ducts adjacent to fire doors, fire dampers, and smoke detectors.
   8. Equipment above hard ceilings.
   9. Other equipment requiring accessibility for operation and maintenance.

B. Type:
   1. Hinged flush-type steel framed door with straps and exposed narrow border.

C. Minimum size:
   1. 18" x 18" unless otherwise indicated.
   2. 24” x 24” for equipment above hard ceilings.
   3. Conform to architectural panel pattern for acoustical ceilings.
   4. Confirm size with Building Inspector and Engineer.

D. Construction:
   1. Hinges: Concealed continuous type.
   2. Locking Device: Flush cam type, screwdriver operated.

E. Fire Rating:
   1. Same or better fire rating than the surrounding area.

F. Access doors located in kitchens, restrooms, or areas where water is present shall be stainless steel.

2.3 FACTORY PAINTING

A. Apply prime coat of rust inhibiting paint, unless located in wet area.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer`s instructions and recommendations.

B. In suspended acoustical ceilings, provide a beaded pin or other approved means for identification and easy removal where necessary.

C. Access doors shall only be installed in areas/locations that are readily accessible.

D. Doors shall be installed in such a manner that door will open 180 degrees.

END OF SECTION

SECTION 23 34 16

HVAC FANS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions, Division 01 Specifications, and Section 23 00 00, apply to this Section.

1.2 SECTION INCLUDES

A. Centrifugal fans

1.3 RELATED SECTIONS

A. Section 23 00 00 - Basic Mechanical Requirements

B. Section 23 05 93 - Testing, Adjusting and Balancing for HVAC

C. Section 23 31 13 - Metal Ductwork

D. Section 23 37 13 - Diffusers, Registers, and Grilles

1.4 REFERENCES

A. AMCA (DIR) - Air Moving and Conditioning Association, Inc.

B. UL - Underwriter’s Laboratory

1.5 QUALITY ASSURANCE

A. UL Listed and Bear Label

B. Tested in accordance with AMCA standards

1.6 SUBMITTALS

A. Provide submittal data on all items specified in this section in accordance with Specification Section 23 00 90, General Conditions, and Division 01.

B. Submit product data indicating typical catalog data, including arrangements, dimensions, general assembly, and materials used in fabrication.

C. Provide in table form a schedule similar to drawings with data listing all fans, information, accessories, etc.

D. Indicate mechanical and electrical service locations and requirements.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acme

B. Cook

C. Greenheck

D. CaptiveAire

E. PennBarry

F. Twin City Fans

2.2 GENERAL

A. Provide fan type, arrangement, capacity, size, motor horsepower, and motor voltage as shown on the drawings.

B. Rate fans according to appropriate Air Moving and Conditioning Association, Inc. (AMCA) approved test codes and procedures. Seal to be attached.

C. Supply fans with sound ratings below the maximums permitted by AMCA standards.

D. All fans provided must bear the UL Label.

E. Sound levels shall be as listed or quieter. Fans with excessive noise will be replaced at Contractor`s expense.

F. Fans are to be supplied with engraved aluminum nameplates indicating CFM, static pressure, manufacturer, serial number, and model number.

2.3 ROOF MOUNTED EXHAUST FANS

A. Type:
   1. Roof mounted, direct driven centrifugal exhaust ventilator. Fan shall be spun aluminum and mounted on vibration isolators.

B. Motors:
   1. NEMA design B with a minimum of Class B insulation rated for continuous duty and furnished at the scheduled voltage.
   2. Motor shall be electronically commutated motor rated for continuous duty and furnished either with internally mounted potentiometer speed controller or with leads for connection to 0-10 VDC external controller.
   3. Exhaust fan motor to be located outside of the exhaust airstream and enclosed in a weather-tight compartment.

C. Mounting:
   1. Resilient mounts outside the air stream.

D. Cooling:
   1. Forced air cooling.

E. Bearing Rating:
   1. Heavy duty regreasable ball type in a cast iron pillowblock housing selected for a minimum L50 life in excess of 200,000 hours at maximum catalogued operating speed.

F. Construction:

1. Fan shall be bolted and welded construction utilizing corrosion resistant fasteners.
2. Spun aluminum structural components shall be constructed of minimum 18 gauge marine alloy aluminum, and bolted to a rigid aluminum support structure.
3. Aluminum base shall have continuously welded curb cap corners for maximum leak protection.
4. Fan wheel shall be backward inclined, constructed of 100% aluminum, and provided with an aerodynamic aluminum inlet cone.
5. Integral conduit chase shall be provided through the curb cap and into the motor compartment to facilitate wiring connections.
6. Provide 1/2 inch galvanized mesh bird screen over openings

G. Features:
1. High Wind Rated
2. Disconnect switch: Factory wire the switch and motor to the junction box
3. Automatic dampers with curb flanges
4. Insulated, prefabricated curb with cant strips and with resilient gasket on top flange.
5. Minimum 18 gauge galvanized steel or aluminum.
6. Factory installed variable speed controller.
7. Minimum 18-inch curb height.
8. Lifting lugs.

H. Verify roof slope so that fans are installed in a level condition.

I. Coordinate and furnish curbs that are compatible with roof being installed.

2.4 CEILING MOUNTED EXHAUST FANS

A. Type:
1. Centrifugal, direct driven exhaust fans

B. Motors:
1. Motor shall be totally enclosed type with permanently lubricated bearings and built-in thermal overload protection.

C. Construction:
1. Fan housing shall be minimum 20 gauge galvanized steel and acoustically insulated.
2. Blower and motor assembly shall be mounted to a minimum 14 gauge reinforcing channel.
3. Fan wheels shall be twin DWDI centrifugal forward curved type, constructed of galvanized steel.
4. Integral aluminum backdraft damper.

D. Features:
1. Disconnect switch: Internal wiring box with switch.
2. Blower assembly to be easily removed without disconnecting the ductwork.
3. Factory tested prior to shipment.
4. Powder painted white steel grille.
5. Factory installed variable speed controller.
6. Provide 277 volt to 120-volt transformer.

2.5 SUPPLEMENTAL EQUIPMENT

A. Weatherproof motor covers for outdoor installations:
   1. Apply the same finish as used on the fan.

B. Belt driven fans:
   1. 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 percent speed variation from full open to full closed.

C. Nonadjustable motor sheaves:
   1. Use for motor sizes over 15 horsepower.

D. Factory wired safety disconnect switch on each unit.

E. Heaters with starters.

F. Internal overload protection circuit.

2.6 PROTECTIVE COATINGS

A. Apply manufacturer`s standard prime coat and finish to all fans, motors, and accessories, except on aluminum surfaces or where special coatings are required.

B. Galvanizing:
   1. Hot dip coat all surfaces which require galvanizing.
   2. Where galvanizing is specified, a zinc coating may be used.
   3. After fabrication, apply the zinc coating and air dry the coating to 95 percent pure zinc.
      a. Zinc Coatings:
         1) Amercoat
         2) Diametcoat
         3) Sealube
         4) Zincilate

C. All exhaust fans which will operate in a corrosive environment (Science Labs, etc.) shall have a factory applied acid resistant coating.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install fans according to the manufacturer`s instructions and in the locations shown on the drawings.

B. All roof mounted fans shall have electrical wiring and conduit internal to roof curb and fan housing. No external wiring or conduit will be allowed on roof.

C. Verify compliance of “in Situ” vibration readings with AMCA 204-05.

D. All fans shall be air balanced in accordance with Section 23 05 93.

E. Top of level curb to have minimum 11” from finished roof to top of curb.

F. Screw fans to curbs with gasketed screws.

3.2 START-UP

A. Start fans to verify rotation and operation sequence prior to test and balance.

3.3 IDENTIFICATION

A. Provide identification per Section 23 05 53.

END OF SECTION

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SECTION 23 37 13

DIFFUSERS, REGISTERS, AND GRILLES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions, Division 01 Specifications, and Section 23 00 00, apply to this Section.

1.2 SECTION INCLUDES

A. Grilles

B. Diffusers

C. Registers

1.3 RELATED SECTIONS

A. Section 23 00 00 - Basic Mechanical Requirements

B. Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC

C. Section 23 31 13 - Metal Ductwork

D. Section 23 34 16 - HVAC Fans

1.4 REFERENCES

A. ARI Standard 890-94 - Rating of Air Diffusers and Air Assembles.

1.5 SUBMITTALS

A. Provide submittal data on all items specified in this section in accordance with Specification Section 23 00 90, General Conditions, and Division 01.

B. Product data for review prior to placement of purchase order:
   1. Outlets
   2. Grilles
   3. Registers
   4. Control devices
   5. Diffusers
   6. Similar equipment

C. Product data shall be submitted for each device specified. Data shall be arranged to match grille schedule.

D. If a manufacturer other than the one scheduled on the plan is used, the sizes shown on the plans shall be checked for performance, noise level, face velocity, throw, pressure drop, etc., before the submittal is made.

E. Selections shall meet the manufacturer`s own published data for the above performance criteria.

F. If grilles other than those scheduled by name are furnished, manufacturer shall be prepared to demonstrate compliance with noise criteria at Engineer`s request and to Engineer`s satisfaction.

1.6 COORDINATION

A. Coordinate this work with work under Division 26 to ensure that intended functions of lighting and air systems are achieved.

B. Locations of outlets on plans are approximate and shall be coordinated with other trades to make symmetrical patterns.

C. Locations shall be governed by the established pattern of the lighting fixtures or architectural reflected ceiling plan.

D. The Contractor shall move any grille, register, or outlet up to four feet in any direction as directed by the Engineer at no additional cost.

PART 2 PRODUCTS

2.1 GENERAL

A. Provide grilles, registers, and diffusers as shown or scheduled on the plans. Conform to ARI 890-94.

B. All air distribution devices in kitchen and any wet areas such as locker rooms, showers, and restrooms shall be 100% aluminum construction.

C. All air distribution devices for 1-hour structures (walls or ceilings) shall be steel construction conforming to all codes and standards.

2.2 MANUFACTURERS

A. Metalaire

B. Krueger

C. Titus

D. Nailor

E. Price

F. Greenheck

2.3 PERFORMANCE CRITERIA

A. Throw: Velocity at the end of the throw, in the 5’-0” occupancy zone, will be between 25 to 50 FPM.

B. Noise levels (NC Curve):
   1. Not to exceed those scheduled below.
      a. Classrooms, Libraries, and Offices - 25 N.C.
      b. Cafeterias - 30 N.C.
      c. Gymnasiums - 40 N.C.

C. All devices shall be tested per Air Diffusion Council and labeled as such.

2.4 FINISHES

A. Paint exposed devices with factory standard prime coat or factory finish coat. Architect/Engineer to determine final color of grille.

PART 3 EXECUTION

3.1 INSTALLATION

A. Where called for on the schedules, the grilles, registers, and ceiling outlets shall be provided with deflecting devices and manual dampers. These shall be the standard product of the manufacturer, subject to review by the Engineer.

B. All ceiling devices shall be furnished to be compatible with the ceilings in which they are installed.

END OF SECTION

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SECTION 23 43 23

BIPOLAR IONIZATION AIR PURIFICATION SYSTEM

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions, Division 01 Specifications, and Section 23 00 00, apply to this Section.

1.2 DESCRIPTION OF WORK

A. This section describes the design, performance, and installation of a bipolar ionization air purification system intended for use on the project. Ionization units shall be supplied to provide between 500 and 1500 negative ions per cubic centimeter in the areas served.

B. Where the air purification system is intended to reduce outside ventilation air in accordance with the International Mechanical Code and ASHRAE Std 62.1, the manufacturer shall provide calculations to justify such reduction.

1.3 RELATED SECTIONS

A. Section 23 00 00 - Basic Mechanical Requirements

B. Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC

C. Section 23 31 13 - Metal Ductwork

D. Section 23 37 13 - Diffusers, Registers, and Grilles

1.4 SUBMITTALS

A. Provide submittal data on all items specified in this section in accordance with Specification Section 23 00 90, General Conditions, and Division 01.

B. Submit product data indicating typical catalog data, including arrangements, dimensions, general assembly, and materials used in fabrication.

C. Provide in table form a schedule similar to drawings with data listing all units, information, accessories, etc.

D. Indicate mechanical and electrical service locations and requirements.

1.5 QUALITY ASSURANCE

A. The air purification system shall be a product of an established manufacturer with a minimum of 10 outside air reduction installations in successful operation in the USA. Technologies that do not operate through a gas disassociation process like UV lights, powered particulate filters, and/or polarized media filters, will not be considered.

B. A qualified representative from the manufacturer shall be available to inspect the installation of the air purification system to ensure installation in accordance with

manufacturer`s recommendation.

C. The air purification system products shall be tested and listed by UL and ETL according to UL Standard 2998 - Electrostatic Air Cleaners. Air purification system products shall specifically be tested and passed UL 2043 to ensure plenum rating.

D. The operation of bi-polar ionization units shall conform to UL 867 with respect to ozone generation.

E. The manufacturer must submit Indoor Air Quality calculations to confirm acceptable indoor conditions at the scheduled air flows in accordance with ASHRAE Std 62.1. The calculations shall be independently validated to verify accuracy of the IAQ calculations and conformance with ASHRAE Std 62.1 by third-party testing on a previous installation.

1.6 RELATED WORK PERTAINING TO OTHER SPECIFICATIONS

A. Electrical wiring

B. Ductwork

1.7 REFERENCE CODES AND STANDARDS

A. UL Standard 2998 and UL 2043

B. National Electric Code NFPA 70

C. ASHRAE Std 62.1

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

A. Plasma Air International

B. Bioclimatic

C. Phenomenal Air

D. Air Oasis

E. Other qualified manufacturers meeting the requirements of this specification may be
1. submitted for approval 10 business days prior to bid date.

2.2 PERFORMANCE CRITERIA

A. The bipolar ionization system shall operate and be a zero ozone product.

B. Each piece of air handling equipment, so designated on the plans, details, equipment schedules, and/or specifications shall contain a plasma ion generator with bipolar ionization output as described here within.

C. The Bi-polar Ionization system shall be capable of:
1. Effectively neutralizing microorganisms downstream of the bipolar ionization equipment (mold, bacteria, virus, etc.).
2. Controlling gas phase contaminants generated from human occupants, building structure, furnishings, and outside air contaminants.

3. Reducing space static charges.
4. Reducing space particle counts.
5. When mounted to the air entering side of a cooling coil, keep the coil free from pathogen and mold growth.
6. All manufacturers shall provide documentation by an independent accredited laboratory that proves the product has minimum neutralized rates for the following pathogens given the allotted time and in space conditions.
    a. MRSA - 99.75% in 30 minutes
    b. Influenza Virus (H1N1) - 80.5% in 30 minutes, 86.6% in 60 minutes
    c. E. Coli - 99.43 % in 120 minutes
    d. Cladosporium Cladosporiodes - 97.7% in 120 minutes
    e. Aspergillus Niger - 97.1% in 120 minutes
    f. Staphylococcus Aureus - 81.7% in 120 minutes
7. Manufacturers not providing the equivalent space neutralized rates shall not be acceptable. All manufacturers requesting prior approval shall provide to the engineer independent test data from an accredited independent lab confirming the neutralized rates and time per the above.

D. The bipolar ionization system shall operate in such a manner that equal amounts of positive and negative ions are produced. Single pole ion devices shall not be acceptable.
1. Airflow rates may vary through the full operating range of a VAV system. The quantity of air exchange shall not be increased due to requirements of the air purification system.
2. Velocity Profile: The air purification device shall not have a maximum velocity profile.

E. Humidity: Plasma Generators shall not require preheat protection when the relative humidity of the entering air exceeds 85%. Relative humidity from 0 - 100%, condensing, shall not cause damage, deterioration, or dangerous conditions to the air purification system.

2.3 EQUIPMENT REQUIREMENTS

A. Electrode Specifications (Bi-polar Ionization):
1. Each plasma generator with bipolar ionization output shall include the required number of electrodes and power generators sized to the air handling equipment capacity.
2. Electrodes shall be energized when the main unit disconnect is turned on and the fan is operating.
3. Ionization output from each electrode shall be a minimum of 5 million ions/cc when tested at 2” from the ion generator.
4. Manufacturer shall demonstrate that no voltage potential exists due to exposed electrical components in the duct system or plenum. Exposed needles protruding into the air steam will not be accepted.

B. Air Handler mounted units
1. Where so indicated on the plans and/or schedules, Plasma generators shall be supplied and installed. Ion generators for air handling units shall be furnished in a linear or rack mounted configuration so as to minimize the space required for installation. Ionization "rack" shall be no more than 3" deep in the direction of airflow.

2. The mechanical contractor shall mount the plasma ionization rack and wire it to the remote mount power supply panel using only low voltage wiring. Low voltage wiring shall be defined as 12V. The use of line voltage (120V or 230V) or high voltage cabling (600V or higher) shall not be acceptable due to safety concerns.
3. The remote mount power supply panel shall be capable of accepting voltage ratings of 12V DC, 24V AC, 120V AC, or 230V AC. The panel shall have an on/off switch, power indicator LED, and a set of dry contacts which will indicate ionizer functionality. Dry contacts that indicate power available only shall not be acceptable.

C. Duct mounted units
1. Where so indicated on the plans and/or schedules, plasma ion generators shall be supplied and installed by the mechanical contractor. The contractor shall follow all manufacturer IOM instructions during installation.
2. Ion generators shall be furnished with a factory-equipped gasketed mounting flange to prevent air leakage. Gasketed flange shall be a minimum of 1 1/8" wide around the perimeter of the ionizer to ensure no leakage occurs.
3. Ion generators shall be field installed in a location that is convenient for visual inspection, removal, and servicing. They shall include an ion indicator light clearly visible from below the installed location.
4. Ion generators shall be wired from the 24V AC fan and common terminal of the control power circuit. Ion generators shall be capable of directly accepting 24V AC power. The use of loose step down transformers or power converters shall not be acceptable.

2.4 ELECTRICAL AND CONTROL REQUIREMENTS

A. Ion generators shall contain a built-in power supply and operate on 24V AC and shall connect to the fan and common terminals of the fan coil unit or air handling unit served. Ion generators requiring a loose 24V, 120V, or 230V transformer or power supply will not be accepted.

B. Wiring, conduit, and junction boxes shall be furnished and installed by the electrical contractor within housing plenums and shall be UL and NEC NFPA 70 approved.

C. All plasma ion generators shall include internal short circuit protection, overload protection, and automatic fault reset. Overload protection and associated automatic fault reset shall occur internally to the unit and be performed through circuitry on the unit`s PCB. Manual fuse replacement and manual fault reset of each unit shall not be accepted.

D. All plasma ion generators shall include an external BMS interface to indicate ion generator status and alarm. Light emitting diode shall be visible from the ground for each unit and shall be on any time power is on to the unit and ions are being generated. Light signaling unit power only shall not be acceptable.

PART 3 EXECUTION

3.1 INSTALLATION REQUIREMENTS

A. Ionization units shall be installed per manufacturer`s installation instructions and requirements.

3.2 ASSEMBLY AND INSTALLATION

A. Assemble ionization units and install in supply ductwork downstream of all coils and upstream of the first supply tap. Ionization units are not to be installed in return air ductwork.

B. Ionization units to be installed inside unit cabinet. No screws or penetrations will be allowed to attach inside unit. The preferred mounting location is upstream of the fan inlet, downstream from unit particle filter(s), and upstream of unit’s cooling coil.

C. Electrical contractor shall complete single point power connections.

D. Protect equipment from water and damage before and after installation.

3.3 COMMISSIONING AND TRAINING

A. A manufacturer`s authorized representative shall provide start-up supervision and training of owner`s personnel in the proper operation and maintenance of all equipment.

B. Provide 5 copies of Operating and Maintenance Manuals.

C. Optional Add for Handheld Ion Counter: Provide to the owner a portable handheld ion counter with a calibrated range of 0 to 20,000 ions/cm3 and an accuracy of +/- 25% within the specified range. Ion counter shall have automatic zeroing capability on 10-minute intervals.

3.4 WARRANTY

A. Equipment shall be warranted by the manufacturer against defects in material and workmanship for a period of twelve months after shipment or eighteen months from owner acceptance, whichever occurs first. Labor to replace equipment under warranty shall be provided by the installing contractor.

END OF SECTION

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SECTION 23 52 33

WATER TUBE BOILERS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions, Division 01 Specifications, and Section 23 00 00, apply to this Section.

1.2 SECTION INCLUDES

A. Natural gas-fired hot water boilers for use in providing hot water for space heating.

1.3 RELATED SECTIONS

A. Section 22 16 01 - Natural Gas Piping and Appurtenances

B. Section 23 00 00 - Basic Mechanical Requirements

C. Section 23 05 19 - Meters and Gauges for HVAC Piping

D. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment

E. Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC

F. Section 23 09 23 - Energy Management Control System

G. Section 23 21 13 - Hydronic Piping, Valves, and Appurtenances

H. Section 23 21 23 - Hydronic Pumps

1.4 REFERENCES

A. Texas Department of Labor Boiler Rules and Regulations.

B. AGA - American Gas Association

C. GAMA - Gas Appliance Manufacturers Association

D. ASME - The American Society of Mechanical Engineers

E. NFPA - National Fire Protection Association

F. ANSI - American National Standards Institute

G. Texas Boiler Law

1.5 SUBMITTALS

A. Product Data:
   1. Provide submittal data on all equipment specified in this section in accordance with Section 23 00 00, General Conditions, and Division 01.
   2. Submit product data indicating typical catalog of information including arrangements.

3. Submit product data sheets indicating dimensions, general assembly, and materials used in fabrication.
4. Indicate mechanical and electrical service locations and requirements.
5. Submit manufacturer`s installation instructions.

B. Shop Drawings:
1. Submit 1/4" per foot shop drawing(s) showing all ducts, piping, and equipment shown by plans and specifications. Submit drawings on all mechanical rooms. The drawings shall be coordinated with structural and electrical. Provide sections for all congested areas and mechanical rooms.

1.6 WARRANTY

A. Heat Exchanger:
1. 10-year limited warranty against failure caused by defective workmanship or material.

PART 2 PRODUCTS

2.1 MANUFACTURER/MODEL

A. Lochinvar

B. Aerco

C. Larrs

D. Camus

E. Raypak

F. RBI

G. Patterson-Kelley

2.2 TYPE

A. Natural Gas Fired
1. Material:
a. 16-gauge jacket material.
b. Galvanized inside and outside.
c. Protect with a 3-coat acrylic enamel finish.

B. Meet performance criteria listed on the plans.

C. National Board listed for 160 psi working pressure.

D. AGA listed and approved.

E. ASME "H" stamped.

F. Test certified at 84% thermal efficiency.

G. Minimum 4:1 turndown

H. Factory assembled, pre-wired, and tested.

I. Boiler manufacturer to provide primary pump for low-temperature bypass piping system.

2.3 WATER-CONTAINING SECTIONS

A. Material:
1. Copper

B. Construction:
1. Fin-tube construction using straight, solid copper tubes.
2. Extruded integral fins spaced at 7 fins per inch.
3. Tubes to be set horizontal and rolled securely into glass-coated cast iron headers. The tubes shall terminate into a one piece, lined, cast iron header. There shall be no bolts, gaskets, or "O" rings in the header configuration.

2.4 HEAT EXCHANGER

A. Construction:
1. Horizontal, two-pass configuration. Gasket-less.
2. Completely enclose the combustion chamber for maximum efficiency.

2.5 COMBUSTION CHAMBERS

A. Type:
1. Sealed combustion type employing "power burner" concept.

B. Burner:
1. The combustion chamber shall be sealed and completely enclosed with ceramic fiberboard insulation.
2. The burner shall have an integral blower to precisely control the Fuel/Air mixture for maximum efficiency.
3. Pre-purge cycle: "Cleans" the combustion chambers prior to ignition upon a call for heat.

2.6 STANDARD OPERATING CONTROLS

A. Glow-plug ignition device.

B. Operating aquastat.

C. Electric high-limit switch.

D. Automatic main gas valve.

E. Redundant gas valve.

F. Main gas pressure regulator.

G. Master switch with pilot light.

H. ASME pressure relief valve.

I. Temperature gauges.

2.7 OPERATION MONITORING

A. External viewing ports:
   1. Permits visual observation of burner operation.

B. Low NOx Requirements:
   1. All boilers shall meet the TNRCC requirements for low NOx emissions as follows:
      a. ≤ 75 MBTU 55 PPM
      b. > 75 ≤ 400 MBTU 55 PPM
      c. >400 MBTU 30 PPM

C. Boilers/water heaters not meeting these standards will be rejected.

2.8 THREE-WAY MIXING VALVE

A. Provide and install low-temperature mixing valve at the inlet/ bypass of each boiler.

2.9 FLUE

A. Provide type, category, and size per manufacturer with stainless inner liner.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install at the locations shown and in accordance with the details provided on the plans and in these specifications.

B. Provide a factory start-up report by the boiler supplier. Start-up report shall be made and delivered to the mechanical engineer and the test and balance agency. The following items shall be noted and recorded. Temperature settings for each stage, high limit temperature, inlet water temperature, outlet water temperature, temperature difference (Delta T), gas pressure (Inches WC), unit on, unit off, type of gas, manifold gas pressures at each gas valve, air pressure at combustion air blower, type of venting, draft readings, supply water settings, and name of reporting person.

C. Equipment Mounting:
   1. Install boilers on cast-in-place 4” concrete equipment base.

D. Install gas-fired boilers according to NFPA 54, ANSI Z223.

E. Assemble and install boiler trim.

F. Install electrical devices furnished with boiler but not specified to be factory mounted.

G. Install control wiring to field mounted electrical devices.

H. Hardwire interlock each boiler to carbon monoxide (CO) sensor.

3.2 CONNECTIONS

A. Piping:
   1. Each boiler shall be provided with all necessary inlet and outlet connections. Refer to specific Boiler’s specification sheet for connection sizes.

2. Check Manufacturer's Installation Manual for clearance dimensions and install piping that will allow for service and ease of maintenance.
3. Install piping from equipment drain connection to nearest floor drain. Piping shall be at least full size of connection and adhere to proper codes.

END OF SECTION

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SECTION 23 81 26

SPLIT SYSTEM HVAC UNITS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions, Division 1 Specifications, and Section 23 00 00, apply to this Section.

1.2 SECTION INCLUDES

A. Split system HVAC units.

1.3 RELATED SECTIONS

A. Section 22 13 18 - Condensate Piping

B. Section 23 00 00 - Basic Mechanical Requirements

C. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment

D. Section 23 05 93 - Testing, Adjusting and Balancing for HVAC

E. Section 23 09 23 - Energy Management Control System

F. Section 23 23 00 - Refrigerant Piping

G. Section 23 31 13 - Metal Ductwork

1.4 REFERENCES

A. Refer to Section 23 00 00 for complete names of references identified in this section.
   1. AGA - American Gas Association
   2. AHRI 210/240 - Unitary Air-Conditioning and Air Source Heat Pump Equipment
   3. AHRI 270 - Sound Rating of Outdoor Unitary Equipment
   4. ANSI/ASHRAE Std 15 - Safety Code of Mechanical Refrigeration
   5. ASHRAE Std 90.1 I-P-2001 - Energy Standard for Buildings Except Low Rise Residential Buildings
   6. ASHRAE Std 62.1-2001 - Ventilation for Acceptable Indoor Air Quality
   7. D.O.E. - Department of Energy
   8. IECC - International Energy Conservation Code
   9. NFPA 70 N.E.C. National Electrical Code
   10. UL - Underwriters Laboratory

1.5 SUBMITTALS

A. Product Data:
   1. Provide submittal data on all equipment specified in this section in accordance with Section 23 00 90, General Conditions, and Division 1.

B. Submittals shall include:
   1. Unit model number

2. Refrigerant type
3. Sound rating in accordance with AHRI 270
4. Cooling efficiency in accordance with AHRI 210/240
5. All accessories

C. Submit product data indicating typical catalog of information including arrangements.

D. Submit product data sheets indicating dimensions, general assembly, and materials used in fabrication.

E. Provide in table form a schedule similar to drawings with data listing all unit information, data, accessories, etc.

F. Indicate mechanical and electrical service locations and requirements.

G. Submit letter from air conditioning manufacturer stating refrigerant line design has been reviewed.

H. Submit manufacturer`s installation instructions.

I. Shop Drawings: (adjust as required)
1. Submit 1/4" per foot shop drawing(s) showing all piping, ductwork, and equipment shown by drawings and specifications. Submit drawings on all mechanical rooms. The drawings shall be coordinated with structural, electrical, and fire sprinkler drawings.

J. Equipment Start-up Report
1. Submit an equipment start-up report as provided by the equipment manufacturer. Start-up report shall include the following, but not limited to: verification of system airflow, proper operation of all motors and fans, proper tensioning of belts and pulleys, proper operation of on-board microprocessor control system, proper control of economizer damper, proper compressor operation, and proper operation of cooling, heating, and dehumidification modes.

1.6 QUALITY ASSURANCE

A. UL listed and must display UL label on all units.

B. All units must comply with ASHRAE Standard 90.1 and the applicable International Energy Conservation Code.

C. Unit performance data must be rated in accordance with AHRI 210/240 and must display the AHRI symbol on all standard units.

D. Conform to applicable ANSI/NFPA 70 code for internal wiring of factory wired equipment.

E. Air conditioning manufacturer to visit site and inspect installation of units and refrigerant lines, and provide letter stating installation conforms to installation instructions.

F. Tested in accordance with the Department of Energy.

G. The air conditioning equipment manufacturer shall be solely responsible for their equipment that does not comply with the performance of their published catalogs and specifications.

1.7 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data.
   1. Include manufacturer`s descriptive literature, operating instructions, installation instructions, maintenance, and repair data, including filter replacement and unit lubrication.

B. Air conditioning manufacturer to visit site and inspect installation of units and refrigerant lines, and provide letter stating installation conforms to installation instructions.

1.8 WARRANTY

A. Complete 1-year warranty on all equipment.

B. 5-year warranty provided for the compressors and heat exchangers.

C. 10-year warranty provided for galvanized heat exchangers.

D. 15-year warranty provided for stainless steel heat exchangers.

E. The warranted compressor assembly consists of the starter, rotor, eccentric shaft, eccentric rods, pistons, wrist pins, suction valves, discharge valves, unloading mechanisms, oil pump, and the housing in which these parts are enclosed.

F. The warranty shall indicate model, serial number of the unit, and commencing date. The commencing date of the warranty shall be after the building has been accepted for occupancy.

PART 2 PRODUCTS

2.1 MANUFACTURERS: SPLIT SYSTEM, HEAT PUMP, GAS FURNACE, ELECTRIC HEAT

A. Lennox

B. Trane

C. Daikin

D. Carrier

2.2 SPLIT SYSTEM HEATING/ COOLING UNITS

A. All units to have standard mechanical thermostat terminal strip. Units with OEM branded controls and/or integration boards not allowed.

B. All units 1½ to 2 ½ tons units to be at minimum 13.0 SEER nominal.

C. All units 3 to 5 tons to be at minimum 17 SEER nominal. All units to have two stage compressor and a minimum two speed fan.

D. Minimum Cooling Efficiencies:
   1. EER ratings by AHRI 210/240 and AHRI 340/360 (I-P):
      a. All units SEER/EER values shall meet or exceed Energy Efficiency Ratios shown on schedule.
      b. All units to comply with ASHRAE 90.1.

c. All units to comply with latest International Energy Conservation Code.

E. Electric Furnaces/Air Handlers:
1. Heating capacities:
a. As scheduled on plans at rated voltage.
2. Three-phase electrical power:
a. Impose an equal electrical load on all phases of heater.
b. Electrical resistance elements which are not balanced over all three phases are not acceptable.

F. Condensing Units:
1. Features:
a. Crankcase heaters
b. Timed off control
c. Low Ambient cooling to 45°F
d. Hi/Low pressure switches
e. Over current protection
f. Filter Dryer
g. Provide Hail Guards on all Condensing Units
h. Provide any reference specialties that manufacturer requires
i. Refrigerant 410-A

G. All Air Handlers:
1. Features:
a. 2-inch filter racks to be provided at each air handler.
b. Easy access to filters
c. Provide extra set of filters, Farr 3030 pleated 2” thick. MERV ³ 6.0.
d. Low voltage terminal strip
e. All blowers shall deliver a minimum of 450 cfm/ton at .5" E.S.P.
f. Furnish and install auxiliary drain pans below each air handler. Provide float switches for all auxiliary drain pans.
2. Class I motorized outside air dampers. All outside air dampers to be low leak dampers. Dampers shall have an air leakage rate not greater than 4 cfm/sqft. and shall be labeled by an approved agency when tested in accordance with AMCA 500D.

H. Accessories:
1. Unit with Economizer Mode and Fault Detection and Diagnostics:
a. All cooling only units are to be provided with a dry bulb economizer. When outdoor dry bulb conditions are met, and the space temperature sensor is calling for cooling, the economizer mode of the unit shall provide free cooling to the space.
b. All units 3 tons and above are to be provided with a dry bulb economizer. When outdoor dry bulb conditions are met, and the temperature sensor is calling for cooling, the economizer shall provide free cooling to the space. The dehumidification cycle and heating modes shall be disabled during economizer mode.
c. All economizers must be equipped with fault detection and diagnostics. The motorized, modulating dampers shall be capable of reporting faults to a fault management application system or displayed on the zones thermostat. The fault detection system shall be capable of detecting the following faults:
1) Air temperature sensor failure.

2) Not economizing when the unit should be economizing.
3) Economizing when the unit should not be economizing.
4) Dampers not modulating.
5) Excess outdoor air.

d. Economizer operation, fault detection, and control shall be the responsibility of the controls contractor. There shall be no interlock between the Energy Management Control System and the unit's integral controls in regard to economizer operation. (i.e. Honeywell JADE Controllers are not allowed.)

e. The motorized, modulating outside air damper(s) and motorized return air damper(s) shall be provided and installed by the mechanical contractor. The controls contractor shall provide the 0-100% actuator to control the motorized, modulating outside air damper and the actuator to control the motorized damper in the return section.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with the plans, manufacturer`s instructions, and approved shop drawings.

B. Contractor to provide and install thermostat wire from air handler to condensing units.

C. Contractor to provide and install flexible watertight conduit for wiring.

D. Contractor to provide and install at minimum, 4" concrete housekeeping pad for each condensing unit that will sit on ground.

E. Coordinate with plumbing contractor on all condensate piping.

F. Install roll type filter media overall return air openings during construction if unit is operated. Replace as required.

3.2 IDENTIFICATION

A. Provide identification per Section 23 05 53.

3.3 EQUIPMENT START-UP

A. Equipment manufacturer to provide start-up.

B. Install and make hook-up to float switches.

C. Measure:
1. Outside air temperature, entering and leaving conditions of evaporators and condensers, compressor amps, indoor blower amps, gas pressure, pressure drop across evaporator coil.
2. Operate all units in heating and cooling modes with outside air in operation.
3. Provide report with final request for payment.
4. Install new, clean filters prior to test and balance.
5. Provide connection to refrigeration piping system and evaporators.

END OF SECTION

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SECTION 26 00 00

ELECTRICAL

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1, apply to this Division.

B. Provide all materials, equipment, labor, and transportation required to install a complete and working electrical system. It is the intent of the drawings and specifications to provide complete installations even though each and every item necessary is not specifically mentioned or shown.

C. Bidders shall determine the contents of a complete set of Drawings and Specifications and be aware that they may be bidding from a partial set of drawings, applicable only to the various separate contracts, subcontracts, or trades as may be issued for bidding purposes only. The submission of bids shall be deemed evidence of the review and examination of all existing conditions on site and all drawings, specifications, and addenda issued for this project as no allowances will be made because of unfamiliarity with any portion of the complete set of documents or site conditions.

1.2 RELATED REQUIREMENTS

A. All applicable provisions of Divisions 00 and 01 govern work under this Division. Refer to these articles in the specifications for additional information.

1.3 REFERENCES AND STANDARDS

A. NEC - the abbreviation is the National Electrical Code (NFPA Ch 70). Where used, this shall mean the latest adopted version of the NEC.

B. Perform all Division 26 work in strict accordance with the requirements and recommendations stated in the latest adopted version of all federal, state, and local codes, ordinances, and standards (NFPA, NEC, IECC, etc.) except when requirements are modified by the Authority Having Jurisdiction (AHJ).

C. Where local codes or practices exceed or conflict with the NEC, it shall be the Contractor's responsibility to perform the work in accordance with the local code prevailing and local interpretations thereof by the AHJ. This Contractor shall bear all costs for correcting any deficiencies due to non-compliance.

1.4 ABBREVIATIONS

A. ALT - Alternate

B. AFF - Above finish floor

C. AFG - Above finished grade

D. ATS - Automatic transfer switch

E. CLG - Ceiling

F. DFA - Down from above

G. DISC - Disconnect

H. EWC - Electric water cooler

I. EXIST / EX - Existing

J. FAP - Fire alarm plan

K. FACP - Fire alarm control panel

L. FAGA - Fire alarm graphic annunciator

M. FARA - Fire alarm remote annunciator

N. GND, GRN - Ground

O. GFCI - Ground-fault circuit interrupters

P. LED - Light Emitting Diode

Q. MTS - Manual transfer switch

R. MCC - Motor control center

S. NC - Normally closed

T. NO - Normally open

U. NTS - Not to scale

V. NIC - Not in contract

W. PNL - Panel

X. SFD - Smoke/Fire Damper

Y. TX - Transformer

Z. TYP - Typical

1.5 DEFINITIONS

A. Owner's Representative: Indicates the entity designated or hired to represent an owner on a project. This entity could be the owner themselves, an Architect or could be another third party hired to represent the owner. Verify who will be representing the owner on this project before bidding.

B. Contract Documents: Shall include, but not limited to Drawings, Specifications, Addenda, etc.

C. Approval: It is understood that approval must be obtained from the Owner's Representative in writing before proceeding with the proposed work. Approval by the Owner's Representative of any changes, submitted by the Contractor, will be considered as general in nature and only to aid the Contractor in expediting his work.

D. As required: Indicates that the contractor shall perform the work or provide the material as indicated in accordance with manufacturer's installation instructions and in accordance with the latest adopted version of applicable codes or regulations.

E. Contractor: Where the word(s) "contractor" or "this contractor" is used herein it refers to the contractor engaged to execute the work under this division of the specifications only, even though they may be technically described as a sub-contractor.

F. Directed: Terms such as directed, requested, authorized, selected, approved, required, and permitted mean directed by the Owner's Representative, requested by the Owner's Representative, and similar phrases.

G. Furnish: The term furnish means to equip with what is needed, supply and deliver to the Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

H. Indicated: The term indicated refers to graphic representations, notes, or schedules on the Drawings, or other Paragraphs or Schedules in the Specifications, and similar requirements in the Contract Documents. Terms such as shown, noted, scheduled, and specified are used to help the reader locate the reference. There is no limitation on location.

I. Install: The term install describes operations at the Project site including setting in position, connecting or adjusting for use, the actual unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

J. Or equal: Indicates that the contractor may substitute equipment by another manufacturer if the salient features of the equipment indicated by manufacturer's name and/or described are adequate in the judgment of the Owner's Representative.

K. Provide: Furnish and install all material and labor required for a complete installation ready for operation as required in accordance with the intent of the Contract Documents.

L. Shall: Indicates a mandatory requirement or requirements.

1.6 COORDINATION

A. For additional requirements, see Section 01 30 00 - Administrative Requirements.

B. Electrical service to all portions of existing buildings at the construction site not involved with the project shall remain in operation throughout construction. Provide all required temporary electrical service in the base bid to all required areas to satisfy OSHA requirements.

C. All metering and temporary electrical service charges and/or costs of utilities shall be paid by the Contractor.

D. The drawings are not to be construed as shop drawings but indicate the extent, general locations, arrangement, etc., of conduit systems and equipment. Electrical drawings are diagrammatic and shall not be scaled for exact size. If the contractor has any questions regarding the layout of a particular device or equipment item, he shall contact the Owner's Representative for clarification. This Contractor shall, in laying out their work, refer to other sections of the specifications and other drawings

such as air conditioning, structural, plumbing, architectural, civil, etc., to eliminate conflicts and undue delays in the progress of the work. Where items are furnished by other trades require connections by this Contractor, they shall be held responsible for providing rough-in drawings and assistance upon request.

E. In the event of interferences, piping or equipment requiring set grades or elevations shall have precedence over conduit, luminaires, outlet boxes, etc.

F. Plans, specifications, and other documents have been prepared and developed with reasonable professional care and coordination. It is the intent that all documents are supportive and complimentary, one to the other; and as such what is required by one shall be considered as required and binding as if indicated by all. Work indicated shall include, regardless of whether or not specifically stated, such supportive or required items or work as consistent with what is indicated, is reasonably inferable from what is indicated, and/or is common construction procedure or knowledge with regard to what is indicated.

G. In the event of a conflict between manufacturer's installation instructions and the Drawings, the manufacturer's installation instructions shall govern.

H. Should discrepancies be found among the Contract Documents and/or an interpretation is required, and a decision or interpretation to the contractor is not rendered by the Owner's Representative, it shall be assumed the contractor has reviewed all the documents to find the most costly method or items in question which then shall be required. One document does not take precedence over another when interpreting a discrepancy.

1.7 SUBMITTALS

A. The submittals required in this Division shall conform to and be submitted in accordance with the General Conditions, Instructions to Bidders, Division 1 and requirements listed in all sections of Division 26.

B. Provide submittals in PDF format. Paper submittals shall be rejected.

C. Shop drawings, manufacturer's data materials lists, etc., are required for all equipment and material where submittals are required.

D. Each submittal shall contain data relevant to the particular equipment (including options). The data shall be identified by "highlighting", arrows, underlining, etc. Do not submit pages of non-relevant information. Broad general data is not acceptable. If equipment submitted is not as specified in the Contract Documents, then the submittal shall contain specific details prominently identifying any differences in form, fit or function. If the equipment submitted is not as specified, then the Contractor shall be responsible for any additional costs necessary to install and connect the equipment. This includes, but is not limited to, increased panelboard size, circuit breaker size, disconnect size or circuit size.

E. Submit dimensional layout of all electrical equipment locations, drawn to scale, with equipment locations shown. Clearances shall be in accordance with NEC and local codes. Panelboard and switchgear submittals will be rejected without dimensioned room or equipment location layouts.

F. Some products require that a color selection be coordinated with the Owner's Representative. Information regarding such products shall be submitted to the

Owner's Representative for review.

G. If materials or equipment are installed before being reviewed without comment by the engineer, the contractor shall be liable for the removal and replacement of such unapproved materials and equipment, at no additional expense to the owner. Additionally, if the removal and replacement of unapproved materials or equipment necessitates the removal and replacement of other related materials or equipment, then the contractor shall be liable for the removal and replacement of the related materials and equipment at no additional expense to the owner.

H. Failure to submit items that meet the requirements of the contract documents in ample time for review shall not entitle the contractor to an extension of contract time, and no claim for extension by reason of such default shall be allowed. The contractor may be held liable for delays so occasioned.

1.8 CLOSEOUT SUBMITTALS

A. This Contractor shall accumulate during the job's progress the below list of data and shall keep it updated during construction as a set of Record Documents.
   1. Exact dimensioned locations of all new and existing switchgear, devices, luminaires, controls, all other equipment and new or existing site utilities.
   2. All warranties, as described in this section and in each subsequent specification section.
   3. All shop drawings.
   4. Submittals.
   5. Set of operation and maintenance manuals.
      a. Each operating and maintenance manual shall apply specifically to the equipment installed. In those cases where one manual covers a general class of equipment, the contractor shall be required to identify (highlighting, underlining, etc.) those portions which apply to the installed equipment.
   6. Repair parts lists of all major items and equipment.
   7. Additional items that may be required in Divisions 00 and 01.

B. Upon submitting their request for final payment, this contractor shall turn over to the Owner's Representative, all data mentioned above in the form of a PDF file.

1.9 QUALIFICATIONS

A. For a product or manufacturer to be considered, all products shall be submitted ONLY from manufacturers that:
   1. Specialize in the manufacturing of the products specified for a minimum of five (5) consecutive years.
   2. Has been producing this product for at least two (2) years.

1.10 ADDITIONAL MATERIALS

A. Additional materials to be a dollar cost in the base bid. At the end of the project the contractor shall generate a dollar amount credited back to the owner for any unused items.

B. Include the following cost on a dollar basis in the base bid:
   1. All costs to provide five (5) additional communication outlet or signal locations, all required boxes, labor and conduit as directed by the Owner's Representative. Devices, plates, and wiring by Communications Contractor(s).

2. All costs to provide one (1) additional electrical circuit as required for fire alarm system signal power expanders or fire safety control circuits including all required circuit breakers, wiring, conduit, labor, and devices as specified and directed by the Owner's Representative.
3. All costs to provide one (1) additional electrical circuit, required circuit breaker, wiring, conduit, labor, and devices as specified and directed by the Owner's Representative. Each circuit to be priced with a rating of 20 amps and a distance of 100 feet to furthermost device. Each circuit to include eight (8) duplex receptacles.

C. See "Additional Materials" section throughout the rest of Division 26 for additional materials requirements.

1.11 ATTIC STOCK

A. Furnish attic stock to the owner at substantial completion as a part of the base bid.

B. See "Attic Stock" section throughout the rest of Division 26 for additional attic stock requirements.

1.12 QUALITY ASSURANCE

A. Certification: This contractor shall be certified/licensed to install the products and equipment they are providing.

B. Regulatory Requirements: All products provided under this division shall be manufactured and listed for the intended use and environment installed.

C. See Manufacturers section below for more information.

1.13 DELIVERY, STORAGE, AND HANDLING

A. For additional requirements, see Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. For additional requirements, see Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.

C. Storage and Protection: Material shall be stored in a clean and dry location until installation.

1.14 EXISTING FIELD CONDITIONS

A. The drawings are prepared from the best information available and reflect all conditions commensurate with this information. However, the contractor should visit the site prior to submitting a proposal and should verify the locations, sizes, depths, pressures, etc., of all existing utilities and familiarize themselves with working conditions, hazards, existing grades, soil conditions, obstructions, etc. If it becomes evident that existing site conditions will impair the proper operation of the utilities, the Owner's Representative shall be notified in writing.

B. All proposals shall take these existing conditions and any revisions required into consideration, and the lack of specific site information on the drawings shall not relieve the contractor of any responsibility.

C. This Contractor shall familiarize themselves with working conditions to the extent that they shall be responsible for damage to concealed piping, wiring and other equipment meant to remain, and shall repair any damage caused by their negligence at no cost to the owner.

1.15 WARRANTY

A. This Contractor shall guaranty fully all workmanship, material, equipment, systems, etc., provided by them for a period of one (1) year after substantial completion of the project, unless otherwise indicated in other specification sections. The use of building equipment for temporary service and testing does not constitute the beginning of the warranty. This guaranty means that this Contractor shall make good to the owner, at no cost, any defects that become apparent during the year following substantial completion. This guaranty is in addition to any other guaranties or warranties and is not intended to limit such other guaranties or warranties.

B. Neither the final payment nor any provisions in the Contract Documents shall relieve this Contractor, or the Contractor, of the responsibility for faulty materials or workmanship.

C. The contractor shall remedy any defects due thereto, and pay for any damage to other work resulting there from, which shall appear.

D. This Warranty shall not be construed to include the normal maintenance of the various components of the system covered by these specifications.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Unless otherwise noted, products shall be only from manufacturers that have been in business for at least five (5) consecutive years.

2.2 SUBSTITUTION OF PRODUCTS

A. Substitutions: Shall meet any Division 1 requirements in addition to the substitution requirements listed here.

B. Any/all proposed substitutions are subject to PRIOR APPROVAL and must be received by the Engineer and/or Owner's Representative no less than ten business days prior to the schedule date for opening of bids.

C. Items noted as "No Substitutes" or "No Alternates" shall be as specified only. No substitutions will be accepted.

D. Only such items as specified or approved as acceptable will be installed on this project.

E. Substitution of products specified herein will be considered only when a complete list of proposed alternative equipment is submitted to the Engineer and/or Owner's Representative in writing, supported by adequate technical and cost data. This includes a complete description of the proposed substitution, drawings, catalog cut sheets, performance data, test data, or any other data or information necessary for proper evaluation.

F. Manufacturers' names are listed herein and on the plans to establish a standard of quality and design. Where a manufacturer's name is mentioned, products of other manufacturers may be considered if, in the opinion of the Engineer and/or Owner's Representative, the substitution is of equivalent quality or better than that of the material specified.

G. The Contractor's Bid represents that the bid price is based solely upon the materials and equipment described in the Contract Documents and that he contemplates no substitutions or extras.

H. Requests for substitution are understood to mean that the Contractor:
   1. Has personally investigated the proposed substitution and determined that it is equivalent or superior in all respects to that specified.
   2. Will provide the same guarantee for the substitution that they would for that specified.
   3. Will, at no cost to the Owner, replace the substitute item with the specified product if the substitute item fails to perform satisfactorily.

I. After Award of the Contract, substitutions will be considered only under one or more of the following circumstances.
   1. The substitution is required for compliance with subsequent interpretations of code or insurance requirements.
   2. The specified product is unavailable through no fault of the Contractor.
   3. The manufacturer refuses to warranty the specified products as required.
   4. Subsequent information that the specified product is unable to perform properly or to fit in the designated space.

J. Revisions to the electrical system caused by substitutions shall be under the supervision of the Engineer at a standard hourly rate charged by the Engineer and shall be paid by the Contractor originating the changes.

2.3 PERFORMANCE REQUIREMENTS

A. All materials, components, products, assemblies, equipment, etc. shall be new, free from defects, listed (by an NEC accepted listing agency), and approved/rated for the environment and purpose.

PART 3 EXECUTION

3.1 EXAMINATION

A. For additional requirements, see Section 01 30 00 - Administrative Requirements (Coordination and verification of existing project/site conditions before starting work).

3.2 INSTALLATION

A. The Contractor shall obtain all permits required to commence work and, upon completion of the Work, obtain and deliver to the Owner's Representative a Certificate of Inspection by an AHJ in the project city and state. The Contractor shall pay required permit fees.

B. All work shall be done by experienced craftsmen skilled in the applicable trade.

C. All equipment shall be installed in strict compliance with manufacturer's installation instructions and properly torqued using a calibrated torque tool.

D. Unprofessional and incomplete work shall be rejected and corrected at no additional expense. The judgement of professionalism and completeness of work shall be made by the Engineer and/or Owner's Representative and shall be final.

E. All electrical connections shall be made per NEC 110.14 and torqued per manufacturer's instructions.

F. Where existing utilities already exist or where renovation/addition work is to be done, maintain all utility services during construction to existing structures and/or portions of a project that are to remain in place and operational.

G. This Contractor assumes all responsibility for the safety of their personnel on the project during construction. The Contract Documents do not include materials, procedures, components, etc., required to ensure construction safety. Refer to General Conditions for additional information.

H. This Contractor shall be responsible for damage to the project caused by this Contractor's failure to recognize hazards associated with items such as lack of power, scheduling of work (tardiness), inexperienced workmen, excessive cutting, etc. This Contractor shall repair at no expense to the owner any such damage.

I. Contract Documents do not show exact location and elevations of lines. Deviate from drawings as required to conform to the general construction, provide proper grading and installation.

3.3 INTERFACE WITH OTHER WORK

A. Cooperation with trades of adjacent, related or affected materials or operations, and/or trades performing continuations of this work under subsequent contracts is considered a part of this work in order to affect timely and accurate placing of work and to bring together, in proper and correct sequence, the work of such trades, including under the general contractor Division 1 and Division 23.

B. The Electrical Contractor shall coordinate installation of the electrical system with the General Contractor, Mechanical, Plumbing, and Communications Contractors to insure a complete working system for the Owner.

C. The Electrical plans are based on the equipment and device schedules shown on the drawings or as called for in the specifications. Should any mechanical equipment or device associated devices be changed or accepted from those which are shown or noted, all electrical and/or mechanical changes shall be made at the expense of the trade or contractor initiating the change with no expense to the Owner's Representative, Engineer, etc.

D. Coordinate all utility services and/or revisions with utility companies.

E. Make permanent connection to new utilities or existing lines. Determine depth and location, and bid accordingly. Relocate and repair any existing lines cut by general construction work.

F. Provide all lighting contactors with control relay. Coordinate required coil voltage with controls system.

3.4 CONTRACTOR COORDINATION - ELECTRICAL / MECHANICAL (DIV 23)

A. Electrical Contractor to provide the following:
1. All line voltage wiring, conduits, back boxes and hook-up to all HVAC equipment including required fused or non-fused safety switches.
2. All boxes and conduit into accessible attic space for all thermostats and sensors. Coordinate with Mechanical Drawings for exact locations and requirements.
3. All contactors and relays shown on the Electrical Drawings only.
4. All conduit and back boxes for control wiring in all mechanical spaces to protect control wiring from damage. Conduit and back boxes to be required from 6” above each piece of equipment or control to a common 12” square NEMA 1 enclosure provided by Electrical Contractor and mounted directly above the EMCS/BMS controls in that space. Coordinate all required conduit paths with mechanical contractor before bidding and again before installing. Mechanical contractor to provide Electrical Contractor with conduit paths required for controls wiring on a drawing with adequate dimensions for bidding.

B. Mechanical Contractor to provide the following:
1. All contactors and relays for mechanical equipment control. Coordinate control voltage between trades as required.
2. All HVAC motor starters (with heaters as required) and/or VFDs.
3. All associated HVAC equipment, thermostats, controls, control wiring, etc.
4. All HVAC related relays, contactors, and switches required to start/stop Mechanical Equipment other than switches shown on and required by Division 26.

3.5 CONTRACTOR COORDINATION - ELECTRICAL / PLUMBING (DIV 22)

A. Electrical Contractor to provide the following:
1. All line voltage wiring, conduits, back boxes and hook-up to all plumbing equipment including required fused or non-fused safety switches.

B. Plumbing Contractor to provide the following:
1. All plumbing equipment.
2. All relays, contactors, and switches required to control Plumbing Equipment other than switches shown on and required by Division 26.

3.6 CONTRACTOR COORDINATION - ELECTRICAL / CONTROLS (DIV 23, 25)

A. Electrical Contractor to provide the following:
1. All junction boxes (standard one or multi-gang) required for controls contractor. Coordinate with controls contractor for exact locations.
2. Various relays, devices, wiring and other equipment for control equipment as indicated or required per details on Electrical Drawings.

B. Controls Contractor to provide the following:
1. All required relays associated with controls in specifications.
2. All hardware, software and sensors related to controls.
3. All conduit required above ceiling.
4. All control wiring.

3.7 CONTRACTOR COORDINATION - ELECTRICAL / COMMUNICATIONS (DIV 27)

A. Electrical Contractor to provide the following:

1. All receptacles and direct connection to all communications systems and equipment as shown and as required.
2. All building interconnect and service entry conduits as indicated on drawings. Unless otherwise noted, provide two (2) schedule 40 PVC 4" conduits buried at a depth of 24". Provide concrete or fiberglass pull boxes as shown or as required and rated for the location and traffic. Provide intermediate pull boxes for every 500 feet of conduit run or for every pair of 90 deg radius bends.
3. All ground conductors and bonding to the building grounding system for all communications equipment panels and racks. See Section 26 05 26 - Grounding and Bonding, notes on drawings and details for more information.
4. All required standard back boxes as required for wall-mounted devices furnished by Communications Contractor.
5. All raceway/conduit as required for accessibility of all communications systems cabling as listed below and as indicated on the drawings and details (whether furnished under a Division 01 allowance, by the Owner, Division 26 and/or Division 27).
    a. Provide raceway/conduit for cabling in above-ceiling spaces at the following locations:
        1) All wall penetrations.
        2) All HVAC duct penetrations (Per NEC 800).
        3) All cabling travelling through a plenum or other environmental air space (Per NEC 800).
    b. Provide raceway/conduit for all cabling from wall-mounted back boxes to accessible spaces per Communications Device Backboxes detail. Coordinate exact size and locations with communications contractor before installation.
    c. Provide full raceway/conduit for all cabling in exposed ceilings or when cabling is to be exposed on walls. Coordinate exact size and locations with communications contractor before installation.
6. Installation of all special boxes and equipment cabinets furnished by Owner or Communications, Security, and Safety Contractor(s).

B. Communications Contractor to provide the following:
1. All communications systems complete with equipment, cabling, special backboxes, hardware, and all other required devices.
2. Furnish all special boxes in timely manner to the electrical contractor for installation as required.
3. All attachments for all communications cable above accessible ceilings to be supported from the building structure and bundled.

3.8 CONTRACTOR COORDINATION - ELECTRICAL / ELECTRONIC SAFETY & SECURITY (DIV 28)

A. Electrical Contractor to provide the following:
1. All receptacles and direct connection to all security and safety equipment as shown and as required.
2. All ground conductors and bonding to the building grounding system for all security and safety equipment panels. See Section 26 05 26 - Grounding and Bonding and details for more information.
3. All required standard back boxes as required for wall-mounted devices furnished by security and safety contractors.

4. All raceway/conduit as required for accessibility of all security and safety systems cabling (whether furnished under a Division 01 allowance, by the Owner, Division 26 and/or Division 28) as listed below and as indicated on the drawings and details.
    a. Provide raceway/conduit for all cabling in above-ceiling spaces at the following locations:
        1) All wall penetrations.
        2) All HVAC duct penetrations (Per NEC 800).
        3) All cabling travelling through a plenum or other environmental air space (Per NEC 800).
    b. Provide raceway/conduit for all cabling from wall-mounted back boxes to accessible spaces per Communications Device Backboxes detail. Coordinate exact size and locations with security and safety contractor before installation.
    c. Provide full raceway/conduit for all cabling in exposed ceilings and when cabling is to be exposed on walls. Coordinate exact size and locations with security and safety contractor before installation.
5. A dedicated circuit for the Fire Alarm Control Panel (FACP). Provide power to all Fire Safety Control Function devices as shown on the drawings. Each circuit breaker shall be labelled as "FIRE ALARM CIRCUIT" in the panel directory and labelled "FIRE ALARM" at the lockout clip on the circuit breaker.
6. All fire safety control circuits shall be of "fail safe" operation and shall not have backup power. These circuits shall be controlled by a power relay located within three (3) feet of the breaker panel. These circuits shall be switched by a power relay controlled by the fire alarm system and wired by the Electrical Contractor.

B. Fire Alarm Contractor to provide the following:
1. All security and safety systems complete with equipment, cabling, special backboxes, hardware, and all other required devices.
2. Final connection of all duct-mounted smoke detectors to the fire alarm system. Detector housings and control relays are to be mounted by the Division 23 Contractor.

3.9 CONTRACTOR COORDINATION - ELECTRICAL / OTHER

A. Electrical Contractor to provide required hook-up to line voltage at all electromagnetic door holder/release, fire/smoke dampers, smoke dampers, etc. Provide required relays and wiring to fire alarm panels and coordinate with other specified work.

B. Line voltage and hook-up to all building automation equipment (Division 25) including required manual safety switches with fuses/heaters of required size.

3.10 EQUIPMENT CONNECTIONS

A. This Contractor shall bring all required electrical service to all equipment items furnished under other sections of these specifications or by the Owner, make final connections, and leave equipment ready for operation. This Contractor shall coordinate with any affected trade to assure correct operation of the equipment item, i.e., phase rotation, switching, control location, accessibility, etc.

B. When the contractor is uncertain about the method of installation, proper location, etc., they shall ask for further instructions or details. Failure to request such information will not excuse non-compliance.

C. All roof mounted mechanical equipment shall be served through and concealed in curb. Penetration through side of curb is not permitted. If not possible, then contractor shall notify the Owner's Representative in writing providing a no cost alternative.

3.11 INSTALLATION - OTHER WORK

A. Cutting and Patching
   1. All cutting required by the installation of sleeves, conduit, equipment, etc., shall be coordinated with the General Contractor, but performed by this Contractor. Patching shall be by General Contractor. This Contractor shall not cut any structural element or any finished work without written permission from the Owner's Representative.
   2. This Contractor shall cut and patch all paving as required by the installation of buried conduit or wire.

B. Concrete Work
   1. This Contractor shall provide all forming, reinforcing and concrete as indicated or required for equipment bases, transformer pads, etc. Work shall conform to the applicable portion of Division 03 - Concrete.

C. Painting
   1. All painting except "touch-up" shall be provided under Division 09 - Painting unless otherwise noted on Drawings. All exposed conduit, equipment, etc., shall be left clean and free from rust or grease and ready for the painter.
   2. Where equipment finishes are damaged, this Contractor shall obtain touch-up paint in matching colors from the equipment manufacturer and paint as required.

D. Trenching and Backfill
   1. This Contractor shall perform all trenching, excavation, shoring, pumping and backfill required in the installation of their work. All trenches shall be maintained dry until all circuits have been satisfactorily tested and then filled in tamped 6" layers immediately after approval of tests by the Owner's Representative. All backfill shall be free of construction debris and any other foreign material which might damage any circuit runs. Stability of backfilled soil shall match adjacent undisturbed soil.
   2. All exterior raceway or cable shall be laid with at least a minimum cover as indicated in the NEC.
   3. The contractor shall exercise all possible care to avoid damage to trees and roots in excavation. Where possible, the contractor shall excavate beyond the drip line of trees. If it is necessary to cut roots 1" to 2 1/2" in diameter, the contractor shall excavate around, cut clean and paint severed ends of roots with a tree wound sealer. Do not cut roots 2 1/2" and larger.

E. Flashing and Waterproofing
   1. All building penetrations to the outside shall be flashed and counter-flashed as required to eliminate leaks. Provide link-seal fitting on all below grade conduit penetrations greater than 2".

3.12 PROTECTION

A. The Contractor shall continuously maintain adequate protection of stored materials and installed equipment. Fixtures and equipment, whether located inside or outside,

shall be tightly covered with sheet polyethylene or waterproof tarpaulin as protection against dirt, rust, moisture and abuse from other trades. Adequate air circulation shall be provided under any protective sheet to prevent condensation build-up. Materials and equipment shall not be stored where it can come into direct contact with the ground. Conduit, conduit hangars, cable tray and equipment shall not be used by other trades as supports for their equipment, scaffolds or personnel. At the completion of the work, equipment, luminaires, exposed supports and piping shall be cleaned of loose dirt, construction debris, overspray, etc., to the satisfaction of the Owner's Representative. Repairs made necessary by damage shall be paid for by the Contractor.

3.13 QUALITY CONTROL

A. For additional requirements, see Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. For additional requirements, see Section 01 70 00 - Execution and Closeout Requirements: Testing, adjusting, and balancing.

3.14 SYSTEM STARTUP

A. All circuit and operational tests of the electrical systems shall be made by this Contractor and repeated until equipment meets or exceeds testing requirements.

3.15 CLEANING

A. For additional requirements, see Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Where all work has been finally tested, this Contractor shall clean all work installed by them, including all luminaires, equipment, and all exposed work.

END OF SECTION

SECTION 26 05 05

SELECTIVE DEMOLITION FOR ELECTRICAL

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Selective demolition of electrical and lighting systems and equipment and the off-site removal of the portions of those systems and equipment not reused, in a code-compliant and lawful manner.

1.2 RELATED REQUIREMENTS

A. Section 26 00 00 - Electrical

B. Section 26 05 53 - Identification for Electrical Systems

PART 2 PRODUCTS

2.1 NOT USED.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing field measurements, circuiting arrangements, wiring and equipment served in areas as shown on the Drawings. Adjust all circuiting, wiring and materials to be provided as required by job conditions.

B. Verify abandoned wiring and existing equipment.

C. Drawings are based on casual field observation and existing record documents. Report discrepancies to the Engineer before disturbing existing installation.

D. The Contractor accepts all existing conditions when beginning demolition, whether or not those conditions are reflected in the contract documents.

3.2 PREPARATION

A. Disconnect electrical systems in walls, floors and ceilings as shown or required.

B. Coordinate utility service outage with the respective utility company and the Owner.

C. Provide temporary wiring and connections to maintain required existing systems that must remain operational during construction.

D. When work must be performed on energized equipment or circuits, use personnel experienced in such operations. Verify phasing on existing equipment and coordinate new phasing before energizing revised service.

E. Disconnect and remove abandoned wiring, devices, conduits, panels and distribution equipment unless otherwise specified in the drawings.

F. Maintain access to existing wiring, devices, panels, and distribution equipment to remain active and requiring access. Modify installation or provide access panels as required.

G. Clean and repair existing wiring devices to remain or to be reinstalled.

3.3 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Demolish and extend existing electrical work under provision of Division 1 and this section.

B. Remove, relocate and extend existing installations to accommodate new construction as required.

C. Remove exposed abandoned raceway, including abandoned raceway above accessible ceiling finishes. Cut raceway flush with walls and floor, and patch surfaces.

D. Remove concealed abandoned raceway to its source.

E. Disconnect abandoned outlets and remove devices. Remove abandoned outlets when raceway is abandoned and removed. Install blank cover for abandoned outlets not removed.

F. Remove abandoned wiring to the source of the supply.

G. Mark all unused breakers as spares and turn them off.

H. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls, floors and patch surfaces.

I. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets which are not removed in masonry construction.

J. Disconnect and remove electrical devices and equipment serving equipment that has been removed.

K. Disconnect and remove abandoned lighting fixtures. Remove brackets, stems, hangers and other accessories.

L. Extend existing conduit, raceway and box installations using materials and methods compatible with existing electrical installations or as specified.

M. Confirm with Owner or Architect regarding the handling and disposal/reuse of removed material, equipment, devices, lights, etc.

N. Clean and repair existing raceway and boxes to remain or to be reinstalled.

O. Where demolition of equipment or materials is required, this Contractor shall minimize cutting and exercise all due caution to leave undamaged surfaces, material and equipment meant to remain.

P. All existing items that are to be removed shall remain property of the owner unless declared as salvage. Salvage materials shall become property of the contractor and be removed from the site. Items declared as the owner's property shall be neatly

stored on the site as directed by the owner.

Q. Existing electrical equipment (except cast-in-place conduit) such as panelboards, wiring devices, luminaires, junction boxes, etc., shall be removed from the job unless othewise noted.

R. Please note that demolition of the HVAC system will require electrical work and coordination. Refer to the complete set of construction documents for additional information regarding the phasing of the demolition and construction.

3.4 MAINTAIN EXISTING ELECTRICAL

A. Maintain access to existing electrical installations which remain active. Modify installation or provide access panel as appropriate.

B. Where a circuit is interrupted by removal of a device or luminiare from that circuit, install wire and conduit as required to restore service to the remaining devices and luminaires on that circuit.

C. Maintain access to existing boxes and other installations remaining active and requiring access. Modify installation or provide access panel.

D. Repair adjacent construction and finishes damaged during demolition and extension work.

3.5 REPAIR / RESTORATION

A. Clean and repair existing materials and equipment, in areas of revision, which remain or which are to be reused.

B. Panelboards:
1. Clean exposed surfaces and check tightness of all electrical connections.
2. Replace damaged circuit breakers and provide closure plates for vacant positions.
3. Provide typed circuit directory showing revised circuiting arrangement as specified, on all existing switchgear.
4. Provide new identification nameplates per Section 26 05 53.
5. Verify room names and numbers with Owner's Representative and indicate correct room names and numbers that are permanent for the facility.

3.6 RE-INSTALLATION

A. Install all relocated materials and equipment under the provisions of Divisions 1 and 26.

END OF SECTION

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SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. This section includes conductors for power circuits, including terminations and connectors.

1.2 RELATED REQUIREMENTS

A. Section 26 00 00 - Electrical

B. Section 26 05 26 - Grounding and Bonding for Electrical Systems

1.3 REFERENCES AND STANDARDS

A. ICEA S-61-402 - Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy

B. UL 44 - Thermoset-Insulated Wires and Cables

C. UL 83 - Thermoplastic-Insulated Wires

D. NECA 1 - NEIS standards for workmanship

E. UL 493 - Thermoplastic Insulated Underground Feeder and Branch Circuit Cables

1.4 SUBMITTALS

A. Submittals required in this section shall conform to and be submitted in accordance with the General Conditions, Division 1, and Division 26.

B. Submit product data for the following:
   1. Building wiring and all conductors on this project.
   2. Conductor terminations
   3. Connectors

1.5 CLOSEOUT SUBMITTALS

A. Closeout submittals shall include the following:
   1. Product Data listed above.
   2. Record of all actual locations of components and circuits.

1.6 QUALITY ASSURANCE

A. General work practices for electrical construction shall be in accordance with NECA 1, Standard Practices for Good Workmanship in Electrical Construction.

B. Regulatory Requirements: All products provided under this section shall be listed for the intended use.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Storage and Protection: Material shall be stored in a clean and dry location until installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Conductors shall be manufactured in the United States. Acceptable manufacturers are:
   1. Alan Wire (Sikeston, MO)
   2. Cerrowire (Hartselle, AL)
   3. Encore Wire (McKinney, TX)
   4. General Cable (Highland Heights, KY)
   5. Southwire (Carrollton, GA)

B. All other manufacturers shall require pre-approval in accordance with specification section 26 00 00 - Electrical.

2.2 MATERIALS

A. All feeders to be soft-drawn annealed copper.

B. All branch circuit conductors shall be soft-drawn annealed copper.

C. Aluminum is permissible ONLY where specifically indicated on the Drawings. Aluminum used shall be AA-8xxx rated and compact stranding is preferred.

2.3 MANUFACTURED UNITS

A. Manufactured conductors for power circuits:
   1. Conductors for shall be rated for at least 600 volts and 90deg C. No exceptions.
   2. Conductor insulation shall be type THHN/THWN-2 or XHHW-2.
   3. Conductors shall be #12 AWG or larger.
   4. Conductors that are #8 and larger shall be stranded. Conductors that are #12 and #10 may be stranded if crimp on fork terminals are used for device terminations. Otherwise, #12 and #10 shall be solid conductors. Never place bare stranded conductors directly under device screws.
   5. Conductors sized #6 AWG and smaller shall have factory colored insulation.

B. MC Cable: Unless othewise noted on the Drawings, MC cable is allowed ONLY for light fixture whips. Total length not to exceed six feet. MC Cable must meet all requirements listed in this specification section including (but not limited to) separate full-size neutrals, conductor material, isolated ground, installation per NEC, etc.
   1. Conductor Insulation: The insulation over the conductors shall be type THHN 90°C DRY with an extruded polypropylene protective covering.
   2. Armor: A zinc coated galvanized steel armor shall be applied over the cabled wire assembly with an interlock in compliance with Section 13 of UL 1569. Armor shall be colored to identify the voltage and number of conductors.
   3. Fittings: Fittings shall be listed and identified as MCI-A for such use with metal clad interlocking armor ground. Connectors shall be of steel or malleable iron and shall have saddle clamp to insure a tight termination of MC or MCI-A cable to box.

C. Manufactured conductor terminations and connectors:
   1. All accessory materials such as connectors, splice and tap fittings, and terminations shall be of a type designed or intended and suitable for the use. They shall be compatible with the conductor material. Installation, compression, and torque settings shall be per manufacturer's recommendations.
   2. Conductors shall be connected and terminated using suitable clamps, pressure connectors, compression terminals or lugs and hardware of the proper size and listed for the application.
   3. Only connection devices that require the complete removal of the conductor jacket or insulation and result in a connection to the complete conductor surface area are suitable for use. Insulation piercing type connectors, press in type connectors or Wago style connectors shall NOT be used.
   4. Splices and taps shall have a mechanical strength and insulation rating at least as that of the conductors.
   5. Compression systems shall include crimped die index and company logo for purposes of inspection.

PART 3 EXECUTION

3.1 EXAMINATION (SITE VERIFICATION)

A. Do not install the conductors until conduit / raceway system is complete.

B. Before installing the conductors for any branch circuit or feeder, verify that the conductor ampacity is at least as large as the rating of the overcurrent device protecting it, except where approved for use (per NEC) for motor loads. In the event that the conductors would not be adequately protected, notify the engineer before installation.

3.2 INSTALLATION

A. More than one conductor shall not be installed in any termination unless the termination is marked as suitable for more than one conductor.

B. Wire Sizing: Provide conductors sized as indicated on drawings unless modified as described below. Where conductor sizes have been omitted from drawings, bid shall include conductors with ampacity as least as large as the overcurrent protection device protecting the conductors, or at least as large as the amp rating of the load being served, whichever is greater. In such cases, notify the engineer before installation for size verification.

C. Wire Lengths: For 120v branch circuits, #12 wire shall not be run more than 90’, #10 wire shall not be run more than 120’, #8 wire shall not be run more than 150’, etc.

D. Neutral Conductors: Provide a separate neutral conductor for each feeder or branch circuit. Multiple circuits shall not share a common neutral. Neutral conductors shall be sized as large as the phase conductors. Neutral conductors shall not be of a reduced size.

E. Equipment grounding conductors: Provide equipment grounding conductors in accordance with specification section 26 05 26 - Grounding and Bonding for Electrical Systems.

F. Number of Current Carrying Conductors (CCC) per Conduit:
   1. #12 Wire - no more than six (6) CCCs in a single conduit.
   2. #10 Wire - no more than nine (9) CCCs in a single conduit.
   3. ELSE - no more than three (3) CCCs in a single conduit.
   4. When more than three (3) CCCs are in a single conduit, the electrician is responsible for derating conductors per NEC requirements to ensure all loads do NOT exceed a 5% voltage drop from the service entrance conductors.
   5. The equipment grounding conductor shall not be counted for the preceding statements.

G. Installation in Raceways:
   1. All conductors shall be installed in a raceway.
   2. All conductors installed in a raceway shall be pulled together. Use an approved wire pulling compound when pulling large conductors.
   3. Do not bend any conductor either permanently or temporarily during installation to radii less than four times the outer diameter of conductors.
   4. Do not exceed manufacturer`s recommended values for maximum pulling tension.
   5. When installing conductors in existing conduit, the interior of the existing conduit shall be cleaned and inspected for damage prior to the installation of the new conductors to insure that there is nothing that will damage the conductor insulation.
   6. The pulling device used shall be per manufacturer's installation instructions and shall be suitable to prevent damage to the conductors and the raceway.

H. Terminations:
   1. Use pressure type lugs or connectors for terminations or splices of all stranded conductors. Use ring tongue type terminators on all control wiring. More than one conductor shall not be installed in any termination unless the termination is marked as suitable for more than one conductor. With the written approval of the engineer’s office, an exception to this may be allowed for the installation of the surge protective devices required in specification section 26 43 00 - Surge Protective Devices.
   2. Conductors shall not be supported solely by their terminations.
   3. Terminations shall be made such that the stripped length of the conductor is no longer than required for the terminal, lug, or connector.
   4. Conductive antioxidant shall be applied on all connections per manufacturer's instructions, regardless of conductor material.

I. Splices:
   1. Conductor splices shall be kept to a minimum.
   2. Where splices are required, they shall be in a box or enclosure. Splices within a conduit run are not acceptable.

J. Color Coding:
   1. Provide factory colored insulated conductors for #6 AWG and smaller.
   2. Color code larger insulated conductors with an approved field-applied tape 2" wide on each end of conductors.
   3. If existing wiring in renovation or addition work has a consistent color coding, then match the existing and note in record documents. Otherwise, colors shall be as follows:

Line	**208/120V**	240/208V 1ph	**240/120V**	**480/277V**
A	Black	Black	Black	BROWN
B	Red	n/a	Orange	ORANGE
C	Blue	Red	Blue	Yellow
Neutral	White	White	White	Gray
Ground	Green	Green	Green	Green
Isolated Ground	Green +Yellow	Green + Yellow	Green + Yellow	Green + Yellow

4. Switch leg shall be the same color as the un-switched phase wiring. Travelers, and special systems as selected by the Contractor. Note in record drawings.

K. Identification: All conductors in a panelboard shall be identified by means of tags or tape.

L. MC Cable: Where allowed, install MC Cable to meet all NEC requirements.
1. Support: All MC Cable shall be supported by dedicated J cable hangers or cable tray. Where suspended from the ceiling or roof structure, use split-ring hangers or wrought-iron hanger rods.
2. Fittings: Follow manufacturer’s instructions for cable preparation for installation of fittings. Cleanly cut the cable end with metal clad cable rotary cutting tool to ensure flush seating of the cable into the fitting. Properly torque fitting securement screws. Provide anti-shorting bushings at both ends of each length of cable.
3. Conductors in Enclosures: Provide neat and workmanlike installation with conductors tied with nylon wire ties in terminal cabinets, gutters, and similar locations.

3.3 SITE TESTS

A. Perform in accordance with manufacturer`s printed testing procedures, applicable industry standards, ANSI standards, IEEE standards, and NEMA standards. Provide calibrated testing equipment in good working order and which complies with the above requirements. The below test shall be performed after the conductors have been pulled into the conduit and after terminations have been added, but before final connections are made. Document all readings and testing and make documentation available to owner upon request.

B. Feeder Insulation Test: The insulation of new service entrance conductors and each new feeder run shall be tested using a megger. Readings must indicate not less than one (1) megohm to be acceptable.

C. Branch Circuit Insulation Test: The insulation of each new branch circuit shall be tested using an ohm meter. Readings must indicate not less than one (1) megohm to be acceptable.

END OF SECTION

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SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Grounding and Bonding shall include the solid grounding of the various electrical systems and equipment and the proper bonding of all electrical system components and equipment to meet NEC article 250 and all other applicable codes and ordinances. These systems shall be provided for the proper protection of life, equipment, circuits, and systems.

B. Permanently ground entire lighting and power systems in accordance with the latest adopted version of the NEC, including service equipment, distribution panels, lighting panelboards, switch and starter enclosures, motor frames, grounding type receptacles, and other exposed non-current carrying metal parts of electrical equipment.

C. Grounding and bonding requirements specified in this section may be supplemented in other sections of these Specifications.

1.2 RELATED REQUIREMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions, Division 1 Specifications and Section 26 00 00 - Electrical, apply to this Section.

B. Section 26 00 00 - Electrical

1.3 REFERENCES AND STANDARDS

A. NEC Article 250 (and others)

B. IEEE 142 - Recommended Practice for Grounding of Industrial and Commercial Power Systems.

C. IEEE 1100 (Green book) - Recommended Practice for Powering and Grounding Electronic Equipment.

D. ANSI/UL 467 - Safety Standard for Grounding and Bonding Equipment.

1.4 SUBMITTALS

A. Submittals required in this section shall conform to and be submitted in accordance with the General Conditions, Division 1, and Division 26 requirements.

B. Product Data: Submit data on grounding electrodes and connections.

1.5 CLOSEOUT SUBMITTALS

A. Provide submittal data of all equipment in O&M Manuals.

1.6 DELIVERY, STORAGE AND HANDLING

A. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging and with plastic sheathing.

1.7 COORDINATION

A. Complete grounding and bonding of building reinforcing steel (rebar) to the satisfaction of the local AHJ prior to concrete placement.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer List
1. Apache Grounding
2. Copperweld, Inc.
3. Erico, Inc. (nVent, Cadweld)
4. ILSCO Corporation
5. O-Z Gedney Co.
6. Thermoweld
7. Thomas & Betts

2.2 PERFORMANCE REQUIREMENTS

A. General
1. All materials used for grounding and bonding and all work performed shall conform to requirements of NEC, IEEE 142, and be listed for the application and environment.
2. All Grounding and Bonding shall be in strict accordance with Article 250, 517, etc. of the latest adopted version of the NEC.
3. Grounding electrode system shall have a resistance to earth of 5 ohms or less. Where this cannot be met, provide two additional ground rods to form a "triple ground rod" installation. Under no conditions shall the system have a resistance greater than 25 ohms to ground, per NEC 250, at any location in the system.

B. Ground Rods
1. Copper cladding permanently bonded to a high-strength steel core.
2. 3/4 inch by 10 feet (19mm by 3m) Straight, Conform to UL 467.

C. Conductors
1. Grounding conductor - copper, insulated (green) where required or uninsulated where allowed in the Specifications or by code, sized per drawings or NEC Table 250.95
2. Bonding jumpers - insulated conductor, sized to be minimum cross-sectional area greater than or equal to that of the equivalent grounding conductor as determined from NEC Table 250.95.
a. Where braided bonding jumpers are indicated or otherwise required, provide copper tape, braided #3/0 bare copper wire, terminated with copper ferrules.
3. Grounding ring around a building - #2 uninsulated copper, otherwise sized per NEC.
4. Grounding ring around a utility transformer - #2 uninsulated copper (unless sized per drawings), otherwise sized per NEC or by utility requirements.

D. Connections
   1. General: All connectors shall be listed and labeled as grounding connectors for the materials used.
   2. Welded bond - Exothermic welded connection or bond such as Cadweld. No phosphorous or any other caustic, toxic or explosive substance may be used.
      a. Provide exothermic materials, accessories, and tools for preparing and making permanent field connections between grounding system components.
   3. Clamps - listed bronze connectors, suitable for grounding and bonding applications, in configurations required for a particular installation.

E. Bus Bars
   1. Bare annealed copper bars, 1/4" x 4" x 20" unless otherwise noted on the drawings.

PART 3 EXECUTION

3.1 PREPARATION

A. Remove paint, rust, mill oils, and all surface contaminants at connection points.

3.2 APPLICATION

A. Unless otherwise indicated, the below list of connection styles shall be followed.

B. Outdoor BELOW GRADE grounding connections
   1. Welded bond only, no exception

C. Outdoor Above Grade Grounding Connections
   1. Clamps may be used. Use welded bond where clamping is not accessible or practical.

D. Indoor Grounding and Power Connections
   1. Clamps may be used. Use low-smoke/low emission welded bond where clamping is not accessible or practical.

3.3 INSTALLATION

A. General
   1. Ground and bond electrical systems and equipment in accordance with NEC requirements except where the Drawings or Specifications exceed NEC requirements, then follow the Drawings or Specifications.
   2. Bond all ground electrodes together to form the grounding electrode system including metal underground water pipe, metal frame of the building or structure, concrete encased electrodes, ground ring, rod and pipe electrodes and plate electrodes.
   3. At all electrical system components, assemblies, circuits, etc. that are over 120v to ground, provide locknuts and/or listed fittings per NEC 250.97 for bonding of metal raceways. In case of oversized, concentric or eccentric knockouts, comply with NEC 250.92(B). The use of snap-in, wedge-type, or pivot-type connectors is prohibited.
   4. Permanently attach equipment and grounding conductors prior to energizing equipment.

5. Refer to drawings for additional special grounding systems or grounding requirements not mentioned here.

B. Concrete Encased Electrode:
   1. Fabricate with 20 feet (6m) of conductor laid lengthwise in excavation for foundation or footings. Install so conductor is within 2 inches (50mm) of the bottom of the concrete. Where base of foundation is less than 20 feet (6m) in length, coil excess conductor at base of foundation. Bond conductor to reinforcing steel at four locations, minimum. Extend conductor below grade and connect to building grounding electrode.

C. Main Electrode:
   1. Provide a building ground rod and bond it to the grounding electrode system. Where ohmic values exceed 5 ohms to ground, the building ground rod shall consist of three ground rods, arranged in an equilateral triangular pattern located at least five (5) feet outside an exterior building wall or as otherwise directed. Space 15 feet apart and drive into the earth to a point two (2) feet below finished grade to top of rods. Grounding electrode conductor shall form a continuous loop around rods, and conductor shall be properly bonded to each rod by a fusion weld similar to "Cadweld".
   2. Extend grounding electrode conductor from this ground rod(s) to the grounded service conductor (neutral) in the building main switchboard at an accessible point on the ground bus per NEC 250.24.
   3. Install grounding electrode conductor of 3/0 Copper.

D. Main Bonding Jumper: Shall be sized in accordance with Section 250.66, if not indicated on the drawings, and installed within the same enclosure as the point of bonding of the system neutral service entrance.

E. Water Pipe Electrode: A ten (10) foot minimum length of electrically continuous underground metal water pipe. Bond around insulating joints or sections, insulating pipe, and water meters to make pipe electrically continuous.

F. Fuel Gas Piping:
   1. Each above ground portion of a gas piping system upstream from the equipment shutoff valve shall be made electrical continuous and bonded to the building grounding electrode system, as required in NFPA 54, National Fuel Gas Code.
   2. Gas piping shall not be used as a grounding electrode.

G. Equipment Grounding Conductor:
   1. Comply with NEC Article 250 for sizes and quantities of equipment grounding conductors, except where larger sizes or more conductors are indicated.
   2. All power circuits shall be provided with a separate copper insulated equipment grounding conductor (EGC) run in the raceway with the power conductors. The conduit shall not be used as the sole means of grounding. The insulation of the EGC shall be green.
   3. Bonding to the EGC shall be provided at each end of metallic conduit runs and at all boxes and enclosures.
   4. Connect wiring device grounding terminal to outlet box with bonding jumper and branch circuit equipment grounding conductor.

H. Exterior Lighting:
   1. All metallic outdoor poles and luminaries on metallic or non-metallic lighting poles shall be grounded by bonding in an approved manner to the circuit

grounding conductor. In addition to this, bond pole to a #6 bare copper wire which shall also be bonded to a ground rod. Install the ground rod adjacent to the pole base with the top driven at least two (2) feet below grade.

I. Grounding Busses:
1. Provide a copper bus bar where indicated on Drawings or in rooms containing any of the below list. Provide a #2 AWG insulated grounding electrode conductor from the grounding electrode system to each grounding buss.
2. Provide in each IDF and MDF room.
3. Provide at each CATV / MATV head-end mounting board.
4. Provide at each building communications rack.
5. Provide at each sound reinforcement equipment rack.

J. Communications Systems:
1. Bond each server, patch panel, data and other communications equipment ground (buss type or grounding conductor type) at each piece of equipment and each equipment rack back to the copper grounding buss installed in the room with a bare #6 AWG ground wire.

K. Other grounding systems
1. Other Buildings Served from Common Service:
a. The main building service is the source for electric service.
b. Bond grounding conductor of building main feeder to grounding electrode system.

3.4 CONNECTIONS

A. General
1. Make connections in such a manner as to minimize possibility of galvanic action or electrolysis. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
2. Use electroplated or hot-tin-coated materials to assure high conductivity and make contact points closer in order of galvanic series. Make connections with clean bare metal at points of contact.
3. Aluminum to steel connections shall be with stainless steel separators and mechanical clamps. Aluminum to galvanized steel connections will be with tin-plated copper jumpers and mechanical clamps.
4. Coat and seal connections involving dissimilar metals with inert material such as red lead paint to prevent future penetration of moisture to contact surfaces.

B. Exothermic Welded Connections
1. Use for connections to structural steel and for underground connections except those at test wells. Install at connections to ground rods and plate electrodes. Comply with manufacturer`s written recommendations. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.
2. Terminate insulated equipment grounding conductors for feeders and branch circuits with pressure-type grounding lugs. Where metallic raceways terminate at metallic housings without mechanical and electrical connection to the housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to the ground bus in the housing. Bond electrically noncontinuous conduits at both entrances and exits with grounding bushing and bare grounding conductors.

3. Tighten grounding and bonding connectors and terminals, including screws and bolts, in accordance with manufacturer`s published torque tightening values for connectors and bolts. Where manufacturer`s torquing requirements are not indicated, tighten connections to comply with torque tightening valves specified in UL 486A and UL 486B.

C. Compression - Type Connections
1. Use hydraulic compression tools to provide the correct circumferential pressure for compression connectors. Use tools and dies recommended by the manufacturer of the connectors. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on the ground conductor.

D. Moisture Protection
1. Where insulated ground conductors are connected to ground rods or ground buses, insulate the entire area of the connection and seal against moisture penetration of the insulation and cable.

3.5 SITE TESTING

A. Testing:
1. Test the electrical system after installation is complete. Inspect and test for stray currents, unintended ground shorts, and proper physical condition of grounding system. Correct any deficiencies and re-test to verify satisfactory installation.
2. Document all readings and testing and make documentation available to owner upon request.
3. Perform ground resistance and continuity testing in accordance with IEEE 142.
4. Perform leakage current tests in accordance with NFPA 99.
5. Use true-RMS meters for all voltage and current measurements.
6. Test telecommunications grounding riser to verify continuity.
7. Check all isolated ground receptacles for correct polarity.
8. Test all sub panels of separately derives systems to verify subpanel neutral is isolated from ground.
9. Test isolated power systems for the sound reinforcement system to verify isolation of ground system from other building systems.
10. Verify continuity and isolation of audio system ground bus and grounding riser.

END OF SECTION

SECTION 26 05 33

RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Provide all Raceway and Conduits, Outlet boxes, Pull and Splice boxes, Floor boxes, Wireways, and associated fittings as indicated on the drawings and as required for feeders, branch circuits, splices, taps, equipment connections, and for compliance with regulatory requirements. All locations shown on drawings are approximate unless dimensioned.

B. Provide complete, separate conduit systems for all electrical systems on this project to include, but not limited to service entrance, feeders, branch circuit, control wiring furnished by this contractor, emergency and standby power and lighting circuits, critical power, communication systems, and other electrical systems as required.

C. Provide outlet wiring boxes of the type, shape and size, including depth of box, to suit each respective location and installation; constructed with knockouts or threaded hubs in back and sides, and with threaded holes with screws for securing box covers or wiring devices. Provide outlets as shown, as required and per NEC.

1.2 RELATED REQUIREMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions, Division 1 Specifications and Section 26 00 00 - Electrical, apply to this Section.

B. Divisions 27 and 28 - Communications and Security

C. Section 26 00 00 - Electrical

D. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables

E. Section 26 05 26 - Grounding and Bonding for Electrical Systems

F. Section 26 05 53 - Identification for Electrical Systems

G. Section 26 21 00 - Low Voltage Electrical Service Entrance

1.3 REFERENCES AND STANDARDS

A. ANSI/ANSI C80.1 - Zinc-Coated Rigid Steel Conduit

B. ANSI/ANSI C80.4 - Zinc Coated Electrical Metallic Tubing

C. ANSI/ANSI C80.4 - Fittings for Rigid Metal Conduit and Electrical Metallic Tubing

D. ANSI/NEMA Publication No. OS 1 - Sheet-steel Outlet Boxes, Device Boxes, Covers and Box Supports, and Cast Aluminum Covers.

E. ANSI/UL 1 - Flexible Metal Conduit

F. ANSI/UL 5 - Surface Metal Raceways and Fittings

G. ANSI 77 - Load ratings for underground boxes

H. ANSI/UL 514 - Electrical Outlet Boxes and Fittings.

I. ANSI/UL 651 - Rigid Nonmetallic Conduit

J. ANSI/UL 797 - Electrical Metallic Tubing

K. ANSI/UL 870 - Safety Standard for Wireways, Auxiliary Gutters and Associated Fittings

L. ETL PVC-001 - PVC-Coated Rigid Steel Conduit

M. NEC - The latest adopted version of the National Electrical Code.

N. NEMA TC2 - Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80) and Fittings

O. NEMA TC3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing

P. UL 6 - Rigid Metal Electrical Conduit

Q. UL 360 - Liquid tight Flexible Steel Conduit

R. UL 467 - Electrical Grounding and Bonding Equipment

1.4 ABBREVIATIONS AND ACRONYMS

A. This specification uses the acronyms and abbreviations from the NEC unless otherwise noted.

1.5 DEFINITIONS

A. This specification section uses the NEC for definitions unless otherwise noted.

B. Back box - junction box (j-box), back box, pull box and similar.

C. Raceway - conduit, raceway, tubing, wireway and similar.

1.6 DESIGN REQUIREMENTS

A. All conduit, wireway, raceways, boxes, fittings, installation hardware, accessories, and similar products whether directly or indirectly referenced in the specifications or drawings shall be:
   1. Suitable and listed for the space / area / environment where they are installed.
   2. Installed / mounted / suspended per latest adopted version of the NEC, NECA "Standard of Installation" and Manufacturer's installation instructions. This work includes but not limited to clamping, cutting, threading, bending, assembly, supporting, patch coating, etc.

B. Box and fittings shall be made of the same material as the conduit material they are installed with, unless modified below or otherwise noted on the drawings.

1.7 SUBMITTALS

A. Submittals required in this section shall conform to and be submitted in accordance with the General Conditions, Division 1, and Division 26 requirements.

B. Submit from the following list, all items used on this project: Rigid metal and non-metallic conduit, flexible metal and nonmetallic conduit, liquid-tight flexible metal and non-metallic conduit, tubing, all fittings, surface raceways, wireways, pull boxes, junction boxes (j-boxes), handholes, mounting hardware, accessories, etc.

C. Submit on all cover plates, extension rings, fittings, labeling, and supports for conduits inside and on roof.

1.8 CLOSE-OUT SUBMITTALS

A. Record actual routing of all conduits larger than 3/4".

1.9 DELIVERY, STORAGE AND HANDLING

A. Protect all conduit from corrosion, entrance of debris, moisture and sunlight, prior to and after installation.

1.10 COORDINATION

A. Coordinate mounting heights, orientation and locations of back boxes for outlets mounted above counters, benches, back splashes, etc.

B. Conduit systems shall not be covered or otherwise concealed until review has been made and approvals obtained from the AHJ.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Raceways, Wireways, Gutters and Conduits: AFC, Aflex, Allied, American Conduit, Calbond, Cantex, Carlon, Champion, Hoffman, Hubbell, KorKap, Nepco, Nucor, Omega, Plasti-Bond, Perma-Cote, Pittsburgh, Sedco, Spang, Square-D, T&B, Western Tube and Wheatland, Walker and Wiremold.

B. Surface-mount Raceways: Hubbell, Mono-Systems, Panduit, Tehalit and Wiremold

C. Boxes and Fittings: Appleton, Cantex, Eaton, ECN Korns, Hoffman, Hubbell, Keystone, Lew, Madison, nVent Caddy, Orbit Industries, Raco, Regal, Stahlin, Steel City, Thomas & Betts and Walker.

D. Others: As listed on Drawings.

2.2 GENERAL PERFORMANCE REQUIREMENTS

A. Minimum conduit/raceway size shall be 3/4" except for in walls for receptacles and switch leg circuits, which may be 1/2".

B. Fittings shall be threaded or compression type. Set screw or bolt-on fittings are NOT acceptable.

C. All fittings shall have an insulated throat bushing, no exceptions.

D. See Section 26 05 19 - Low Voltage Conductors for information on where MC Cable is allowed. Where and when allowed, it shall be installed per manufacturers instructions and NEC requirements.

2.3 RIGID METAL CONDUIT - STEEL (RMC) - PER ANSI C80

A. Steel - Hot-dipped galvanized rigid steel (GRC) and galvanized intermediate metallic conduit (IMC) with zinc-coated threads and an outer coating of zinc chromate.

B. Fittings - per NEMA FB 1
1. Malleable iron, either cadmium plated or hot-dipped galvanized. Die cast zinc.
2. Use deflection and expansion couplings with bonding jumpers at all expansion joints where required. Steel Clamps.

2.4 RIGID METAL CONDUIT - ALUMINUM (RAC) - PER ANSI C80

A. Aluminum - Rigid aluminum conduit shall be threaded only.

B. Fittings - per NEMA FB 1
1. Aluminum fittings required.
2. Use deflection and expansion couplings with bonding jumpers at all expansion joints where required.

C. Conditions - Aluminum conduit shall not be installed in direct contact with concrete or masonry construction.

2.5 PVC COATED RIGID METAL CONDUIT - NEMA RN 1

A. Steel - Galvanized rigid steel conduit with external polyvinyl chloride (PVC) coating complying with NEMA RN 1 and listed and labeled as complying with UL 6 and ETL PVC-001.

B. Fittings - per NEMA FB 1
1. PVC coated (40 mils) exterior, urethane coated (2 mils) interior- malleable iron or steel.
2. Use fittings listed and labeled as complying with UL514B.

C. Conditions - The installer shall be certified by Manufacturer to install coated conduit.

2.6 ELECTRICAL METALLIC TUBING (EMT) - ANSI C80.3

A. Galvanized Thin Wall Steel or Aluminum Tubing

B. Fittings - per NEMA FB 1
1. Die cast zinc, pressure cast, malleable iron or steel. Clamps shall be steel. Where aluminum tubing is allowed, aluminum fittings are required unless otherwise noted.

C. Conditions - Aluminum conduit shall not be installed in direct contact with concrete or masonry construction.

2.7 RIGID NONMETALLIC CONDUIT (RNC)

A. PVC - Schedule 40 polyvinylchloride, NEMA TC 2, high impact resistant.

B. RTRC - Fiberglass, NEMA TC 14, standard wall.

C. Fittings - per NEMA TC 3 & 14, Solvent weld socket type.

D. Conditions - Do NOT use PVC for elbows in sizes 1-1/2" and larger.

2.8 FLEXIBLE METAL CONDUIT (FMC)

A. Steel - Spiral-wound, square interlocked, hot-dipped galvanized steel.

B. Aluminum - Spiral-wound, square interlocked aluminum.

C. Fittings - per NEMA FB 1
1. Cadmium plated two-screw, double-clamp malleable iron. Hot-dipped galvanized two-screw, double-clamp malleable iron. Pressure cast. Steel cast. Zinc coated, aluminum.

2.9 LIQUID-TIGHT FLEXIBLE METAL CONDUIT (LFC)

A. Steel - Spiral-wound, square interlocked, hot-dipped galvanized steel strip with a bonded outer jacket of PVC.

B. Fittings - per NEMA FB 1
1. Cadmium plated, compression type, malleable iron. Hot-dipped galvanized, compression type, malleable iron. To be insulated throat at terminations.
2. Aluminum - Copper free (1% or less)

2.10 WIREWAYS / GUTTERS

A. Steel - Not less than 16-gauge sheet steel. Size and length shall be as indicated on drawings. Otherwise, provide dimensions per NEC 366 & NEC 376, but never smaller than 4 inches by 4 inches. Construction shall be oil-tight, dust-tight and rain-tight with hinged fully gasketed cover. Finish shall be ANSI gray epoxy paint over rust-inhibiting prime coat.

B. Fittings - lay-in type with removable top, bottom and sides; Captive screw drip shield.

2.11 SURFACE RACEWAYS - SINGLE CHANNEL

A. Steel - Not less than 0.04" thickness sheet steel. One piece for up to 7 - #12 AWG wire capacity. Two piece for 8 or more - #12 AWG wire capacity. In unfinished spaces, finish shall be enamel over rust-inhibiting prime coat, not less than 0.25 square inch cross section.

B. PVC - Rigid polyvinyl chloride (PVC), not less than .20 square inch cross section. Two piece construction, minimum 5 - #12 AWG wire capacity.

C. Finish - In all spaces, coordinate color with Architect.

D. Fittings - Provide all required manufacturer's standard accessories and fittings for a complete installation.

2.12 SURFACE RACEWAYS - DUAL CHANNEL

A. Aluminum - two compartment, with receptacles and data devices as noted on electrical and technology drawings.

B. PVC - Wiremold 4320, Panduit T-70 non-metallic raceway or similar, two compartment, with receptacles and data devices as noted on electrical and technology drawings.

C. Finish - In all spaces, coordinate color with Architect.

D. Fittings - Provide all required manufacturer's standard accessories and fittings for a complete installation.

2.13 GENERAL OUTLET / BACK BOX / JUNCTION BOX

A. All boxes shall meet NEMA OS 1 (metallic) and NEMA OS2 (nonmetallic).

B. Cast Boxes - NEMA FB 1, Type FS or FD malleable iron or aluminum. Furnish gasketed cover by box manufacturer and provide threaded hubs.

C. Masonry Boxes - Shall have gang capacity and extension ring covers to match the number of devices installed.

D. Floor-mounted back boxes - shall be adjustable and gasketed.

E. Outlet and pull boxes - for single or ganged back boxes.
1. Interior - standard box shall be 2-1/8" deep or better. Use 3-1/2" deep boxes as needed and 1-1/2" shallow boxes as required for wall depth.
2. Exterior - standard box shall be 3-1/2" deep NEMA 3R or better.
3. In Ground or Concrete - NEMA 4 cast iron box with external recessed flanged cover. Depth as required.

F. Box Ganging - Gang type boxes shall be used where multiple devices are located adjacent to one another, including ceiling, wall and cast in floor boxes.

G. Box Barriers - In boxes with multiple switches, where the voltage between adjacent switches exceeds 150 volts to ground, provide an enclosure equipped with identified, securely installed barriers between adjacent devices.

H. Wall Plates - As specified in Section 26 27 26 - Wiring Devices.

2.14 PULL / SPLICE BOXES AND HAND HOLES

A. Surface Mounted Cast Metal Box: NEMA 250, Cast aluminum with ground flange, neoprene gasket and SS cover screws.

B. In-Ground Cast Metal Box: NEMA 250, Type 6, cast aluminum with flanged (smooth/nonskid) cover, recessed cover box for flush mounting

C. Handholes: Fiberglass with weatherproof nonskid cover with Pre-cut 6 inch x 6 inch (150 mm x 150 mm) cable entrance at center bottom of each side.

2.15 POWER AND COMMUNICATIONS FLOOR BOXES AND POKE-THRUS:

A. Shallow Floor Boxes - lid to be square, color to be per Architect
1. 2-gang and 4-gang - RFBA series by Walker, CFB series by Hubbell

B. Standard Floor Boxes - lid to be SQUARE, color to be per Architect
1. 2-gang, 4-gang, 6-gang, and 10-gang - RFBAx by Walker, CFBx by Hubbell

C. Poke-Thru Devices - Provide all telecommunications and data plates in each poke-thru as noted on the Communications Drawings and as specified in section 26 05 34. Lid / top color to be per Architect.
   1. 4", 6", 8", and 10" w/matching lid - Wiremold Evolution series, Hubbell S1Rx series

2.16 ROOFTOP CONDUIT SUPPORTS

A. Supports shall be adjustable height. Metal parts to be stainless steel or galvanized steel.

B. This product shall be used ONLY when conduits are indicated on the drawings to be run on the roof.

C. Approved Products
   1. Miro Industries Model 24-R-AH, 48-R-AH, 24AH and 48AH
   2. Portable pipe hangers #PP10

PART 3 EXECUTION

3.1 PREPARATION

A. Place conduit sleeves in the cavities of walls and floor slabs for the free passage of conduits.

B. Set all conduit sleeves in place a sufficient time ahead of concrete placement so as not to delay the work.

C. Apply caulking for all conduit sleeves through floors and through exterior walls.

D. Plugs or caps shall be installed before concrete placement begins.

3.2 GENERAL INSTALLATION

A. The drawings indicate an approximate location of boxes for switches, light outlets, power outlets, raceways etc. These drawings may not give complete and accurate information in regard to locations of such items. The exact locations shall be determined by reference to the Drawings and by actual measurements during construction of the building, subject to approval by the Owner's Representative.

B. The Owner's Representative reserves the right to adjust locations of raceway and boxes up to 6 feet in any direction prior to rough-in to accommodate intended purpose at no additional cost.

C. Ground and bond all raceway and boxes in accordance with Section 26 05 26.

D. Identify all raceway and boxes in accordance with Section 26 05 53.

3.3 CONDUIT AND RACEWAY APPLICATION

A. General Application
   1. Raceway Systems - all raceway shall be verified with the local code authority before use. In the case of questionable or denied use, the contractor shall be required to use a raceway system permitted by the local code at no additional cost.

2. Conduit sleeves - Provide RMC sleeves at all locations where conduits pass through beams, outside walls, fire rated walls, or structural members. The size of these sleeves shall be such as to permit readily the subsequent insertion of conduit of the proper size with adequate clearance for movement due to expansion and contraction. Where conduits pass through outside walls, the inside diameter of each pipe sleeve shall be at least 1/2" greater than the outside diameter of the service pipe. After the conduits are installed, fill the annular space between the conduit and its sleeve with a mastic or caulk. Use packing as required to accomplish this. At fire rated wall penetrations, use fire barrier.
3. Surface-mount raceway - not permitted except as noted on the drawings or in locations where concealing conduit is not possible.
4. Wireway / raceway - where required or shown on drawings. It shall be solid, without knockouts, with hinged cover, placed so that cover is gravity closed.
5. Branch circuits - shall not be installed in or under the ground floor slab unless specifically required on the drawings or pre-approved by EOR. No exceptions.

B. UNDERGROUND
1. Acceptable Conduit - Rigid Metal Conduit and PVC.
2. Fittings - all elbows shall be galvanized steel or fiberglass, no PVC. Other fittings shall match conduit material.
3. Boxes - Shall be cast metal, concrete or fiberglass. Shall be ANSI 77 traffic rated for the location
   a. Street / drive - vehicle Tier 22 rated
   b. Sidewalk - personnel or vehicle Tier 8 rated
   c. Grass - personnel Light Duty rated
4. Conditions - Conduit risers from elbow to above grade shall be RMC.

C. IMBEDDED IN / PASSING THROUGH CONCRETE
1. Acceptable Conduit - Rigid Metal Conduit.
2. Fittings - shall match the conduit material.
3. Masonry Boxes - Galvanized steel masonry rated box.
4. Conditions -
   a. PVC allowed only where required by utility provider.
   b. Where allowed, conduit imbedded in concrete shall not be larger than 3/4". Verify with project Structural Engineer prior to placing.

D. CRAWLSPACE
1. Acceptable Conduit - PVC.
2. Fittings - shall match the conduit material.
3. Boxes - shall match the conduit material.

E. WET AND DAMP LOCATIONS
1. Acceptable Conduit - Rigid Metal Conduit.
2. Fittings - shall be rated for the space and shall match the material of the conduit they are installed with.
3. Boxes - recessed shall match conduit material. Surface-mount shall be stainless steel.

F. CONCEALED / EXPOSED DRY LOCATIONS
1. Acceptable Conduit - EMT
2. Fittings - shall match the conduit material.
3. Boxes - Malleable iron or cast aluminum type FS / FD, with threaded hubs and gasketed covers.

4. Conditions - Do not use aluminum in cinder-fill walls.

G. EXISTING WALLS
   1. Acceptable Conduit -
      a. Concealed - Flexible Metal Conduit and EMT
      b. Surface-Mount - Surface-Mount Raceway and EMT
   2. Fittings - shall match the conduit material.
   3. Conditions - SM raceway shall be used in finished spaces. EMT may be used only in unfinished spaces, unless otherwise directed on the drawings.

H. INDOOR EQUIPMENT CONNECTIONS
   1. Acceptable Conduit - Flexible Metal Conduit and Liquid-Tight FMC.
   2. Fittings - shall match the conduit material.
   3. Boxes - shall match the conduit material.
   4. Conditions -
      a. Where flexible metal or nonmetallic conduit are used, total length not to exceed 72” above ceiling, 48” exposed below ceiling.
      b. In kitchen or similar spaces, use LTFMC unless otherwise directed on the drawings.
      c. Install flexible conduit to all recessed luminaires in accessible ceilings. Do not use more than 4 flexible metal conduits per junction box to supply luminaires in a location. Do not supply a luminaire from another with any Raceway or FMC. Suspend junction boxes and conduits from high roofs with hangers and trapeze.

I. OUTDOOR ABOVE GRADE
   1. Acceptable Conduit - Rigid Metal Conduit.
   2. Fittings - shall match the conduit material.
   3. Boxes - Weatherproof cast steel or cast aluminum.
   4. Conditions - Conduits may be used on a roof ONLY where indicated on the drawings and shall be supported per these specifications.

J. OUTDOOR EQUIPMENT CONNECTIONS
   1. Acceptable Conduit - Liquid-Tight FMC.
   2. Fittings - shall be rated for the space or environment.
   3. Boxes - shall be rated for the space or environment.
   4. Conditions - flexible conduit types shall not exceed 72" in length.

K. CORROSIVE ENVIRONMENTS
   1. Acceptable Conduit - PVC and Liquid-Tight FNC.
   2. Fittings & Boxes - shall be rated for the space or environment.
   3. Conditions - Flexible conduit for equipment connections only unless otherwise noted on the drawings.

L. HAZARDOUS LOCATIONS
   1. Acceptable Conduit - Rigid Metal Conduit
   2. Conditions - All conduit, boxes, fittings, hardware, etc. shall be rated for hazardous location.

M. PASSING THROUGH A FIRE WALL
   1. Acceptable Conduit - EMT and Rigid Metal Conduit
   2. Conditions - Provide fire caulking at all penetrations.

3.4 CONDUITS AND RACEWAY INSTALLATION

A. General
1. Unless otherwise indicated on the drawings, conduits shall be concealed in walls, partitions and above the ceiling. In rooms where ceilings are not present or scheduled, orient conduit parallel or perpendicular to structure.
2. Install each entire conduit system complete before pulling in any conductors. Clean the interior of every run of conduit before pulling in conductors. See Section 26 05 19 - Low Voltage Power Conductors for additional requirements for installation of conductors in raceways.
3. Conduits shall be continuous between enclosures such as outlet, junction and pull boxes, panels, cabinets, motor control centers, etc. The conduit must enter and be secured to enclosures so that each system is electrically continuous throughout. Where knockouts are used, provide double locknuts, one on each side. At conduit terminations, provide insulated throat fittings. Where conduits terminate in equipment having a ground buss, such as in switchgear, and panelboards, provide conduit with an insulated grounding bushing.
4. In mechanical spaces, install final equipment connections down from overhead where possible.
5. Cap open ends of raceways until conductors are installed to prevent ingress of dirt and moisture.
6. Close ends and unused openings in wireways and gutters.
7. Rigid nonmetallic conduit shall be adequately solvent welded at joints to form a tight, waterproof connection. Provide insulated ground wire in all PVC conduit and extend to ground buss.
8. Provide two spare 1 inch conduits stubbed into attic space at flush mounted electrical cabinets.
9. Moisture traps - provide junction box with drain fitting at low points in conduit system to avoid moisture traps.
10. Grounding - The installation shall comply with all NEC grounding requirements. See specification section 26 05 26 - Grounding and Bonding for Electrical Systems for additional grounding requirements.
11. Use expansion-deflection fittings on conduits 2 inches and larger crossing structural expansion joints and on exposed conduit runs where necessary. Provide bonding jumpers across fittings in metal raceway systems. Provide fittings to accommodate expansion and deflection where raceway crosses seismic, control and expansion joints.

B. Support
1. Install conduits parallel and supported on Unistrut or equal trapezes and anchored with split ring hangers, conduit straps or other devices specifically designed for the purpose. Wire ties are not permitted. Do not attach raceway to ceiling support wires or other piping systems.
2. Securely fasten and support all conduit runs. Provide required clamps, straps, clips, hangers and brackets. Raceways installed in joists shall be secured to joists with clamps at 20`0" maximum spacing. Raceways installed parallel to joists shall be supported by caddy clips (1 inch or smaller) or in unistrut/threaded rods/beam clamps trapeze at 15`-0" centers. Raceways installed perpendicular to bottom of joists shall be secured with individual conduit hangers at 10`-0" maximum spacing or unistrut/threaded rods/beam clamps at 15`-0" maximum centers. Raceways supported by straps at walls shall be supported per NEC. Support all raceways within one foot of each box, cabinet, disconnect, bend or

other raceway termination.

3. Raceways shall be supported with 2-hole straps. Single hole straps are not acceptable.
4. Support raceway using coated steel or malleable iron straps, clevis hangers, and split hangers.
5. Group related raceway; support using conduit rack. Construct rack using steel channel specified in Section 26 05 29; provide space on each for 25 percent additional raceways.
6. Do not support raceway with wire or perforated pipe straps. Remove wire used for temporary supports

C. Raceway Spacing
1. Maintain clearance between raceway and piping for maintenance purposes.
2. Maintain 12 inch (300 mm) clearance between raceway and surfaces with temperatures exceeding 104 degrees F (40 degrees C). (Excluding roof mounted conduits.)

D. Raceway Bends
1. Make bends with standard ells or conduit bent in accordance with the NEC. Make field bends using equipment designed for the particular conduit material and size involved. Bends must be free from dents or flattening. Use no more than the equivalent of three (3) 90-degree bends in any run between terminals and cabinets, or between outlets and junction boxes or pull boxes. Provide conduit bodies to make sharp changes in direction, as around beams. Provide factory elbows for bends in metal conduit larger than 2 inch (50 mm) size.

E. Concealed Locations
1. Install concealed conduit as directly and with the largest radius bends as possible. Conceal conduit in finished areas.

F. Pull string
1. Provide a Greenlee #431 or equal (240 lbs.) nylon pulling line in conduits in which wiring is not installed under this work, such as controls, signal, and similar systems. Identify both ends of the line by means of labels or tags reading "Pulling Line".

G. Fire Rated Walls
1. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping, ductwork, conduit and other items, requiring firestopping to comply with the latest applicable edition of the UL Fire Resistance Directory, Volumes I and II.

H. Raceway Routing
1. Raceway routing is shown in approximate locations unless dimensioned. Route to complete wiring system.

I. Rooftop Installation
1. Rigid metal conduit installed on the roof shall be securely fastened in place and supported on approved supports at least every 10 feet. Additionally, conduit shall be securely fastened and supported within 3 feet of each outlet box, junction box, device box, cabinet, conduit body, or other conduit termination.
2. Liquid-tight flexible metal conduit on the roof shall be securely fastened in place by an approved means within 12 inches of each box, cabinet, conduit body, or other conduit termination, and shall be supported and secured at intervals not to

exceed 4.5 feet. Flexible conduit shall not lay on roof.

J. Raceway Assembly
   1. Bring conduit to shoulder of fittings; fasten securely.
   2. Provide conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.

K. Surface Raceway
   1. Provide flat-head screws, clips, and straps to fasten raceway channel to surfaces; mount plumb and level.
   2. Provide insulating bushings and inserts at connections to outlets and corner fittings.

3.5 WIREWAY AND GUTTER INSTALLATION

A. Install wireways and surface raceways where noted or as required. Field apply a 90 percent grey zinc paint coating over cuts or scratches before any other finish is applied.

B. Serve surface-mount raceways from flush outlet boxes mounted behind raceway where possible and as directed.

3.6 COMMUNICATION SYSTEMS CONDUIT INSTALLATION

A. This contractor shall provide all raceways and conduits for all communication systems shown and/or required per specifications and as shown on the electrical and communications drawings. Communication Systems may include but are not limited to fire alarms, intercoms, data, security, antenna and media management.

B. This contractor shall provide a conduit pathway above ceiling for fire alarm, data, av systems, etc. between all spaces and the corridor, where walls go to deck. Coordinate exact conduit size (1” to 2”) and quantity with low voltage contractors and installers.

C. Raceways and conduit requirements shall be coordinated by this contractor with each Communication Systems Contractor and the general contractor.

D. See Specification Divisions 25, 27 and 28 for additional requirements.

3.7 ROOFTOP CONDUIT SUPPORT APPLICATION AND INSTALLATION

A. All roof-mounted conduits are to be supported and secured using an approved pipestand product manufactured for the purpose of supporting piping and conduit.

B. Supports shall be mounted onto a 12” x 24” x 2” concrete block.

C. Concrete block shall be placed over a ½” traffic block which is securely attached with mastic to the roof.

D. Electrical conduit, gas piping, and condensate may be mounted onto the same support.

3.8 BACK BOXES, OUTLETS AND FITTINGS APPLICATION

A. Back Boxes - Sizes and configuration shall be as required for the intended service and shall conform to and be applied in accordance with the NEC (Table 314-16(a)).

Provide extension rings, expandable bars sets, supports, gaskets for weatherproof type etc., where required.

B. At all ceiling-mounted boxes, provide supports and attachments to properly support ceiling and bracket-type devices or luminaires. Where the box shall support the device, the box shall be rated for the weight of the device/luminaire supported.

C. Voice & Data Outlet: Provide back boxes at each voice and data outlet. Communications wiring, device and plate to be provided by communications contractor. See Specification Divisions 27 and 28 for additional requirements.

3.9 BACK BOXES, OUTLETS AND FITTINGS INSTALLATION

A. Do not connect or install outlet boxes back-to-back.

B. Mounting height of a wall-mounted outlet box means the height from finished floor to bottom of box.

C. Unless otherwise shown or specified, install boxes for switches at 44" and receptacles at 18" AFF. Verify door swings with drawings and schedules and locate switches and pull stations, unless otherwise noted, on the strike side of the door.

D. Where back boxes are required for switches, receptacles, data jacks, thermostats, CO2 sensors, etc. and are shown next to each other, all devices shall be installed at the same height and, where possible, provide a gang back box and cover them with a multi-gang cover plate.

E. Where boxes are indicated adjacent to each other, mount these boxes in a symmetrical pattern with all tops at the same elevation.

F. Install boxes as required to facilitate cable installation in raceway systems.

G. Provide boxes in conduit runs of more than 100 feet or as required in Division 26.

H. Protect boxes in such a manner as to prevent foreign material, such as plaster, from entering boxes. Boxes shall be thoroughly cleaned of foreign materials before pulling conductors.

I. Orient boxes to accommodate wiring devices oriented as specified in Section 26 27 26 - Wiring Devices, as indicated on the drawings or as indicated in the details.

J. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

K. Accessible Ceilings - Install outlet and junction boxes no more than 6 inches (150 mm) from ceiling access panel or from removable recessed luminaire. Provide suitable access doors for all boxes mounted above gypsum/hard or otherwise inaccessible ceilings.

L. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.

M. Install flush mounting box without damaging wall insulation or reducing its effectiveness.

N. Install adjustable steel channel fasteners for hung ceiling outlet box.

O. Do not fasten boxes to ceiling support wires or other piping systems.

P. Support boxes independently of conduit.

Q. Install gang box where more than one device is mounted together. Do not use sectional box.

R. Provide plaster rings for all boxes in plastered walls and ceilings.

S. Install gang box with plaster ring for single device outlets.

T. Provide boxes so that covers are readily accessible and easily removable after completion of the installation.

U. Provide all standard boxes, pull junction, wiring device and/or splice boxes for all systems in ceilings, walls and slabs.

V. All low voltage systems in attic or crawl spaces specified in Division 23 are not included.

W. At all ceiling-mounted receptacle and luminaire (exit light, pendants, linear direct/indirect, etc.) locations, provide a heavy-duty dual bar hanger with ceiling ties to support the back box. Provide Cooper Industries BA50F or approved equal with appropriate back box for the application.

X. All outlet boxes shall be mounted between joists/studs and supported by both adjacent joists/studs, not just one. All outlet boxes shall be supported by a rigid box support or mounting bracket that stretches the entire length between the joists/studs and is mechanically fastened to joists/studs at each end. Outlet boxes shall not be supported from only one side or by only one joist/stud regardless of stud material.

Y. Plates shall cover any cracks between box and tile. Use oversize plates where necessary.

Z. At all exit luminaires installed in grid ceilings (T-grid), provide a Cooper Industries BA50F or approved equal.

3.10 FLUSH BOXES

A. Mount all outlet boxes such that finished installation with mud ring is within 1/4 inch of the finished wall or ceiling line unless otherwise indicated. Provide knockout closures to cap unused knock out holes where knock out holes have been removed. Install outlets flush with finish walls or ceiling surfaces for concealed wiring.

B. Provide galvanized steel extension rings where required to extend the box forward in conformance to NEC requirements. Attach ring with at least two machine screws. Install electrical boxes and fittings in compliance with NEC requirements and in accordance with the manufacturer`s written instructions and with recognized industry practices to ensure that the boxes and fittings serve the intended purposes. Under no circumstances shall a conduit enter/exit an extension ring. Conduits shall enter/exit the electrical box only.

C. Locate boxes and conduit bodies to ensure accessibility of electrical wiring. Install blank cover plates, painted to match surrounding, at pull boxes, junction boxes and all others to which no luminaire or device is to be attached.

D. Securely fasten outlet boxes in position using clips or other suitable means. Secure boxes rigidly to the substrate upon which they are being mounted. Solidly embed boxes in concrete or masonry. Boxes shall not be permitted to move laterally, or to be supported only by EMT or conduit.

3.11 POWER AND COMMUNICATIONS FLOOR BOXES AND POKE-THRU DEVICES:

A. Provide and install all wiring, devices, back boxes, covers, plates, conduit and hardware as required for a complete installation. Do not daisy-chain floor boxes or poke-thru devices with conduits unless otherwise noted on drawings. See Section 26 27 26 for wiring devices to go in floor boxes.

B. Provide duplex receptacles and associated wiring per below table unless otherwise noted on the drawings. Provide circuits as shown on drawings. If powered by an isolated ground circuit, all receptacles shall be isolated ground. Provide conduits indicated in below table from each box to nearest wall and then up to accessible attic space for power, data, A/V and other wiring.

SIZE	Recept. Qty.	Power Conduit	Data Conduits	
2-gang	1x duplex	1x - 1"	1x - 1-1/4"	
4-gang	2x duplex	*1x - 1"	2x - 1-1/4"	
6-gang	3x duplex	*2x - 1"	2x - 1-1/4"	
8-gang	4x duplex	*2x - 1"	2x - 1-1/4"	
10-gang	5x duplex	*2x - 1"	3x - 1-1/4"	

* or as required.

3.12 INTERFACE WITH OTHER PRODUCTS

A. Install conduit to preserve fire resistance rating of partitions and other elements, using materials and methods in accordance with Section 07 84 00.

B. Route conduit through roof openings for piping and ductwork or through suitable roof jack with pitch pocket. Coordinate location with roofing installation.

C. Locate outlet boxes to allow luminaires positioned as indicated on Drawings and Architect’s reflected ceiling plan.

D. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.

3.13 ADJUSTING

A. Adjust flush-mounting outlets to make front flush with finished wall material.

B. Install knockout closures in unused openings in boxes.

3.14 CLEANING

A. Clean interior of boxes to remove dust, debris, and other material.

B. Clean exposed surfaces and restore finish.

3.15 EXISTING WORK

A. For any renovation, it is intended to reuse the existing conduits if they prove to be adequate in size and integrity, unless otherwise noted on the drawings.

END OF SECTION

SECTION 26 05 53

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Identification required for electrical equipment and systems.

B. All identification required by code or ordinance shall be provided, whether or not shown on Drawings or specified herein.

1.2 RELATED REQUIREMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions, Division 1 Specifications and Division 26, Section 26 00 00 - Electrical apply to this Section.

B. See the following sections for related work.
   1. Section 26 20 00 - Low-Voltage Electrical Distribution

1.3 REFERENCES AND STANDARDS

A. ANSI Z535.4

B. Federal Specification (L-P-387) - labelling, materials and color standards

1.4 SUBMITTALS

A. Submittals required in this section shall conform to and be submitted in accordance with the General Conditions, Division 1 and Division 26.

B. Product Data:
   1. Submit product data for sign materials. Refer to Electrical Identification detail on drawings for additional information.
   2. Submit manufacturer’s catalog literature for each product required.
   3. Submit electrical identification schedule including list of wording, symbols, letter size, color coding, tag number, location, and function.

1.5 CLOSEOUT SUBMITTALS:

A. After the owner’s room number list is finalized, submit a list of all electrical identification tags. The list shall include the actual text that will appear on each tag. Include the owner’s and architects room numbers on all tags. This list shall be submitted for the review of the owner's representative.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three (3) years experience.

1.7 DELIVERY, STORAGE AND HANDLING

A. Accept identification products on site in original containers. Inspect for damage.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

PART 2 PRODUCTS

2.1 MATERIALS

A. General Requirements
   1. Lettering - shall be Arial font
   2. All means of identification referenced in this section shall be of sufficient durability to withstand the environment per NEC 110.21. Where plastic is used outdoors, it shall be UV rated or treated.
   3. Colors shall conform to FS L-P-387.
   4. Thickness for signs and engraved labels - 1/16" thick

B. Signs - For identifying multiple electrical services
   1. Outdoors - Aluminum
   2. Indoors - Plastic
   3. Appearance - White with black lettering, lettering - 1/4" tall or larger.

C. Equipment Labels - For panelboards, switchboards, switchgear, disconnects, equipment, etc.
   1. Outdoors - UV rated engravable plastic (L-P-387)
   2. Indoors - Engravable plastic (L-P-387)
   3. Appearance - white with black lettering, lettering - 1/4" tall or larger.

D. Electrical Safety Labels - for Arc Flash labels
   1. Inside building or enclosure - self-adhesive vinyl
   2. Appearance - industry standard colors and layout

E. Marker Labels - for circuit identification and other labelling
   1. Write-on marker label with a laminating portion for protection.
   2. Appearance - writing portion shall be white, laminate portion shall be clear. Provide a wider label with color bands where required to identify electrical systems per list in part 3 below.

F. Wire Markers - for circuit or voltage identification
   1. Conductor marking - electrical tape
   2. Circuit marking - Tubing type, cloth tape, split sleeve
   3. Appearance - colors to match list below

G. Underground Warning Tape
   1. Four inch wide plastic tape
   2. Appearance - colored red and yellow with suitable warning legend describing buried electrical lines

H. Mechanical fasteners - stainless steel screws, non-corroding pop rivets

PART 3 EXECUTION

3.1 PREPARATION

A. Coordinate with the architect to obtain a list of the finalized owner's room number list before ordering identification tags.

B. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 APPLICATION OF EQUIPMENT LABELLING

A. Main Service Disconnecting Means
1. Mark the label on the main service disconnecting means with the calculated fault current listed on the panel schedule along with the issue date of the drawings per NEC 110.24(A). The calculated fault current shall be labelled "Maximum Fault Current" and the date shall be labelled "date calculations performed".
2. Provide a sign at each service at each structure per NEC 230.2(E)

B. Panelboards, Switchboards, Switchgear
1. Circuit Directory shall be frame mounted inside the door with heat-resistant transparent face and a directory card that is type written and completely filled out.
2. Circuit Directory shall coordinate each breaker with the proper load served. Each circuit shall be uniquely identifiable per NEC 408.4(A) including room numbers. Room numbers shall be as directed by Owner.
3. Circuit Directory shall indicate all spares and spaces in erasable pencil.
4. Equipment label shall indicate the high leg per NEC 408.3

C. Instantaneous Fault Current (AIC) - electrician to field-mark the equipment labels with the calculated instantaneous fault current (as shown on panel boards) per NEC 110.24(A) and use the seal date as the calculation date.

D. When series rated panels are specifically allowed, provide a label affixed by the manufacturer indicating the tested and approved series rating combinations per NEC Article 240.86. Provide an additional label affixed behind the panel door to be field marked in accordance with NEC Article 110.22(C).

3.3 INSTALLATION OF EQUIPMENT IDENTIFICATION

A. General
1. Install all identification per manufacturer installation instructions, NEC and NECA standards.
2. Install all labels in an easily visible location and parallel to equipment lines.
3. Provide signs and tags for equipment requiring identification as shown on drawings and for equipment as required by latest adopted version of the NEC.
4. All signs and tags to be mechanically fastened. Double-sided tape or other fastening methods are not acceptable.
5. Provide for each main disconnect not grouped together.
6. Install signs on outside of cover for safety switches and time clocks.
7. Install signs on outside top, not on door, and at each circuit for panelboards, switchboards and motor control centers.
8. All labeling identification shall contain both the owner's and architect's room names and numbers. Coordinate with General Contractor to secure construction

room numbers.
9. Provide all additional signage required by local authority at no cost to the Owner.
10. Install identification only when ambient temperature and humidity conditions are within range recommended by manufacturer.
11. Refer to Section 26 24 16 - Panelboards for Distribution Switchgear for more information.
12. Refer to Section 26 21 00 - Low Voltage Electrical Service Entrance for more information.

B. Existing Work
1. Install identification on existing equipment to remain in accordance with this section.
2. Install identification on all unmarked existing equipment.
3. Replace lost nameplates, labels or markers.
4. Update panel schedules to all panels changed/affected during renovation.

C. Back Box Cover & Identification
1. Back boxes - Marker Labels or Sharpie (permanent black felt-tip marker)
2. Information - Label with source panel and circuits. Label as "future use" if there are no conductors pulled.
3. Back Box Cover Color
   a. Fire Alarm System - Red
   b. Other (unless otherwise specified herein) - White

D. Electrical Distribution Nameplates
1. Application - Panelboards, Switchboards, Switchgear, Transformers
2. Identification - Sign or Equipment Label with mechanical fasteners, per NEC 408.4(B).
3. Information shall include (Example in parenthesis)
   a. Panel designation (CHAC)
   b. Voltage, phase and wires (277/480v 3ph 4w)
   c. Source of service (Fed from MSB)

E. Electrical Equipment Nameplates
1. Application - Safety Switches, Disconnects for HVAC, motors, time clocks, water heaters, etc. and Enclosure for controls, relays, contactors, solenoids, other electrical assemblies.
2. Identification - Sign or Equipment Label with mechanical fasteners
3. Information shall include (Example in parenthesis)
   a. Load served (A/H #C206)(Parking Lot Lighting)
   b. Voltage and phase (480v 3ph)
   c. Circuits used (CHAC-15,17,19)

END OF SECTION

SECTION 26 05 73

POWER SYSTEM STUDIES

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Provide calculation of various parameters of the new and/or existing electrical system along with feedback to the electrician to ensure:
   1. Proper adjustment of all adjustable breakers for efficient operation
   2. Proper labelling for equipment and personnel safety.

B. Performing Protective Device Coordination Studies

C. Performing Arc Flash analysis

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions, Division 1 Specifications and Section 26 00 00, apply to this Section.

1.3 RELATED SECTIONS

A. Section 26 00 00 - Electrical

1.4 COORDINATION

A. Coordinate special tests and/or equipment start-up as specified or implied in related sections.

1.5 SUBMITTALS

A. Submittals required in this section shall conform to and be submitted in accordance with the General Conditions, Division 1, and Division 26 requirements.

PART 2 PRODUCTS

2.1 PERFORMANCE / DESIGN CRITERIA

A. x

B. Submit studies in accordance with ANSI/IEEE Standard 242 Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems.

C. Submit one-line diagram for each electrical service. Key all equipment and components on diagram to items in the studies.

PART 3 EXECUTION

3.1 GENERAL

A. This contractor shall coordinate with the submitted equipment manufacturer to provide the below studies per the requirements in the specifications. This contractor

shall coordinate all wire and conduit sizes and feeder lengths to the equipment manufacturer for the purposes of conducting the studies.

B. The submitted equipment manufacturer shall provide the below studies, complete with a report including any cautionary items, equipment adjustments and proper equipment labels.

3.2 APPLICATION

A. Short-Circuit Current Study
   1. x
   2. Provide a short-circuit current analysis for each main switchboard and downstream distribution. Short-circuit analysis shall calculate short-circuit levels at service transformer secondary, switchboard main breaker, each feeder breaker and all levels of downstream distribution equipment. Assume infinite source bus.
   3. Label each switchboard and panelboard with the Instantaneous Fault Current per Section 26 05 53 Identification for Electrical Systems.

B. Overcurrent Protective Device Coordination Study
   1. Overcurrent Protective Device Coordination Study shall be performed in accordance with NFPA 70 - National Electrical Code and NFPA 99 – Health Care Facilities Code.
   2. For any project where service entrance equipment is added or changed, provide a short circuit and OCPD coordination study for the entire system.
   3. For any project where electrical panels are added or changed but the service entrance equipment is not changed, provide a short circuit and OCPD coordination study for the service entrance equipment and all affected panels.
   4. For any project involving mechanical equipment changes including chillers, cooling towers, air handlers, condensers, pumps, or rooftop units, provide a short circuit and OCPD coordination study for the affected portion of the system including affected panels and branch circuit overcurrent protective devices.
   5. For any project where service entrance equipment and electrical panels are added, provide a short circuit and OCPD coordination study for all service entrance equipment and panels.
   6. Submit the short circuit and OCPD coordination to the city upon request. The level of detail and format shall conform to city requirements.
   7. Coordinate the short circuit current ratings (SCCR, withstand rating) of mechanical equipment with the available short circuit current. The short circuit current ratings of all electrical and mechanical equipment shall exceed the available short circuit current.
   8. Adjust settings of adjustable circuit breakers to achieve selective coordination of the system. Notify the engineer if selective coordination cannot be achieved.
   9. x
   10. Provide a time-current coordination study for each main switchboard. Coordination study shall compare the operating levels and times of the protective devices to the withstand levels and times that the equipment can sustain without damage or failure. Determine electronic trip unit settings necessary to achieve optimal selective coordination between 480-volt main service circuit breaker and first level of feeder distribution devices. Determine setting for all adjustments of trip units of all electronic circuit breakers that are linked by zone-selective interlocking. Furnish time-current curves for the two (or more) levels of distribution protected with electronic trips, plus the first additional distribution

level served from the switchboard feeder. Show a separate composite plot for each feeder breaker trip rating with the main breaker. Plot composite time-current curves on log-log background. Add a typical frame size of downstream molded-case circuit breaker to each switchboard feeder composite plot.

C. Arc Flash Hazard Study
   1. For any project where new service entrance equipment is added or existing service entrance equipment is changed, provide an arc flash and fault study with all required labels for the service entrance equipment and all downstream electrical panelboards and switchboards per NEC 110.16 and 110.21(B).
   2. For any project where electrical panels are added or changed but the service entrance equipment is not changed, provide an arc flash and fault study with all required labels for all affected panelboards and switchboards per NEC 110.16 and 110.21(B).

END OF SECTION

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SECTION 26 08 00

COMMISSIONING OF ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Commissioning:
   1. Commissioning is a systematic process of ensuring that all building systems perform interactively according to the design intent and the owner's operational needs. Commissioning during the construction phase is intended to achieve the following specific objectives according to the Contract Documents:
      a. Verify that applicable equipment and systems are installed according to the manufacturer's recommendations and to industry accepted minimum standards and that they receive adequate operational checkout by installing contractors.
      b. Verify and document proper performance of equipment and systems.
      c. Verify that O&M documentation is complete.
      d. Verify that the Owner's operating personnel are adequately trained
   2. The systems to be commissioned include: electrical switchgear and panels, emergency power systems (if included), UPS Systems (if included), electrical and lighting controls, fire alarm system, and life safety systems and controls.
   3. Commissioning requires the participation of affected Division contractors to ensure that all systems are operating in a manner consistent with the Contract Documents. All affected Division contractors shall be familiar with all parts of the commissioning plan issued by the CA (Commissioning Authority) and shall execute all commissioning responsibilities assigned to them in the Contract Documents.
   4. Commissioning Team:
      a. The members of the commissioning team consist of the Commissioning Authority (CA), the designated representative of the owner, the General Contractor (GC or Contractor), the Architect and Design Engineers, the Mechanical Contractor (MC), the Electrical Contractor (EC), the Controls Contractor (CC), the Fire Alarm Contractor, and any other installing subcontractors or suppliers of equipment. The Owner's building or plant operator/engineer is also a member of the commissioning team.

1.2 COMMISSIONING AUTHORITY

A. The commissioning authority and/or agency shall be selected and employed by the building owner. The commissioning agent shall be a licensed professional engineer in the State where the work will be performed, and shall be experienced in the commissioning of mechanical and electrical systems of the type installed in this project. Experience in construction process, direct digital control systems, test and balance and ASHRAE Guideline 1 - 1998 is mandatory. The commissioning agent shall not be associated with or employed by a mechanical contractor, or equipment supplier.

1.3 COMMISSIONING PLAN

A. Commissioning Plan:
   1. The commissioning plan provides guidance in the execution of the commissioning process. Just after the initial commissioning scoping meeting the CA will provide the plan, which will continue to evolve and expand as the project progresses. The Specifications will take precedence over the Commissioning Plan.

B. Commissioning Process:
   1. The following narrative provides a brief overview of the typical commissioning tasks during construction and the general order in which they occur.
   2. Commissioning during construction begins with a scoping meeting conducted by the CA where the commissioning process is reviewed with the commissioning team members.
   3. Additional meetings will be required throughout construction, scheduled by the CA with necessary parties attending, to plan, scope, coordinate, schedule future activities and resolve problems. Generally, these meetings will be included with or will be sequential with regular subcontractor meetings.
   4. Equipment documentation is submitted to the CA during normal submittals, including detailed start-up procedures.
   5. The CA works with the Subs in developing startup plans and startup documentation formats, including prefunctional checklists to be completed, during the startup process.
   6. In general, the checkout and performance verification proceeds from simple to complex; from component level to equipment to systems and intersystem levels with prefunctional checklists being completed before functional testing.
   7. The Subcontractors, under their own direction, execute and document the prefunctional checklists and perform startup and initial checkout. The CA documents that the checklists and startup were completed according to the approved plans. This may include the CA witnessing start-up of selected equipment and systems.
   8. The installing contractors, suppliers and manufacturers, develops specific equipment and system functional performance test procedures with the assistance of the CA.
   9. The procedures are executed by the Subcontractors, under the direction of, and documented by the CA.
   10. Items of non-compliance in material, installation or setup are corrected at the Subcontractor’s expense and the system retested.
   11. The CA reviews the O&M documentation for completeness. All O&M documentation must be submitted and approved before the start of training.
   12. Commissioning shall be completed before Substantial Completion.
   13. The CA reviews, pre-approves and coordinates the training provided by the Subs and verifies that it was completed.
   14. Deferred testing is conducted, as specified or required.

1.4 RESPONSIBILITIES

A. General Contractor (GC):
   1. Facilitate the coordination of the commissioning work by the CA, and with the CA ensure that commissioning activities are being scheduled into the master schedule.

2. Include the cost of commissioning in the contract price.
3. Furnish a copy of all construction documents, addenda, change orders and approved submittals and shop drawings related to commissioned equipment to the CA.
4. In each purchase order or subcontract written, include requirements for submittal data, Systems/O&M data, commissioning tasks and training.
5. Ensure that all Subs execute their commissioning responsibilities according to the Contract Documents and schedule.
6. A representative shall attend a commissioning scoping meeting and other necessary meetings scheduled by the CA to facilitate the Commissioning process.
7. Coordinate the training of owner personnel.
8. Prepare Systems/O&M manuals and Systems manuals, according to the Contract Documents, including clarifying and updating the original sequences of operation to as-built conditions.

B. Warranty Period:
1. Ensure that Subcontractors execute seasonal or deferred functional performance testing, witnessed by the CA, according to the specifications.
2. Ensure that Subs correct deficiencies and make necessary adjustments to O&M manuals and as-built drawings for applicable issues identified in any seasonal testing.

C. Electrical Contractors and Sub-Contractors:
1. The commissioning responsibilities applicable to each of the subcontractors are generally as follows (all references apply to commissioned equipment only). Specific requirements are shown in the appropriate Divisions.
2. Construction and Acceptance Phases
    a. Include the cost of commissioning in the contract price.
    b. In each purchase order or subcontract written, include requirements for submittal data, commissioning documentation, Systems/O&M data and training.
    c. Attend a commissioning scoping meeting and other meetings necessary to facilitate the Commissioning process.
    d. Contractors shall provide the CA with normal cut sheets and shop drawing submittals of commissioned equipment as part of the normal submittal process.
    e. Provide additional requested documentation, prior to normal O&M manual submittals, to the CA for development of start-up and functional testing procedures.
        1) Typically this will include detailed manufacturer installation and start-up, operating, troubleshooting and maintenance procedures, full details of any owner-contracted tests, full factory testing reports, if any, and full warranty information, including all responsibilities of the Owner to keep the warranty in force clearly identified. In addition, the installation, start-up and checkout materials that are actually shipped inside the equipment and the actual field checkout sheet forms to be used by the factory or field technicians shall be submitted to the Commissioning Authority.
        2) The Commissioning Authority may request further documentation necessary for the commissioning process.

f. Provide a copy of the Systems/O&M manuals and submittals of commissioned equipment, through normal channels, to the CA for review and approval.
g. Contractors shall assist (along with the design engineers) in clarifying the operation and control of commissioned equipment in areas where the specifications, control drawings or equipment documentation is not sufficient for writing detailed testing procedures.
h. Provide assistance to the CA in preparing the specific functional performance test procedures. Subs shall review test procedures to ensure feasibility, safety and equipment protection and provide necessary written alarm limits to be used during the tests.
i. Develop a full start-up and initial checkout plan using manufacturer's start-up procedures and the prefunctional checklists from the CA for all commissioned equipment. Submit to CA for review and approval prior to startup.
j. During the startup and initial checkout process, execute the prefunctional checklists for all commissioned equipment.
k. Perform and clearly document all completed startup and system operational checkout procedures, providing a copy to the CA.
l. Address current A/E punch list items before functional testing
m. Provide skilled technicians to execute starting of equipment and to execute the functional performance tests. Ensure that they are available and present during the agreed upon schedules and for sufficient duration to complete the necessary tests, adjustments and problem solving.
n. Perform functional performance testing under the direction of the CA for specified equipment. Assist the CA in interpreting the monitoring data, as necessary.
o. Correct deficiencies (differences between specified and observed performance) as interpreted by the CA, and A/E and retest the equipment.
p. Prepare Systems/O&M manuals according to the Contract Documents, including clarifying and updating the original sequences of operation to as-built conditions.
q. Prepare redline as-built drawings for all drawings and final as-builds for contractor-generated coordination drawings.
r. Provide training of the Owner's operating personnel as specified.
s. Coordinate with equipment manufacturers to determine specific requirements to maintain the validity of the warranty.

D. Warranty Period:
1. Execute seasonal or deferred functional performance testing, witnessed by the CA, according to the specifications.
2. Correct deficiencies and make necessary adjustments to O&M manuals and as-built drawings for applicable issues identified in any seasonal testing.

E. Equipment Suppliers:
1. Provide all requested submittal data, including detailed start-up procedures and specific responsibilities of the Owner to keep warranties in force.
2. Assist in equipment testing per agreements with Subs.
3. Include all special tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment according to these Contract Documents in the base bid price to the Contractor, except for stand-alone data logging equipment that may be used by the CA.

4. Provide information requested by CA regarding equipment sequence of operation and testing procedures.
5. Review test procedures for equipment installed by factory representatives.

F. Commissioning Authority (CA):
1. The CA is not responsible for design concept, design criteria, compliance with codes, design or general construction scheduling, cost estimating, or construction management. The CA may assist with problem-solving non-conformance or deficiencies, but ultimately that responsibility resides with the general contractor and the A/E. The primary role of the CA is to develop and coordinate the execution of a testing plan, observe and document performance - that systems are functioning in accordance with the documented design intent and in accordance with the Contract Documents. The Contractors will provide all tools or the use of tools to start, checkout and functionally test equipment and systems, except for specified testing equipment supplied and installed by the CA.
    a. Coordinates and directs the commissioning activities in a logical, sequential and efficient manner using consistent protocols and forms, centralized documentation, clear and regular communications and consultations with all necessary parties, frequently updated timelines and schedules and technical expertise.
    b. Coordinate the commissioning work and, with the GC, ensure that commissioning activities are being scheduled into the master schedule.
    c. Revise, as necessary, Commissioning Plan-Construction Phase.
    d. Plan and conduct a commissioning scoping meeting.
    e. Request and review additional information required to perform commissioning tasks, including Systems/O&M materials, contractor start-up and checkout procedures.
    f. Before startup, gather and review the current control sequences and interlocks and work with contractors and design engineers until sufficient clarity has been obtained, in writing, to be able to write detailed testing procedures.
    g. Review and approve normal Contractor submittals applicable to systems being commissioned for compliance with commissioning needs, along with A/E reviews.
    h. Perform site visits, as necessary, to observe component and system installations. Attend selected planning and job-site meetings to obtain information on construction progress. Review construction meeting minutes for revisions/substitutions relating to the commissioning process. Assist in resolving any discrepancies.
    i. Approve pre-functional tests and checklist completion by reviewing prefunctional checklist reports and by selected site observation and spot checking.
    j. Approve systems startup by reviewing start-up reports and by selected site observation.
    k. Review the functional performance test procedures for equipment and systems developed by the subcontractors and suppliers. This may include energy management control system trending, or manual functional testing.
    l. Coordinate, witness and approve manual functional performance tests performed by installing contractors. Coordinate retesting as necessary until satisfactory performance is achieved.

m. Review equipment warranties to ensure that the Owner's responsibilities are clearly defined.
n. Oversee and approve the training of the Owner's operating personnel.
o. Compile and maintain a commissioning record.
p. Review and approve the preparation of the Systems/O&M manuals.
q. Provide a final commissioning report.

1.5 WARRANTY PERIOD

A. Coordinate and supervise required seasonal or deferred testing and deficiency corrections.
1. Return to the site at 10 months into the 12-month warranty period and review with facility staff the current building operation and the condition of outstanding issues. Also interview facility staff and identify problems or concerns they have operating the building as originally intended. Make suggestions for improvements and for recording these changes in the Systems/O&M manuals. Identify areas that may come under warranty or under the original construction contract. Assist facility staff in developing reports, documents and requests for services to remedy outstanding problems.

B. Scheduling:
1. The CA will work with the GC according to established protocols to schedule the commissioning activities. The CA will provide sufficient notice to the CM and GC for scheduling commissioning activities. The GC will integrate all commissioning activities into the master schedule. All parties will address scheduling problems and make necessary notifications in a timely manner in order to expedite the commissioning process.

PART 2 PRODUCTS

2.1 TEST EQUIPMENT

A. All standard testing equipment required to perform startup and initial checkout and required functional performance testing shall be provided by the Division contractor for the equipment being tested.

B. Special equipment, tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment, according to these Contract Documents shall be included in the base bid price to the Contractor and left on site.

C. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Specifications.

PART 3 EXECUTION

3.1 MEETINGS

A. Scoping Meeting:
1. Within 90 days of commencement of construction, the CA will schedule, plan and conduct a commissioning scoping meeting with the entire commissioning team in attendance. Meeting minutes will be distributed to all parties by the GC. Information gathered from this meeting will allow the CA to revise the Commissioning Plan to its "final" version, which will also be distributed to all

parties.

B. Miscellaneous Meetings:
   1. Other meetings will be planned and conducted by the CA as construction progresses. These meetings will cover coordination, deficiency resolution and planning issues with particular subs. The CA will plan these meetings and will minimize unnecessary time being spent by Subs.

3.2 REPORTING

A. The CA will regularly communicate with all members of the commissioning team, keeping them apprised of commissioning progress and scheduling changes through memos, progress reports, etc.

B. Testing or review approvals and non-conformance and deficiency reports are made regularly with the review and testing as described in later sections.

C. A final summary report by the CA will be provided focusing on evaluating commissioning process issues and identifying areas where the process could be improved. All acquired documentation, logs, minutes, reports, deficiency lists, communications, findings, unresolved issues, etc., will be compiled in appendices and provided with the summary report.

3.3 SUBMITTALS

A. The CA will provide appropriate contractors with a specific request for the type of submittal documentation the CA requires to facilitate the commissioning work. These requests will be integrated into the normal submittal process and protocol of the construction team. At minimum, the request will include the manufacturer and model number, the manufacturer's printed installation and detailed start-up procedures, full sequences of operation, Systems/O&M data, performance data, any performance test procedures, control drawings and details of owner contracted tests. In addition, the installation and checkout materials that are actually shipped inside the equipment and the actual field checkout sheet forms to be used by the factory or field technicians shall be submitted to the Commissioning Authority. All documentation requested by the CA will be included by the Subs in their Systems/O&M manual contributions.

B. The Commissioning Authority will review and approve submittals related to the commissioned equipment for conformance to the Contract Documents as it relates to the commissioning process, to the functional performance of the equipment and adequacy for developing test procedures. This review is intended primarily to aid in the development of functional testing procedures and only secondarily to verify compliance with equipment specifications. The Commissioning Agent will notify the appropriate persons as requested, of items missing or areas that are not in conformance with Contract Documents and which require resubmission.

C. The CA may request additional design narrative from the A/E and Controls Contractor, depending on the completeness of the design intent documentation and sequences provided with the Specifications.

3.4 START-UP, PREFUNCTIONAL CHECKLISTS AND INITIAL CHECKOUT

A. The following procedures apply to all equipment to be commissioned. Some systems that are not comprised so much of actual dynamic machinery may have very simplified PCs and startup.

B. General:
   1. Prefunctional checklists are important to ensure that the equipment and systems are hooked up and operational. It ensures that functional performance testing (in-depth system checkout) may proceed without unnecessary delays. Each piece of equipment receives full prefunctional checkout. No sampling strategies are used. The prefunctional testing for a given system must be successfully completed prior to formal functional performance testing of equipment or subsystems of the given system.

C. Start-up and Initial Checkout Plan:
   1. The CA shall assist the commissioning team members responsible for start-up of any equipment in developing detailed start-up plans for all equipment. The primary role of the CA in this process is to ensure that there is written documentation that each of the manufacturer-recommended procedures have been completed. Parties responsible for prefunctional checklists and start-up are identified in the commissioning scoping meeting and in the checklist forms. Parties responsible for executing functional performance tests are identified in the testing requirements.
      a. The CA assist in the development of checklists that indicate required procedures to be executed as part of start-up and initial checkout of the systems and the party responsible for their execution.
      b. The Contractor determines which trade is responsible for executing and documenting each of the line item tasks and notes that trade on the form. Each form may have more than one trade responsible for its execution.
      c. The subcontractor responsible for the purchase of the equipment develops the full start-up plan by combining (or adding to) the CA's checklists with the manufacturer's detailed start-up and checkout procedures from the O&M manual and the normally used field checkout sheets. The plan will include checklists and procedures with specific boxes or lines for recording and documenting the checking and inspections of each procedure and a summary statement with a signature block at the end of the plan.
      d. The full start-up plan could consist of something as simple as:
         1) The contractor and CA prefunctional checklists.
         2) The manufacturer's standard written start-up procedures copied from the installation manuals with check boxes by each procedure and a signature block added by hand at the end.
         3) The manufacturer's normally used field checkout sheets.
      e. The subcontractor submits the full startup plan to the CA for review and approval.
      f. The CA reviews and approves the procedures and the format for documenting them, noting any procedures that need to be added.
      g. The full start-up procedures and the approval form may be provided to the CM for review and approval, depending on management protocol.

D. Execution of Prefunctional Checklists and Startup:
   1. Four weeks prior to startup, the Subs and vendors schedule startup and checkout with the GC and CA. The performance of the prefunctional checklists, startup and checkout are directed and executed by the Sub or vendor. When checking off prefunctional checklists, signatures may be required of other Subs for verification of completion of their work.

2. The CA shall observe, at minimum, the procedures for each piece of primary equipment, unless there are multiple units, (in which case a sampling strategy may be used as approved).
3. For lower-level components of equipment the CA shall observe a sampling of the prefunctional and start-up procedures.
4. The Subs and vendors shall execute startup and provide the CA with a signed and dated copy of the completed start-up and prefunctional tests and checklists.
5. Only individuals that have direct knowledge and witnessed that a line item task on the prefunctional checklist was actually performed shall initial or check that item off.

E. Deficiencies, Non-Conformance and Approval in Checklists and Startup:
1. The Subcontractors shall clearly list any outstanding items of the initial start-up and prefunctional procedures that were not completed successfully, at the bottom of the procedures form or on an attached sheet. The procedures form and any outstanding deficiencies are provided to the CA within two days of test completion.
2. The CA shall work with the Subcontractors and vendors to correct and retest deficiencies or uncompleted items. The CA will involve the CM or GC and others as necessary. The installing Subcontractors or vendors shall correct all areas that are deficient or incomplete in the checklists and tests in a timely manner, and shall notify the CA as soon as outstanding items have been corrected and resubmit an updated start-up report and a Statement of Correction on the original non-compliance report. When satisfactorily completed, the CA recommends approval of the execution of the checklists and startup of each system using a standard form.

3.5 FUNCTIONAL TESTING

A. This sub-section applies to all commissioning functional testing for all divisions.
1. Objectives and Scope:
a. The objective of functional testing is to demonstrate that each system is operating according to the documented design intent and Contract Documents. Functional testing facilitates bringing the systems from a state of substantial completion to full dynamic operation. Additionally, during the testing process, areas of deficient performance are identified and corrected, improving the operation and functioning of the systems.
b. In general, each system should be operated through all modes of operation where there is a specified system response. Verifying each sequence in the sequences of operation is required.
2. Development of Test Procedures:
a. Before test procedures are written, the CA shall obtain all requested documentation and a current list of change orders affecting equipment or systems, including an updated points list, program code, control sequences and parameters. Each Sub or vendor responsible to execute a test, shall provide assistance to the CA in developing the procedures review (answering questions about equipment, operation, sequences, etc.). Prior to execution, the CA shall provide a copy of the test procedures to the Sub(s) who shall review the tests for feasibility, safety, equipment and warranty protection. The CA may submit the tests to the A/E for review, if requested.
b. The purpose of any given specific test is to verify and document compliance with the stated criteria of acceptance given on the test form.

3. Test Methods:
   a. Functional testing and verification may be achieved by manual testing (persons manipulate the equipment and observe performance) or by monitoring the performance and analyzing the results. The CA will determine which method is most appropriate for tests that do not have a method specified.
4. Coordination and Scheduling:
   a. The Subs shall provide sufficient notice to the CA regarding their completion schedule for the prefunctional checklists and startup of all equipment and systems. The CA will schedule functional tests through the GC and affected Subcontractors. The CA shall direct, witness and document the functional testing of all equipment and systems. The Subs shall execute the tests.
   b. In general, functional testing is conducted after prefunctional testing and startup has been satisfactorily completed. Testing proceeds from components to subsystems to systems. When the proper performance of all interacting individual systems has been achieved, the interface or coordinated responses between systems is checked.

3.6 DOCUMENTATION, NON-CONFORMANCE AND APPROVAL OF TESTS

A. Documentation:
   1. The CA shall witness and document the results of all functional tests using the specific procedural forms developed for that purpose. Prior to testing, these forms are provided to the GC for review and approval and to the Subs for review. The CA will include the filled out forms in the Commissioning Report.

B. Non-Conformance:
   1. The CA will record the results of the functional test on the procedure or test form. All deficiencies or non-conformance issues shall be noted and reported on a standard non-compliance form.
   2. Corrections of minor deficiencies identified may be made during the tests at the discretion of the CA. In such cases the deficiency and resolution will be documented on the procedure form.
   3. Every effort will be made to expedite the testing process and minimize unnecessary delays, while not compromising the integrity of the procedures.
   4. As tests progress and a deficiency is identified, the CA discusses the issue with the executing contractor.
      a. When there is no dispute on the deficiency and the Sub accepts responsibility to correct it:
         1) The CA documents the deficiency and the Sub’s response and intentions and they go on to another test or sequence
      b. If there is a dispute about a deficiency, regarding whether it is a deficiency or who is responsible:
         1) The deficiency shall be documented on the non-compliance form with the Sub’s response and a copy given to the GC and to the Subcontractor representative assumed to be responsible.
         2) Resolutions are made at the lowest management level possible. Other parties are brought into the discussions as needed. Final interpretive authority is with the A/E. Final acceptance authority is with the Owner.
         3) Once the interpretation and resolution have been decided, the appropriate party corrects the deficiency, signs the statement of correction on the non-compliance form and provides it to the CA. The

CA reschedules the test and the test is repeated until satisfactory performance is achieved.

C. Cost of Retesting:
   1. The cost for the Subcontractor to retest a prefunctional or functional test, if they are responsible for the deficiency, shall be theirs. If they are not responsible, any cost recovery for retesting costs shall be negotiated with the GC.
   2. The Contractor shall respond in writing to the CA at least as often as commissioning meetings are being scheduled concerning the status of each apparent outstanding discrepancy identified during commissioning. Discussion shall cover explanations of any disagreements and proposals for their resolution.
   3. The CA retains the original non-conformance forms until the end of the project.

D. Failure Due to Manufacturer Defect:
   1. If 10%, or three, whichever is greater, of identical pieces (size alone does not constitute a difference) of equipment fail to perform to the Contract Documents (mechanically or substantively) due to manufacturing defect, not allowing it to meet its submitted performance spec, all identical units may be considered unacceptable. In such case, the Contractor shall provide the Owner with the following:
      a. Within one week of notification, the Contractor or manufacturer's representative shall examine all other identical units making a record of the findings. The findings shall be provided within two weeks of the original notice.
      b. Within two weeks of the original notification, the Contractor or manufacturer shall provide a signed and dated, written explanation of the problem, cause of failures, etc. and all proposed solutions which shall include full equipment submittals. The proposed solutions shall not significantly exceed the specification requirements of the original installation.
      c. The Owner will determine whether a replacement of all identical units or a repair is acceptable.
      d. Upon acceptance, the Contractor and/or manufacturer shall replace or repair all identical items, at their expense and extend the warranty accordingly, if the original equipment warranty had begun. The replacement/repair work shall proceed with reasonable speed beginning within one week from when parts can be obtained.

E. Approval:
   1. The CA notes each satisfactorily demonstrated function on the test form. The CA recommends acceptance of each test using a standard form. The Owner gives final approval on each test using the same form, providing a signed copy to the CA and the Contractor.

3.7 SYSTEMS/OPERATION AND MAINTENANCE (O&M) MANUALS

A. The following Systems/O&M manual requirements do not replace O&M manual documentation requirements elsewhere in these specifications.

B. Each Division shall compile and prepare documentation for all equipment and systems covered in that Division and deliver this documentation to the GC for inclusion in the Systems/O&M manuals, according to this section, prior to the training of owner personnel.

C. The CA shall receive a copy of the O&M manuals for review.

D. Field checkout sheets and logs should be provided to the CA for inclusion in the Commissioning Record Book.

E. Review and Approvals:
   1. Review of the commissioning related sections of the Systems/O&M manuals shall be made by the A/E and by the CA.

3.8 TRAINING OF OWNER PERSONNEL

A. The GC shall be responsible for training coordination and scheduling and ultimately to ensure that training is completed.

B. The CA shall be responsible for overseeing and approving the content and adequacy of the training of Owner personnel for commissioned equipment.

3.9 WRITTEN WORK PRODUCTS

A. Written work products of Contractors will consist of the start-up and initial checkout plan described and the filled out start-up, initial checkout and prefunctional checklists, manufacturer's factory and field testing and inspection forms, contractors' inspection and functional testing forms, Systems/O&M Manuals, training plans and training records.

B. These work products will be supplied to the CA to be included in the final commissioning report.

END OF SECTION

SECTION 26 09 13

ELECTRICAL POWER MONITORING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions, Division 1 Specifications, and Section 26 00 00, apply to this Section.

1.2 SECTION INCLUDES

A. Switchboard instrumentation where shown on the plans.

B. Switchboards 1,000 amps and larger.

1.3 RELATED SECTIONS

A. Section 26 00 00 - Electrical

B. Section 26 24 16 - Panelboards for Distribution Switchgear

1.4 SYSTEM DESCRIPTION

A. The metering and monitoring system shall provide voltage, current, power, and various other metrics at the main service and/or other locations as indicated in this specification.

1.5 SUBMITTALS

A. Submittals required in this section shall conform to and be submitted in accordance with the General Conditions, Division 1, and Division 26, Section 26 00 90 requirements.

B. Manufacturers printed statement of accuracy. Color cut sheets of meter with all accessories to be used.

C. Submit complete product information for the following:
1. Metering
2. CT's
3. Software

1.6 CLOSEOUT SUBMITTALS

A. Wiring diagram of meters and current transformers.

B. Topology of monitoring system if multiple meters are required including location of each meter on an overall or on the electrical riser diagram.

1.7 SPECIAL WARRANTY

A. Provide a 5 year manufacturer’s warranty for all monitoring equipment. The warranty shall include all components including, but not limited to, metering, storage, CTs, software, etc.

1.8 SPECIAL TOOLS AND SPARE PARTS

A. Provide PC-based configuration software tools and/or monitoring software tools if available.

B. Provide a minimum of one communication interface cable for each type of cable required to connect to PC for configuration and monitoring.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Main Service Metering:
   1. Provide Base Model - Square D Power Logic PM 5563 with integrated display & Ethernet or approved equal

B. Equal metering accepted by:
   1. ABB (formerly GE)
   2. Eaton Corporation (formerly Cutler-Hammer)
   3. Siemens

2.2 GENERAL REQUIREMENTS

A. Provide metering for the main service disconnecting means or Main Service Board (MSB / MDP) with data storage and reporting on all properties listed herein. Metering may be internally or externally mounted.

B. Provide a single combined system per service entrance, main, and/or grouped mains.

2.3 MONITORING & ALARM REQUIREMENTS

A. Voltage Properties - monitor and alarm on the following:
   1. Phase Loss: Occurs if less than 50% of nominal line voltage is detected.
   2. Phase Imbalance: Occurs if the maximum deviation between any two phases exceeds the amount of unbalance as a percent of nominal line voltage. Range - 5 to 40% (5% increments)
   3. Phase Reversal: Occurs if any two phases become reversed. Range - more than one second.
   4. Overvoltage: Occurs if incoming voltage exceeds allowed nominal line voltage range. Range - 105% to 140% (5% increments)
   5. Undervoltage: Occurs if incoming voltage drops below allowed nominal line voltage range. Range - 95% to 60% (5% increments)

B. Current Properties - monitor and alarm on the following:
   1. Phase Loss: Occurs if smallest phase current is less than 1/16 of the largest phase current.

C. Delay: Allows existence of overvoltage, undervoltage, or voltage unbalance before an alarm or trip occurs. Range - 0-8 sec. (1 sec. increment)

D. Percent Trip Level and Trip Time Interval: owner adjustable

E. Alarm: Audible or visual alarm at the metering equipment or on the PC monitoring software. Ability to send an email or SMS to one or multiple recipients with alarm

code.

2.4 COMPONENTS

A. Metering - Microprocessor based with communication port to provide monitoring functions as well as deliver inputs to EMCS (or other HVAC controller). With the following accuracy:
   1. AC Ampere: ±0.5% (per phase)
   2. AC Voltage: ±0.5% (all nodes, P-P, P-N)
   3. Watts: ±1%
   4. Power Factor: ±1%
   5. Frequency: ±0.5%
   6. Kw Demand ±1%
   7. Watt Hours: ±1%

B. Data Storage:
   1. Shall hold real time data and 36 months of data history with capability to provide hourly, daily, monthly, and yearly logged data for each category described above.

C. Graphical Energy Reporting:
   1. This feature shall provide a graphical report to building management and operation personnel capable of showing separate categories with real time, hourly, daily, monthly and yearly graphs for up to 36 months.

2.5 SIMPLE ELECTRICAL CONNECTIONS

A. Same as a watt meter.

B. 50/60 cycle, 3 or 4 wire systems.

C. Self-protected from fault.

D. Updated Data Response every 1 second.

E. Replaces ampmeter, voltmeter, watt meter, selector switch, etc.

F. Only CT and PT hook-up required to a single device.

G. No separate potential source required.

H. Active or inactive protection relaying.

I. Interface capability to computer network for data collection.

J. Storage and/or print-out via INCOM.

K. Retains preset parameters in case of a power failure with use of filled settable DIP switches (no batteries).

L. Separate alarm and trip relay outputs.

M. Energy Management features include kilowatt, power factors, demand kilovars, and pulse initiator with each meter. Provide one system per service entrance, main, and/or grouped mains.

2.6 CONSTRUCTION

A. 4.5 inches deep.

B. Door mounted.

C. Panel shall be designed for a harsh industrial environment, and be UL recognized.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install meters so as to be easily removed.

B. Provide all fuse blocks and terminal strips as required.

C. Run 3/4 inch conduit to energy management control system (EMCS) panel. Engineer to decide final location. Provide 120V hook-up to EMCS panel. All control wiring in accordance with other Divisions 1, 23, 25, and 27.

END OF SECTION

SECTION 26 09 16

ELECTRICAL CONTROL COMPONENTS

PART 1 GENERAL

1.1 SUMMARY

1.2 SECTION INCLUDES

A. Time switches for circulating pumps.

1.3 RELATED SECTIONS

A. Section 26 00 00 - Electrical

B. Section 26 00 90 - Electrical Submittal Procedures

C. Section 26 05 53 - Electrical Identification

D. Section 26 28 16 - Enclosed Switches and Circuit Breakers

1.4 SUBMITTALS

A. Submittals required in this section shall conform to and be submitted in accordance with the General Conditions, Division 1 and Division 26, Section 26 00 90 requirements.

B. Product Data: Submit product data for time switches.

C. Samples: Provide a non-returnable sample when requested.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Exterior Lighting Time Switches
   1. Intermatic Inc. #ET Series (Astro type)
   2. Tork #DZS Series (Astro type)

B. Water Heater Time Clocks & Batteries:
   1. Tork Model EH10/20 Digital Control Clock
   2. Intermatic ET2725C
   3. Battery Backup - 9V lithium or super capacitor good for at least 100hrs.

C. All other manufacturers shall require pre-approval in accordance with specification section 26 00 90 - Electrical Submittal Procedures.

2.2 MATERIALS

A. Case:
   1. Indoor/outdoor Nema 3R enclosure made of self-extinguishing high impact plastic or steel with corrosion resistant paint.

B. Type:
   1. Seven day, 24 hour, with skip a day capability. Solid state electronic type. Fully automatic with manual capability.

C. Features:
   1. Contacts:
      a. Minimum 20 amps at 120 VAC resistive.
   2. Backup System:
      a. Maintain program functions for up to 7 days. Provide a new lithium battery per manufacturer`s requirements.
   3. Events and Holiday Schedule:
      a. Daily Minimum: 8 events (on or off) in any order
      b. Weekly minimum: 56 events

D. Photoelectric Control Interface:
   1. Heavy duty photo control with zero cross technology
   2. Mount on conduit and locate on roof where directed by Engineer.
   3. Photo control to bring lights on, timer to turn off.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install near the panelboard supplying service to load per manufacturer`s direction.

B. Mount time switch not more than 12" above top of switchgear and so that the time switch is readily accessible.

C. Programming:
   1. Program the time switches as directed. Include programming and operating instructions in "Records for Owner" as outlined in Section 26 00 00.
   2. Instruct the Engineer in setting the switches before final inspection.

D. Label Time Clock.

3.2 LIGHTING TIME CLOCKS

A. Interior Lights:
   1. Provide electronic time switches for interior lights only where shown on the plans.

B. Exterior Lights:
   1. Provide electronic time switches for all exterior lights even if not shown on the plans.

3.3 WATER HEATER TIME CLOCKS

A. Provide a Digital Control Clock for each water heater. Located time clock in electrical room and label "Water Heater - (Location)".

B. Provide power to each water heater time clock from the same circuit as the general purpose receptacle in the electrical room or from the same circuit as the circulation pump or from the nearest acceptable 120v circuit using a 20A breaker and #12 wire or greater.

C. Set to Operate:
   1. On: 7:00 a.m.
   2. Off: 11:00 a.m.
   3. On: 2:00 p.m.
   4. Off: 6:00 p.m.
   5. Off: Saturdays and Sundays

D. Timer to control both the water heater and any circulating pump. Circulating pump to run continuously as long as water heater is operational. When the water heater is intentionally turned off to conserve energy, then turn off the circulating pump.

E. Provide mechanically held contactor for each water heater circulating pump.

F. Provide a non-fused disconnect at each water heater. Refer to Section 26 28 16 for Enclosed Switches and Circuit Breakers.

END OF SECTION

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SECTION 26 09 23

LIGHTING CONTROL DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. This section includes the provision of a lighting control system for the automatic dimming and deactivation of indoor lighting, except for lighting intended for 24-hour operation.

B. This section does not include controls for theater and stage equipment.

C. This section does not include controls for outdoor ball field lighting.

1.2 RELATED SECTIONS

A. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables

B. Section 26 05 33.11 - Raceways and Conduits for Electrical Systems

C. Section 26 05 53 - Identification for Electrical Systems

D. Section 26 08 00 - Commissioning of Electrical Systems

E. Section 26 27 26 - Wiring Devices

1.3 REFERENCES

A. NEMA Guide Publication WD 7 Occupancy Motion Sensors Standard

B. International Energy Conservation Code (IECC) - version 2018

1.4 DEFINITIONS

A. Motion Sensor - A sensor that detects when an occupant is in a space. This sensor can be wired or configured to be an occupancy sensor or vacancy sensor.

B. Occupancy Sensor - A motion sensor designed or programmed to automatically turn the lighting in a space “on” when an occupant enters the space (based on major motion) and automatically turn the lighting in a space “off” after the occupant is no longer present or detected (based on minor motion) for a predetermined length of time.

C. Vacancy Sensor - A motion sensor designed or programmed to require an occupant to manually turn the lighting in a space “on” and automatically turn the lighting in a space “off” after the occupant is no longer present or detected (based on minor motion) for a predetermined length of time.

D. Dual Technology Sensor - A motion sensor with both infrared and ultrasonic technologies or both infrared and microphonic technologies.

E. Photocell - A light sensitive sensor used to communicate with a room controller to dim the lighting in a daylight zone according to the ambient lighting entering a space via

any method other than electric lighting.

F. Room Controller - The local space lighting controller that interfaces with the luminaires, motion sensors, photocells, smart switches, etc. in each space to control on/off, “scenes”, dimming, and daylight harvesting. This may include the power pack, distributed controller, driver interface modules, interface components, etc. Some or all of this function may be an integral part of the luminaires in the space.

G. Energy Management Control System (EMCS) - May also be called Building Management System (BMS). This system is used to control mechanical systems in the building via PC software.

H. Smart Switch - Intelligent programmable switch capable of communicating with the lighting control system in the space to trigger on/off, “scenes”, dimming, etc.

I. Daylight Zone - Area in a space around/about a window, skylight, or other fenestration measuring how far exterior natural lighting can reach into a space. Not all daylight zones can be combined. Luminaires in a daylight zone are to be controlled separately from the luminaires in the rest of the space. Some daylight zones, after they are identified in a space, will not require any change to the lighting controls already shown and may therefore be disregarded. Those will usually be deleted from the reflected ceiling plans to prevent confusion.

J. Functional Testing - Start-up or testing performed by the manufacturer or certified representative to verify the operation of the complete lighting control system.

K. Commissioning Agent - Third party hired by Owner or the design team to meet IECC commissioning requirements.

1.5 DESIGN REQUIREMENTS

A. The system shall include all required devices for a complete and proper operating system to automatically control the lighting to meet the intent of the IECC. The system may include but not be limited to motion sensors, room controllers, enhanced building controls (if required), low voltage control wiring, photocells, smart switches, intelligent luminaires and all required boxes.

B. Sensor design and layout: Provide the quantity of motion sensors required for complete and proper coverage without gaps within the range of coverage of controlled areas. Rooms shall have 100% coverage to completely cover the controlled area to accommodate all occupancy habits of single or multiple occupants at any location within the room. The locations and quantities of sensors shown on the drawings are diagrammatic and indicate only rooms that are to be provided with sensors. Provide additional sensors if required to properly and completely cover the respective room. 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.

C. Not all required components are shown on the plans.

D. A distributed lighting control system is required. Relay panels are not acceptable unless noted on Lighting Control Chart.

E. Battery operated devices and controls are not acceptable.

F. Refer to Luminaire Schedule and Lighting Control Chart for additional requirements and more information.

1.6 PERFORMANCE REQUIREMENTS

A. All Spaces:
1. Refer to the reflected ceiling plans and Lighting Control Chart for additional information and requirements for controlling the lighting in various areas throughout the building. For projects beyond the scope of a single system, multiple systems shall be networked together to accommodate any size requirement.
2. All portions of the controls mounted above ceiling are to be plenum rated.
3. Wiring between sensors and control units shall be 18 AWG minimum (stranded preferred) or CAT5/5e/6. Wiring shall be plenum rated in plenum spaces and UL listed. Pre-terminated low voltage wiring from the lighting controls manufacturer is preferred.
4. See the Sequences of Operation article in this specification section.

B. Motion Sensors
1. All motion sensors are to be corner (preferred) or ceiling mounted except in single toilets or small closets (< 40sqft) or unless otherwise indicated on the drawings.
2. Where allowed, wall-mounted motion sensors shall be suitable for 120v or 277v lighting.
3. All motion sensors shall be dual technology.
4. All motion sensors to be set to a 20-minute time delay and adjusted to maximum sensitivity, unless otherwise noted on the drawings. Must be capable of being set down to 5 minutes and 1 minute for testing.
5. Coverage areas for major motion and minor motion shall be determined in accordance with Section 3 of NEMA WD 7 Guide.
6. Ultrasonic technology shall utilize a frequency that does not interfere with other sensors, hearing aids, smartboards, etc.
7. All motion sensors on this project shall have masking or internal shielding available to control coverage pattern in the field. Stickers or other external adhesive masking will not be accepted.

C. Timer Switches: Where indicated on the plans, a timer switch control function shall have an override not exceeding 2 hours to meet code.

D. Smart Switches
1. The smart switch shall control the luminaires in the space for all on/off, dimming and/or “scene” controls as indicated in the Lighting Control Chart on the drawings.
2. For device color and cover/trim color, see specification section 26 27 26.
3. The smart switch is to be used as a manual override when used with vacancy sensors.
4. Where keyed switches are indicated on the plans, the “off” feature of the smart switch is to be disabled for a schedule similar to 7a-5p. Coordinate exact schedule with Owner.
5. All programmable switches are to be engraved or internally labeled so that the function of each button is clearly identified. All labeling or engraving must be of high quality and be provided by the lighting system manufacturer.

E. Room Controller
   1. In the event of a hardware or software or component failure, the lighting in the space is to default to the “ON” position.
   2. Provide adequate room controllers in each space for proper operation of the lighting to meet all code requirements and design intent shown on the plans.
   3. All room controllers shall utilize zero-crossing circuitry.

F. See Lighting Control Chart on the drawings for controls by space and sequence of operation.

1.7 PRODUCT DATA

A. Submit product data for all components and accessories of the lighting control system including, but not limited to:
   1. Motion sensors
   2. Photocells
   3. Smart switches
   4. Time switches
   5. Room controllers
   6. Software
   7. Lighting contactors
   8. Low voltage wiring
   9. Intelligent luminaires

B. Product data for motion sensors shall clearly indicate coverage areas for major motion and minor motion determined in accordance with the testing procedures of NEMA Guide Publication WD 7 Occupancy Motion Sensors Standard.

C. Submit a warranty letter with warranty requirements per this specification including and describing coverage for systems that use multiple product brands to provide a complete system.

D. Any product submitted other than from the manufacturers listed below in Part 2 will be rejected.

1.8 SHOP DRAWINGS

A. Submit shop drawings of each reflected ceiling plan in this project showing the specific locations of all parts of the lighting control system including motion sensors, photocells, smart switches, room controllers, enhanced building controls (if required), etc. Motion sensors shown shall include sensor type, sensor mounting, and other pertinent data to allow evaluation of the proposed system.

B. Submit a wiring diagram for all motion sensors, photocells, smart switches, room controllers, etc.

C. Submit a sequence of operations for each unique space type describing the function of each button on each switch and the effects on the lighting in the space. This sequence of operations should be similar to the Lighting Control Chart with the added information describing how the lighting control system pieces/parts work together.

D. Submit a list of switch types by unique space with a list of proposed button labels. This list should be similar to the Button Info on Lighting Control Chart with added information showing switch button layouts and actual labels for this project.

1.9 CLOSEOUT SUBMITTALS

A. Operating and Maintenance Manuals: Provide 2 complete sets of operating, maintenance, and adjustment instructions and other information necessary for proper operation of the lighting control system. These documents shall be included as part of the project operating and maintenance manuals.

B. As-built Drawings: Provide 2 complete sets of as-built reflected ceiling plans showing the location and wiring configuration of all motion sensors, room controllers, photocells, etc.

C. Warranty: Provide 2 copies of warrantees.

D. Training Documentation: Provide a letter in the final documents documenting that Owner (give name of person, date, duration, and content of training) received training required in this section.

E. System Functional Testing Documentation: Provide two (2) copies of documentation reporting the manufacturer's start-up, adjusting, and final testing of the completed installation. Include a list of controllable points to the BMS provider upon completion of lighting controls functional testing.

F. Software Maintenance Agreement: Provide 2 copies of the software maintenance agreement.

1.10 REGULATORY REQUIREMENTS

A. UL Label: All lighting control system products shall be UL-labeled, individually and as a system, for the specific applications utilized on this project.

1.11 MOCK-UPS

A. Provide a product demonstration by the manufacturer of the lighting control system including a sample of each piece and part demonstrating a complete working system. If a product demonstration is not acceptable by Owner or Architect, provide, at additional cost, a mock-up of required space types with complete controls for owner/engineer/construction administration review before installation throughout the building.

1.12 PRE-INSTALLATION MEETINGS

A. Meet with the manufacturer of the lighting controls on-site to review installation, wiring methods, and exact equipment locations of all components prior to starting installation. At this meeting, Contractor shall be trained by the manufacturer or vendor on the installation, setup, and functionality of the system. Failure to have this meeting will result in Contractor assuming full responsibility of all costs incurred to move controls and sensors, replace equipment due to product damage, costs due to installation errors or failure to meet the full intent of the design.

1.13 STORAGE AND PROTECTION

A. Store all product in accordance with manufacturer's storage requirements.

1.14 WARRANTY

A. Provide a five-year parts and one-year labor warranty on the entire control system. Warranty coverage shall begin at the time of Project Substantial Completion.

1.15 SYSTEM STARTUP

A. Provide the initial programming, aiming, and start-up of the system.

B. After system startup and prior to substantial completion of the project, require the manufacturer to test the operation of the complete system (all pieces, every space) to ensure the proper operation of the system throughout the range of building operating conditions. Provide documentation of such functional testing in the closeout submittals. Do this functional testing on all projects, regardless of other additional commissioning or testing requirements.

1.16 OWNER'S TRAINING

A. After functional testing is complete, manufacturer shall provide a minimum of 4 hours of on-site training to Owner's personnel in the operation, adjustment, and maintenance of the system. Do this training in a location where it can be recorded by Owner. Coordinate date, time and location of training one week prior to meeting and provide documentation of such training in the closeout submittals.

1.17 THIRD PARTY COMMISSIONING

A. In addition to functional testing by Contractor and the manufacturer, additional third party commissioning is required to meet IECC requirements. The manufacturer shall be present during the third-party commissioning process. See specification section 26 08 00 for more information.

1.18 ADDITIONAL MATERIALS

A. Additional materials to be a dollar cost in the base bid. At the end of the project, the Contractor shall generate a dollar amount credited back to the Owner for any unused items. All attic stock shall be provided to the Owner at substantial completion. The base bid shall include all additional materials and attic stock.

B. Include in the base bid for additional materials:
   1. All costs to provide 10 additional smart switches equal to the model required for switch type "LC" denoted on the Lighting Control Chart.
   2. All costs to provide 10 additional motion sensors equal to the model required for switch type "LC" denoted on the Lighting Control Chart.
   3. All costs to provide 5 additional photocells equal to the model required for switch type "LC" denoted on the Lighting Control Chart.
   4. All costs to provide 5 additional room controllers equal to the model required for switch type "LC" denoted on the Lighting Control Chart.

C. Include in the base bid for attic stock:
   1. Provide 4 room controllers equal to the model required for switch type "LH" denoted on the Lighting Control Chart.
   2. Provide 4 room controllers equal to the model required for switch type "LC" denoted on the Lighting Control Chart.

3. Provide 8 motion sensors equal to the model required for switch type “LC” denoted on the Lighting Control Chart.
4. Provide 4 photocells equal to the model required for switch type “LC” denoted on the Lighting Control Chart.
5. Provide 2 smart switches for each switch type (LE, LK, LC, etc.) used on the Lighting Control Chart.

D. See Sections 26 00 00 - Electrical and 26 50 00 - Lighting for other additional materials and attic stock to be provided by this Contractor.

1.19 MAINTENANCE SERVICE

A. Provide a three-year manufacturer’s software service agreement with the system. The agreement shall cover all minor updates, bug fixes, and maintenance to the software of the system to maintain all original functionality. The software service agreement shall start at the time of substantial completion.

1.20 SYSTEM SUPPORT

A. Provide five-year complete system support starting from substantial completion. The entire lighting control system (hardware and software) shall be included in the support. The support shall include phone and email communication (as a minimum) for the duration of the support. The system support shall include all technical support, hardware and software questions, warranty help, etc.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. If they comply with these specifications, products of the following, and only the following, manufacturers will be acceptable:
1. Acuity Controls - Chris Sears at 214-658-9030
2. Crestron - Chris Sears at 214-658-9030
3. Douglas Lighting Controls - Brendan Kenna at 214-247-7415
4. Eaton Controls - Allen Pilgrim at 817-267-9300
5. Encelium - Grant Grubb at 214-413-7034
6. Hubbell Controls - Grant Grubb at 214-413-7034
7. Intelligent Lighting Controls - Allen Pilgrim at 817-267-9300
8. Lutron - Randy Schwimmer at 972-406-8700
9. Philips Controls - Brendan Kenna at 214-247-7415
10. WattStopper - Grant Grubb at 214-413-7034

B. No other manufacturers will be accepted.

2.2 MANUFACTURED UNITS

A. All parts of the lighting control system shall be warranted by the same company.

B. All parts of the lighting control system shall be from the approved list of manufacturers above.

C. All parts of the lighting control system shall be aesthetically compatible. i.e., from the same product line or family of products.

D. All sensors shall be from the latest release generation. Do not mix product of different releases or generations.

PART 3 EXECUTION

3.1 SITE VERIFICATION OF CONDITIONS

A. If the work is to be performed in an existing facility, visit the site of the proposed work and observe its conditions so that you may be fully informed as to the materials, labor, workmanship, and conditions under which the work is to be done. If an existing lighting control system exists, then the new system shall work with the existing system.

B. No allowances shall be made on account of any errors, negligence, or failure to be aware of the condition of the existing site.

3.2 INSTALLATION

A. General
1. Provide all lighting controls as required and where indicated, in accordance with manufacturer`s written instructions and project shop drawings, applicable requirements of the NEC, and recognized industry practices to ensure that products serve the intended function.
2. Provide the room controller as required located above the ceiling above the switches near the exit door. Provide a permanent label on the ceiling t-grid to identify its location. The label material shall be as described in specification section 26 05 53. The label shall say “Lighting Controller”. It is acceptable for a room controller to serve more than one space.
3. Provide conduit and wiring in accordance with specification sections 26 05 33.11 and 26 05 19.
4. All motion sensors and switches located in gyms, play areas, multipurpose spaces, etc. shall have a wire guard.

B. Shop Drawing Preparation: At least five working days prior to bid time, provide a set of floor plan drawings and a copy of these specifications to the manufacturer for the purpose of system layout with quantities and creating shop drawings for the owner. Coordinate with the manufacturer to determine the required medium (hard copy or electronic) and the format required by the manufacturer.

C. Sensor Design and Layout by Manufacturer:
1. Refer to Design Requirements article regarding sensor design and layout.
2. Exact locations of control unit hardware boxes shall be based on observing good installation practice and shall be coordinated with other elements of the reflected ceiling plan. Control unit hardware shall be fully concealed.
3. Select the appropriate type of sensor for complete coverage of each space.

D. Lighting Control Cable Routing and Installation:
1. System wiring and equipment installation shall be in accordance with good engineering practices as established by the EIA and the NEC. Wiring shall meet all state and local electrical code requirements.
2. Cable pathways, conduit, and cable support systems shall be complete with bushings, de-burred, cleaned, and secure prior to installation of cable.

3. All wiring shall test free from opens, grounds, or shorts. All lighting control cable shall be supported from the building structure and bundled. Do not attach any supports to joist bridging or other lightweight members.
4. Support system shall provide a protective pathway to eliminate stress that could damage the cabling. The lighting control cable shall not be crushed, deformed, skinned, crimped, twisted, or formed into tight radius bends that could compromise the integrity of the cabling.
5. Lighting control cable must not be fastened to electrical conduits, mechanical ductwork/piping, sprinkler pipes, or routed to obstruct access to hatches, doors, utility access panels, or service work areas. Do not route cables through fire doors, ventilation shafts, grates, or parallel with line voltage electrical conductors. Lighting control cables shall not be run loose on ceiling grid or ceiling tiles.
6. Support shall be provided by mounting appropriate fasteners that may be loaded with multiple cables. Provided that the weight load is carried by the support rod or wire, the support assembly may attach to the ceiling grid for lateral stabilization. The required support wires for the ceiling grid or luminaires shall not be utilized. Any fastener attached to the ceiling grid shall not interfere with inserting or removing ceiling tiles. The cable pathway of supports must be positioned at least 12 inches above the ceiling grid.
7. Provide bushings to protect the cable from damage for conduit ends, box openings, and passage through metal studs.
8. Lighting control cables shall be run in bundles above accessible ceilings and supported from building structure. Cabling shall be loosely bundled with cable Velcro hook ties randomly spaced at 30 to 48 inches on center, cable ties shall not be tight enough to deform cabling and shall not be used to support the cabling.
9. Each cable run shall include a three-foot service loop with Velcro hook ties located in the ceiling above each device. This is to allow for future re-termination or repair.
10. Lighting control cable will not be installed in the same conduit, raceway, tray, duct, or track with line voltage electrical cable without a metallic barrier meeting NEC requirements.
11. Maximum cable pulling tension should not exceed 25 pound-force (110 N) or the manufactures recommendation, whichever is less.
12. Any pulling compounds utilized must be approved by the cable manufacturer and shall not degrade the strength or electrical characteristics of the cable.
13. No terminations or splices shall be installed in or above ceilings, other than in designated end point housings.
14. Cable bends shall not be tighter than the manufacturer's suggested bend radius.
15. Mount all equipment firmly in place. Route cable in a professional, neat, and orderly installation.

E. Lighting Control Cable Support
1. Conduit, duct, or track shall be used for lighting control cable in exposed areas.
2. Cable fill shall not exceed the manufacturers’ instructions for each type of support.
3. All conduit, ducts, track, and raceways shall be supported from the structure at industry standard intervals for the size specified, utilizing proper anchoring devices.
4. All vertical supports shall be attached to the building support structure or concrete ceiling with anchors load rated for 100 lbs. minimum. Down rods shall

be a minimum of 1/4” diameter. Steel uni-strut cross supports shall be 2” minimum.

F. Bushings
1. Provide a plastic snap in bushing at each box opening, passage through a metal stud, and at the end of all open conduit stubs or sleeves prior to lighting control cable installation to protect the cabling from damage:
a. Box openings - Thomas & Betts Knockout Bushing Series 3210, or equivalent.
b. Metal stud passage - Thomas & Betts Twist It Bushing Catalog Number SB1216-SC, or equivalent.
c. Conduit ends - Thomas & Betts Anti-Short Bushing Series 390 or Tite-Bite Combination Couplings Series 442, or equivalent.

G. J-Hooks
1. Attachments for cabling support shall be spaced at approximately 48 to 60 inches on center. Cable bundles shall not be allowed to sag down more than 12-inches mid-span between attachments.
2. All attachments shall be approved for category rated twisted pair cabling. Attachments shall be Caddy part numbers as follow, or equivalent, sized as follows:
a. CAT16HP, 1” diameter - Capacity 15 Category rated cables.
b. CAT21HP, 1.31” diameter - Capacity 40 Category rated cables.
c. CAT32HP, 2” diameter - Capacity 60 Category rated cables.
d. Split bundles greater than 2" dia. or provide cable tray.
3. Do not mix different signal strength cables on the same J-Hook (i.e. fire alarm with data and telephone cable). Multiple J-Hooks can be placed on the same attachment point, up to the rated weight load of the attachment device.

H. Cable Tie Wraps
1. Provide and install Panduit TAK-TY cable ties or equivalent.
2. Velcro hook cable ties shall be furnished and installed to attach wire bundles to supports and for appropriate wire management as required.
3. Hard plastic or metal tie wraps will not be allowed on any data grade cable (Category rated twisted pair cable).

3.3 SEQUENCES OF OPERATION

A. Lighting Controls
1. The smart switch shall be required to be pressed to turn the lights on in all spaces where a vacancy sensor is required. Otherwise, an occupancy sensor may automatically turn the luminaires on. Two minutes prior to turning the lights off, the lighting controls shall dim the luminaires in the space to 50% of their previous output as a notification to the occupants that the controls will soon turn the lighting off. A momentary “blink” is allowed if luminaires are not dimmable. If the motion sensor is not triggered in two minutes, the lighting in the space is to turn off. If the motion sensor is triggered, the lighting controls shall dim the lighting back up to the previous lighting level and timeout is restarted. In spaces with timer switches, the system shall accept an override signal at any time either before or after the lighting is turned off. The occupant shall not be required to wait for the lights to go out before issuing the override.
2. Where shown on the plans, a photocell is to be used to measure the light level and signal to the room controller to dim the luminaires continuously (from 100%

to 15% or lower, including off) in the daylight zone to maintain a consistent (within +10% and -0%) lighting level in the space.

3.4 MANUFACTURER'S FIELD SERVICES

A. Coordinate with the sales representative to coordinate the below requirements with the manufacturer.
   1. The manufacturer shall provide instruction at the start of the job to Contractor regarding the proper installation of the system.
   2. As part of the system startup process, the manufacturer shall provide all initial field programming of the system.
   3. Using certified factory representatives, the manufacturer shall inspect the finished installation against the shop drawings and installation instructions.
   4. Using certified factory representatives, the manufacturer shall do functional testing of the finished installation. Submit documentation of the functional testing in accordance with Part 1 of this specification.

3.5 ADJUSTING

A. Motion sensors may be affected by various conditions in the room. It may be necessary for Contractor to make adjustments, change the location or type of sensor to obtain proper operation in a specific room. Contractor/equipment manufacturer shall have final responsibility for proper operation and coverage of the system in each room and should therefore make labor allowance for such changes and adjustments. Contractor is also responsible for acquiring approval from Engineer for any changes or deviations from project specifications.

B. Work with the manufacturer to correct all findings from manufacturer functional testing.

C. Work with the manufacturer to correct all findings made by the third-party commissioning agent or registered design professional, whichever entity performs the commissioning service. This contractor is responsible for the entire lighting control system and luminaires to pass the commissioning inspection and reporting.

3.6 OWNER'S TRAINING AND DEMONSTRATION

A. Upon completion of testing and adjustment, demonstrate operation of the system to representatives of Owner.

B. Instruct Owner`s personnel in proper maintenance, adjustment, and operation of the motion sensor lighting controls.

C. Discuss with Owner the time clock feature programming requirements (on/off times and school schedule) and teach them to program the clock feature to match the required schedule.

D. Upon completion of testing and adjustment (commissioning), Contractor and a direct employee of the equipment manufacturer (who is already familiar with the details of the project) shall demonstrate operation, proper maintenance, troubleshooting and adjustment of the lighting control system and all sensors throughout the building. Owner shall receive a minimum of 4 hours and a maximum of 8 hours in an on-site training session. The length of the training session shall be at the discretion of Owner. The training shall cover the following areas in detail:

1. Scope of system: Review the as-built documentation with Owner to detail extent of system. Identify locations of all wall stations, wiring, and panels that fall within the scope of the lighting control system. Define clear lines of scope between lighting control system and EMS functions if applicable.
2. Operation of system: Cover normal operation of switches, push buttons, LCD interfaces, and software (if provided). Provide documentation to Owner showing the operational zoning of controlled circuits and all time-clock events programmed into the Lighting Control System. Show Owner how to change and add/delete events.
3. Maintenance and Troubleshooting of system: Detail any required or optional preventive maintenance actions required of Owner. Go over step-by-step procedures to troubleshoot all possible failure modes of each component type of the lighting control system. Cover procedure to get lights turned on in any space containing a lighting control system in the event the control system fails. Identify any specialized equipment necessary to support all the above actions.
4. Service and Support of system: Identify nearest direct support contact for the manufacturer and provide both telephone and email contact details.

END OF SECTION

SECTION 26 20 00

LOW VOLTAGE ELECTRICAL DISTRIBUTION

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Electrical service including underground primary requirements, transformer and secondary enclosure requirements, overhead and underground service entrance requirements, metering, and final connections.

B. Provide and install all components of the low voltage distribution system(s) including all switchboards, panelboards, transformers, fuses, circuit breakers, disconnects, MCCs, etc. as shown on the Drawings and as required for a complete and working system. All equipment shall be sized to meet the latest adopted version of NEC 220 requirements as a minimum.

1.2 RELATED REQUIREMENTS

A. Section 26 00 00 - Electrical

B. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables

C. Section 26 05 26 - Grounding and Bonding for Electrical Systems

D. Section 26 05 33 - Raceways and Boxes

E. Section 26 05 53 - Identification of Electrical Systems

F. Section 26 05 73 - Power System Studies

G. Section 26 43 00 - Surge Protection Devices

1.3 REFERENCES AND STANDARDS

A. ANSI - C33.4/C57.96

B. ANSI/UL 98 - Safety Standard for Enclosed Switches.

C. NEC - NFPA 70 National Electrical Code

D. NEMA AB1 - Molded Case Circuit Breakers.

E. NEMA AB2 - Procedures for Verifying the Performance of Molded Case Circuit Breakers.

F. NEMA PB1 - Panelboards.

G. NEMA KS 1 - Enclosed Switches.

H. NEMA ST 1 - Specialty Transformers (Except General Purpose Type)

I. NEMA-ST-20 Dry Type Transformers for General Applications

J. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

K. CODE OF FEDERAL REGULATIONS, Title 10 Energy, Part 431 Energy Efficiency Program for certain commercial and industrial equipment (10 CFR Part 431)

L. UL 1561 - Standard for Dry-Type General Purpose and Power Transformers

M. UL 50 - Cabinets and Boxes.

N. UL 67 - Electric Panelboards.

1.4 COORDINATION

A. Prior to ordering disconnects and fuses or fuse holders, coordinate fuse ratings with the mechanical contractor to verify that fuses for all mechanical equipment matches the MOCP values of the mechanical equipment being provided. This contractor to adjust upstream breaker sizes, branch circuit conductor sizes, whip sizes and disconnect sizes to accommodate the fuse (OCPD) requirements for the supplied equipment.

1.5 SUBMITTALS

A. Submittals required in this section shall conform to and be submitted in accordance with the General Conditions, Division 1, and Division 26 requirements.

B. Provide scaled shop drawings for each electrical equipment room showing the placement of all panelboards, transformers, and other equipment such as mechanical equipment, drawn to scale and dimensioned. Such shop drawings will be reviewed for compliance with the intent of the contract Drawings and the spaces available for the electrical apparatus.

C. Clearly indicate on the submittals whether equipment is fully-rated or series-rated.

D. Arrangement: Arrange panelboard submittals in the order the panelboard schedules appear on the panelboard sheets of the Drawings as read from top to bottom, then left to right.

E. Include the following parameters as applicable in the submittal: equipment name, description, voltage, phase, ampacity, kVA rating, K-rating, control voltage, impedance, etc.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. All panelboards, switchboards, disconnects, OCPDs, etc. shall be from the same manufacturer to ensure proper breaker coordination.

B. All equipment on this project shall be new. Refurbished or used equipment will not be acceptable.

C. The following are approved manufacturers.
1. Eaton (formerly Cutler-Hammer)
2. Square-D

D. All other manufacturers shall require pre-approval in accordance with specification section 26 00 00 - Electrical.

2.2 GENERAL REQUIREMENTS

A. Conductor material for switchboards, panelboards, disconnects, etc. shall be copper.

B. Unless otherwise indicated on the Drawings, provide NEMA 1 enclosures for all equipment located in interior dry locations. Provide NEMA 3R enclosures for all equipment located in exterior or in damp/wet locations. Panelboards, switchboards, disconnects, etc. shall have weatherproof threaded hubs for top/bottom/side conduit entries.

C. Unless specifically noted otherwise on the Drawings, all equipment in these Specifications shall meet the the requirements outlined below.

D. All equipment shall have a factory applied gray finish applied over a rust inhibiting treatment. Any items which have the finish marred shall be touched up or refinished to a new condition before final acceptance. This shall include, but shall not be limited to, sanding and properly removing rust or other contaminants and completely repainting equipment if damage is extensive. Overall acceptance is subject to approval of the Engineer.

E. Provide all labelling and identification per Section 26 05 53 - Identification of Electrical Systems.

2.3 PANELBOARD / SWITCHBOARD COMMON REQUIREMENTS

A. Construction:
   1. NEMA PB 1, Interiors shall be completely factory assembled.

B. Enclosure: Door in door construction, standard conduit knockouts in ends and sides of cabinet. Provide flush type combination catch and key door locks on all panelboards and load centers. Key all locks alike, provide two keys with each panelboard.

C. Buss Information:
   1. Ground Buss: full length, 25% phase rated, bonded to each buss, additional isolated buss in computer and communication panels.
   2. Neutral Buss: full length,
      a. 200% of phase rated - computer or IG panels
      b. 100% of phase rated - lighting and power panels

D. OCPDs: Provide bolt-on circuit breakers unless otherwise indicated on the Drawings.

E. Fault Withstandability: Suitable for operation and able to withstand the symmetrical short circuit current as indicated on the Drawings or available at the location, whichever is larger.

F. Spaces: Install all allotted or indicated spaces so that future OCPDs can be added without additional machining, drilling, tapping or buss extensions.

G. Circuit Identification
   1. Frame-mounted directory with a heat-resistant transparent face for identifying circuits. Mount inside the panelboard door. Use equipment names as reflected

by panel schedules on the Drawings. Use room names and numbers selected by the Owner's Representative, which may differ from those shown on Drawings.
2. Provide on all panelboards, revise existing panelboards per Division 26 with new information.
3. See Section 26 05 53 - Identification for Electrical Systems for more information.

H. Features & Accessories
1. Provide metering and instrumentation per Section 26 09 13 - Electrical Power Monitoring and in conjunction with Division 23 - Energy Management Control System requirements.
2. Provide GFCI protection where required per NEC, as indicated here and as shown on the Drawings.
3. Provide SPDs at the main switchgear per Section 26 43 00 - Surge Protective Devices.

2.4 PANELBOARDS

A. Construction:
1. Flush mounted panelboards: trims shall fasten to permit both horizontal and vertical adjustment.
2. Surface mounted panelboards: trims shall fasten to insure no overhang.

2.5 SAFETY SWITCHES AND ENCLOSED CIRCUIT BREAKERS

A. Product Description:
1. Provide single throw, horsepower rated, 100% load break and make rated, designed for locking in "ON" or "OFF" position, in code gauge steel cabinets, as required by the application and required per the NEC.
2. Provide equipment rated for the required voltage and with the number of poles required, dependent on the equipment requirements.
3. Provide SPDs at equipment in accordance with Section 26 43 00 - Surge Protection Devices

B. Construction:
1. Indoor dry locations use NEMA 1 Heavy Duty (HD).
2. All damp/wet locations and outdoor locations use NEMA 3R, Heavy Duty (HD, NEMA KS-1).

C. Disconnect / Safety Switches:
1. Safety switches shall be fused, unless indicated as non-fused on the Drawings.
2. All disconnects / safety switches shall be lockable in the OFF position.
3. Use fuse clips which are rejecting type to accept Class RK or L fuses only.
4. Size fused safety switches and upstream conductors serving motor loads at 125% to 175% of motor nameplate or per NEC values, whichever is larger, and round to the next standard size.

D. Enclosed Circuit Breakers:
1. Provide where indicated on Drawings, otherwise provide a disconnect / safety switch.

2.6 CIRCUIT BREAKERS

A. Product Description: Bolt-on, quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers; listed and labeled as complying with UL 489; ratings,

configurations, and features as indicated on the Drawings.

B. Interrupting Ratings: Provide size (ampacity) and withstand (AIC) rating as indicated on Drawings. Series Rated Panels are NOT allowed. All panels shall be FULLY RATED.

C. Thermal Magnetic Circuit Breaker: Bimetallic overload elements. Magnetic trip. Common trip type so that an overload or fault on one pole will trip all poles simultaneously. Handle ties are not acceptable.

D. Electronic Trip Circuit Breaker: Furnish solid state, microprocessor-based, true rms sensing trip units with the following field-adjustable trip response settings:
   1. Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
   2. Long time delay.
   3. Short time pickup and delay.
   4. Instantaneous pickup.

E. Features and Accessories: Provide as required, as indicated in the specifications and as shown on the Drawings.
   1. AFCI: Arc fault sensing where arc fault protection is indicated or required.
   2. GFCI: Ground fault pickup and delay where ground fault protection is indicated or required by NEC.
   3. Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
   4. Lock-Out Provision: For locking the circuit breaker in the off position

F. Provide number of poles indicated for the specified equipment or service, with common trip handle for all poles.

G. Independently mount so that a single unit can be removed from the front of the panel without disturbing or removing main buss, other units or other branch circuit connections.

H. All circuit breakers that have an overcurrent trip setting fixed or adjustable at 1200A or higher shall have an Energy-Reducing Maintenance Switch or similar approved method for arc energy reduction and shall meet all requirements of NEC 240.87.

2.7 FUSES

A. Performance Requirements:
   1. All fuses shall be from the same manufacturer.
   2. Provide ampacity rating as indicated on Drawings or required by NEC.
   3. Unless otherwise indicated on the Drawings, size fuses serving all motor loads at 175% of motor nameplate FLA or NEC motor table ampacity, whichever is larger.

B. 600-amp and less: UL Class RK-1 dual element, time delay.

C. 601-amp and larger: UL Class L time delay

2.8 GFCI PROTECTION

A. Ground Fault Protection System:

1. Ground sensor relay (GSR) system with ground break components, solid state construction, adjustable current pick-up and time delay settings.
2. Coordinate ground sensor (CT) with integral test winding of sufficient size to encircle all phase and neutral conductors, for zero sequence monitoring and a solid-state relay to operate the trip circuit on the main switches.
3. Provide required transformer to supply power for tripping switches and connect phase to phase.

B. Accessories Included:
1. Ground fault relaying system for main switches to be zero-sequence type.
2. Ground fault current-detection range to be 100 to 1,200 amperes.
3. Time delay range to be instantaneous to 60 cycles.
4. Derive tripping and control power from control power transformers in switchboard.
5. Components shall include static ground fault sensor, current monitor, and test panel.

C. Where GFCI protection is required or indicated in the specifications or Drawings, coordinate with the equipment manufacturer to provide proper GFCI requirements to determine whether they are intended to be for personnel (5ma) or equipment (30ma).

2.9 FRACTIONAL HORSEPOWER MOTOR-RATED SWITCH

A. Product Description: NEMA WD-1 & WD-6, motor-rated toggle switch. For use when switch-mounted thermal overload relays are not required.

B. Provide quality and features comparable to Leviton MS302/MS303 series, Hubbell HBL78xx series or P&S 7802/7803 series.

2.10 FRACTIONAL-HORSEPOWER MANUAL MOTOR STARTER

A. Product Description: NEMA ICS 2, AC general-purpose, Class A, manually-operated full-voltage controller for induction motors, with toggle control, manual motor starter and thermal overload relay, NEMA WD-1 & WD-6, UL 60947, NEMA ICS 6 enclosure.

B. Control voltage shall be 120v, unless otherwise indicated on Drawings.

C. Provide quality and features comparable to Cutler-Hammer B100x series, Square-D KG-1/2 series, ABB CR1062Sx series or Siemens Class SMF/MMS series.

2.11 MANUAL MOTOR CONTROLLER

A. Product Description: NEMA ICS 2, AC general-purpose, Class A, manually-operated full-voltage controller for induction motors, with push-button operation, red pilot light, manual motor starter and thermal overload relays, NEMA WD-1 & WD-6, UL 60947, NEMA ICS 6 enclosure.

2.12 AUTOMATIC MOTOR CONTROLLER

A. Product Description: NEMA ICS 2, AC general-purpose, Class A, automatic full-voltage controller for induction motors, with push-button override, red pilot light, motor starter and thermal overload relays, NEMA WD-1 & WD-6, UL 60947, NEMA ICS 6 enclosure.

B. Options and Features:
1. Cover Mounted Pilot devices - NEMA ICS 5, standard duty type

2. Pilot Device Contacts - NEMA ICS 5, Form Z, rated A150

2.13 CONTACTORS AND RELAYS

A. General:
1. NEMA ICS 2, magnetic contactor with poles and contacts to match the circuit function and load. All contactors used for lighting shall be "lighting rated".
2. Coordinate coil voltage with controls system. 120v preferred. Provide fused control circuit transformer as required.
3. Provide an enclosure to house all contactors and relays. Each enclosure to be rated for the environment. Provide NEMA 1 indoor and NEMA 4 outdoor or in wet environments, unless otherwise specified on the Drawings.

B. Mechanically-held contactors:
1. Mechanism electrically operated by a solenoids and mechanically latched.
2. Coil clearing contacts to de-energized coils when device is held closed.
3. Required remote control relay and controls for proper latching and unlatching.

C. Electrically-held contactors:
1. Mechanism electrically-held by a solenoid
2. Required relays and controls for proper operation

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify mounting supports are properly sized and located including concealed bracing in walls.

3.2 PREPARATION

A. Coordinate with the power utility company to obtain information regarding the available short circuit current at the service point. Provide this information to the electrical gear manufacturer for use in the overcurrent protective device coordination study required by section 26 05 73 - Power System Studies.

B. Coordinate all requirements with the power utility company and include in the base bid, including but not limited to the following.
1. Whether the service will be overhead or underground.
2. The extent of any underground primary.
3. The need for a secondary enclosure. Provide if required.
4. Any charges from the power utility company for providing service.
5. The need for a transocket for utility metering.

3.3 APPLICATION

A. Panelboards and Switchboards:
1. Provide a complete isolated ground system including isolated ground panel with 200% neutral, SPD and separate isolated ground buss where indicated on the Drawings.

B. Circuit Breakers:
1. Provide ground fault circuit breakers (GFCI) where indicated on the Drawings, panel schedules and/or as required by NEC 422.5, 210.8(B), etc. For example, provide protection at all EWCs, hand dryers, kitchen equipment, concessions

equipment, and so on. Pull separate neutrals with each circuit to ensure correct GFCI operation.
2. Provide combination AFCI circuit breakers where AFCI protection is required per NEC and as indicated on the Drawings.

C. GFCI Protection:
1. Provide ground fault protection at all service entrance equipment in accordance with NEC 230.95 Ground Fault Protection of Equipment.
2. At health care facilities, provide an additional level of ground fault protection in accordance with NEC 517.17 Ground Fault Protection.
3. Provide ground fault sensing and indication on emergency systems in accordance with NEC 700.27 Ground Fault Protection of Equipment.
4. Provide ground fault protection at any additional locations indicated on the Drawings.

3.4 INSTALLATION

A. General:
1. Set all equipment plumb, straight and level.
2. Provide grounding and bonding in accordance with Section 26 05 26 - Grounding and Bonding.
3. Provide and install all equipment, including electrical connections, in accordance with the manufacturer`s written instructions, the applicable requirements of NEC and the NECA "Standard of Installation", and in accordance with recognized industry practices to ensure that products serve the intended function.

B. Electrical Service:
1. Underground primary: Unless otherwise noted on the Drawings, provide two 4" conduits from the power utility company service point to pad-mounted transformers. Primary conductors will be provided by the power utility company. Coordinate exact location of service point with the power utility company.
2. Pad-mounted transformer: Construct the transformer pad in accordance with the power utility company specifications. Coordinate with the power utility company before installation of concrete for exact size, location and all requirements. The transformer will be provided by the power utility company, unless otherwise noted.
3. Underground service entrance: Provide all trenching, conduit, conductors and electrical equipment from the secondary terminals of the transformer/secondary enclosure to the main service disconnects.
4. Overhead service entrance: Provide all conduit, conductors, supports, weatherheads, and sleeving from the electric service point to the main service disconnects.
5. Metering: Provide conduits, conductors, cabinets, racks, transocket, and supports as required by the power utility company for service metering. All utility metering equipment will be provided by the power utility company.
6. Final connection: Coordinate final connection with the power utility company.

C. Panelboards and Switchboards:
1. Install in the locations as shown and as recommended in NEMA PB1.1. Mount the panelboards such that the top of the switch or circuit breaker in the highest position will not be more than 6-1/2 feet above the floor or working platform. Space all panelboards and switchboards to meet the requirements of Article 110 and 408 of the NEC. Anchor enclosures firmly to walls and structural surfaces,

ensuring that they are permanently and mechanically secured.
2. Provide required SPD breaker for each panel/switchboard as indicated on the Drawings.
3. Coordinate installation of panelboards and enclosures with other trades, including Mechanical and Plumbing to avoid clearance issues with dedicated equipment space and working clearances.
4. Furnish and install an engraved laminated nameplate for each circuit breaker or fused switch in distribution panelboards. Refer to electrical equipment identification section of the specifications for more information.
5. Place all free standing or floor mounted equipment on 4" housekeeping pads.
6. Where series rated panels are allowed: Field mark the factory furnished label in accordance with NEC Article 110.22(C).

D. Fuses:
1. Check fasteners on fuse clips for tightness when installing fuses.
2. Install fuses so label is in an upright, readable position. Fuses without labels are not acceptable.
3. Do not install fuses until equipment is ready to be energized.

E. Safety Switches and Enclosed Circuit Breakers:
1. Mount switches no more than 6 inches above and within 6 feet of the equipment served, so that operating handle is easily accessible. Align tops of switches when grouped together.
2. Provide a 4" housekeeping pad for all free standing or floor mounted safety switches whether they are mounted inside or outside.
3. Mount vertically on required separate support system hardware with switch easily accessible (door to open 90 degrees minimum).
4. Permanently mount safety switches from inside with plated or stainless bolts, toggle bolts or anchors. Exposed mounting bolts, screws, etc. are not acceptable.
5. Permanently install fusible switches with class R fuse kits so that fuses are readable when looking at open switch.
6. Do not mount switches/disconnects to access panels or on nameplate data on equipment per NEC.
7. Installation of Conductors: Switches shall not be used as “junction boxes” between HVAC units (splicing or “pig tailing” is not permitted). The maximum number of conductors allowed per termination is determined by the manufacturer’s approved rating for each terminal or lug.
8. Identification: Provide nameplate identification on all HVAC equipment regardless of equipment location per Section 26 05 53 - Identification for Electrical Systems.

F. Contactors and Relays:
1. Unless otherwise indicated on the Drawings, mount contactors in electrical enclosures in electrical room, mechanical room or designated area on Drawings in accordance with manufacturer`s instructions and recommendations.
2. Provide an override toggle switch, for maintenance and testing, located beside each contactor used for lighting.
    a. Mechanically-held contactor: Toggle switch shall be momentary contact, up position shall be ON, center position shall not be labelled and down position shall be OFF. Provide control voltage to switch and labelling for each switch position. Leviton 1256-x or similar.

b. Electrically-held contactor: Toggle switch shall be maintained contact, up position shall be ON, center position shall be OFF and down position shall be AUTO. Provide control voltage to switch and labelling for each switch position. Leviton 1285-x or similar.

3.5 ELECTRICAL SERVICE AND METERING PROVISIONS

A. The contractor shall provide all materials and labor shown on the Drawings and/or required for the complete installation except as specifically indicated to be by the serving utility. The contractor shall provide all requirements as directed by the serving utility company at the cost to the contractor.

3.6 GROUNDING

A. Electrical grounding shall conform to Article 250 of the NEC. See Section 26 05 26 - Grounding and Bonding for more requirements.

3.7 IDENTIFICATION

A. See Section 26 05 53 - Identification for Electrical Systems.

3.8 ADJUSTING

A. Electrical Load Balancing:
   1. Balance panels by checking each phase of all panels under full load and arrange so that all phases carry the same load as near as possible by moving individual branch circuits. After load balancing is complete, correct panel schedule directories to reflect all breakers and loads correctly.

B. GFCI Protection - Initial adjustments at service entrance equipment:
   1. Initial settings: At the time of installation, adjust the settings of the ground fault protection device as follows:
      a. Time delay: Adjust the time delay to 0.3 seconds.
      b. Pick-up: In no case can the setting exceed 1,200 amps. Observing this absolute maximum, adjust the ground fault trip setting to the greater of the following two options.
         1) 15% of the trip rating of the main breaker in the service entrance equipment.
         2) At least as large as the trip rating of the largest downstream overcurrent device that serves a single piece of equipment.

END OF SECTION

SECTION 26 27 26

WIRING DEVICES

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Provide factory fabricated wiring devices of the type and electrical rating for the service indicated, provide proper selection to fulfill the wiring requirements. All wiring devices shall be colored to match each other and associated wall plates unless otherwise required by code or owner requirement.

B. Provide switch, receptacle, outlet, conduit, and special purpose wall plates for wiring devices, with ganging and cutouts as indicated, provided with metal screws for securing plates to devices, screw heads colored to match finish of plate.

C. Provide a compatible receptacle for the cap or plug and cord of all other equipment installed in this project.

1.2 RELATED REQUIREMENTS

A. 26 00 00 - Electrical Requirements

B. 26 05 33 - Raceways and Boxes

1.3 REFERENCES AND STANDARDS

A. ANSI / UL 20 - General - Use Snap Switches

B. ANSI / UL 498 - Electrical Attachment Plugs and Receptacles

C. UL 943 - 2006 - Ground Fault Circuit Interrupters

D. NEMA WD 1 - General - Purpose Wiring Devices

E. NEMA WD 6 - Wiring Devices - Dimensional Requirements

F. NEC - National Electrical Code

G. Applicable Federal Specifications - WC - 596-F, WS-896E

H. Mounting heights per Americans with Disabilities Act

1.4 SUBMITTALS

A. Submittals: Submit on all devices and equipment used on this project that are referenced in this section and used on this project. For more information, see Submittals requirements in 26 00 00 - Electrical.

1.5 CLOSEOUT SUBMITTALS:

A. Submit per Closeout Submittals requirements in 26 00 00 - Electrical.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years [documented] experience.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide products by one of the following, unless specific manufacturers are listed or restricted elsewhere in this specification section:
   1. Arrow Hart / Eaton Corp. / Cooper Industries
   2. Bell
   3. Bryant
   4. GE
   5. Gleason
   6. Graco
   7. Hubbell Inc.
   8. KH Industries
   9. Leviton
   10. Pass & Seymour / Legrand / Wiremold
   11. Perfectline
   12. ReelCraft
   13. Wattstopper

2.2 GENERAL REQUIREMENTS

A. Unless otherwise specified herein or indicated on the drawings, all devices shall be specification grade, heavy duty, 20A rated (at equipment rated voltage with the required number of poles), back and side-wired with grounding terminals. Screw terminals only, no push-in terminals. These devices shall comply with NEMA WD-1 Standards and shall all be listed.

B. Color:
   1. Device color shall be coordinated with Owner's Representative and shall reasonably match across all divisions. Emergency devices and plates shall be red per NFPA.
   2. Device plate color shall be as follows: Stainless steel

C. All devices shall be properly labelled and identified per NEC, NFPA and IECC requirements.

2.3 AC / TOGGLE SWITCHES

A. Unless otherwise specified herein or indicated on the drawings, all switches to be quiet-type, complying with UL20 and Federal Specification WC896.

B. Key-Operated switches shall be Single pole, with factory-supplied key in lieu of switch handle. Corbin-style or barrel lock and key. Single-hump key not acceptable.

C. Wall Switches:

	Singe Pole	Double Pole	Three Way	Four Way	Pilot Light
Leviton	1221-S	1222-S	1223-S	1224-S	1221-PLR
Hubbell	CS1221	CS1222	CS1223	CS1224	1221-PL
P & S	CS20AC1	CS20AC2	CS20AC3	CS20AC4	CS20AC1-RPL

D. Slotted Key-Operated Switches:

	Singe Pole	Double Pole	Three Way	Four Way
Leviton	1221-L	1222-L	1223-L	1224-L
Hubbell	HBL 1221	HBL 1222	HBL 1223	HBL 1224
P & S	PS20AC1L	PS20AC2L	PS20AC3L	PS20AC4L

E. Captive Twist Key-Operated Switches:

Leviton	1221-2KL w/WS-35 key	1222-2KL w/WS-35 key	1223-2KL w/WS-35 key	1224-2KL w/WS-35 key
Hubbell	HBL 1221-RKL	HBL 1222-RKL	HBL 1223-RKL	HBL 1224-RKL
P & S	PS20AC1KL	PS20AC2KL	PS20AC3KL	PS20AC4KL

F. Motor-Rated Switches:

	20A 2-Pole	20A 3-Pole	30A 3-Pole
Leviton	MS302-DS	MS303-DS	MS303-DS
Hubbell	HBL7832D	HBL7810D	HBL7810D
P & S	7802MD	7803MD	7803MD

2.4 RECEPTACLES

A. Unless otherwise specified herein or indicated on the drawings, all receptacles to be NEMA 5-20R duplex, complying with NEMA WD 6 Standards, UL 498 & 943, Federal Specification WC596F & W-C-596.

B. IG Receptacles: All Isolated Ground receptacles to be four wire with self-ground strap. Place these receptacles at all computer and communications/technology locations if IG panels are provided.

C. GFCI Receptacles: GFCI receptacles to be NEMA 5-20R duplex, self test, auto monitoring, complying with UL 943 and UL 498.

D. SPD Receptacles: NEMA 5-20R duplex, Type 3 SPD, >200 Joules, >6kA Surge, 3-mode, with indicator light

E. Specification Grade, Heavy Duty Receptacles:

	20A Duplex	20A GFCI	20A IG	20A SPD
Leviton	5362	G5362x	5362-IG	5380x
Hubbell	5362	GFRST20	equal by Hubbell	5362x
P & S	5362	P2097	equal by P&S	5362-SP

F. Weatherproof Receptacles:

1. All weatherproof receptacles shall have GFCI protection at the device or at the breaker.
2. Receptacle covers protected from rain shall be zinc die-cast weather-resistant cover with self-closing lid, Leviton 4992, P&S WIUCAST1, or equivalent.
3. Receptacle covers not protected from rain shall be “While-In-Use” cover, Leviton 5977DGY, P&S WIUC10DGL, or equivalent.

2.5 VOICE/DATA OUTLETS

A. Refer to Division 27 for device and device plate requirements.

2.6 DEVICE PLATES

A. Both standard and oversized (Jumbo) device plates are allowed. However, where oversized device plates are used, the entire room shall use oversized device plates.

B. Weatherproof Cover Plate: Provide cast aluminum weatherproof device plates with hinged cover for each outlet for exterior receptacles as indicated. When outdoor receptacle is permanently in use (heat tape, etc.) provide a cover listed as "While in use"

PART 3 EXECUTION

3.1 PREPARATION

A. Clean debris from outlet boxes before installing devices.

3.2 APPLICATION

A. All devices shall have GFCI and AFCI protection per NEC 210.

B. All receptacles shall meet tamper-resistant requirements of NEC 406 for the location installed.

3.3 INSTALLATION

A. All Devices:
1. Install devices plumb and level.
2. Install switches with OFF position down.
3. The Owner's Representative can move any device, before installation, up to 6 feet in any direction at no additional cost.
4. Install stainless steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.
5. Connect wiring devices by wrapping solid conductor around screw terminal. For other options, see 26 05 19.
6. Do not install behind markerboards, millwork, permanent mounted equipment, etc. Verify on Architectural drawings before installation. Where installed in unsuitable location, the Contractor will move as directed at no cost to Owner.

B. GFCI Receptacles:
1. Install separate GFCI device at each location. Do not use feed through feature for any GFCI receptacle unless specifically noted on the drawings.

C. Device Plates:
1. Use a single one-piece device plate for ganged devices (switches & receptacle).

2. Provide oversize plates where required to completely cover wall opening. Where oversize plates are used, all plates in room shall be oversize style.

3.4 QUALITY CONTROL

A. Verify outlet boxes are installed at proper height.

B. Verify wall openings are neatly cut and completely covered by wall plates.

C. Verify branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

D. Operate each wall switch with circuit energized and verify proper operation.

E. Verify each receptacle device is energized and test each for proper polarity.

F. Test each GFCI receptacle device for proper operation.

3.5 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

END OF SECTION

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SECTION 26 50 00

LIGHTING

PART 1 GENERAL

1.1 SUMMARY

A. This section supplements section 26 00 00 - Electrical and contains additional requirements applicable to all lighting systems.

1.2 SECTION INCLUDES

A. Interior and exterior lighting systems, with the exception of sports lighting and theatrical lighting.

B. Luminaires, LED drivers, emergency battery packs, and emergency power transfer devices.

1.3 RELATED SECTIONS

A. Section 26 00 00 - Electrical

B. Section 26 00 90 - Electrical Submittal Procedures

C. Section 26 09 16 - Electrical Control Components

D. Section 26 09 23 - Lighting Control Devices

1.4 REFERENCES

A. Energy Star

B. DLC - DesignLights® Consortium

C. TCLP - Federal Toxicity Characteristic Leaching Procedure

D. UL 1598 - Standard for Safety - Luminaires

E. UL 924 - Standard for Safety - Emergency Lighting and Power Equipment

F. UL 8750 - Standard for Safety - Light Emitting Diode (LED) Equipment for Use in Lighting Products

G. ANSI/UL 844 - Standard for Safety - Luminaires for Use in Hazardous (Classified) Locations

H. ANSI C78.377 - Specifications for the Chromaticity of Solid-State Lighting Products

I. NECA/IESNA 500 - Recommended Practice for Installing Indoor Commercial Lighting Systems

J. NECA/IESNA 501 - Recommended Practice for Installing Exterior Lighting Systems

K. IESNA LM-79 - Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products

L. IESNA LM-80 - Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays, and Modules

M. IESNA TM-21 - Projecting Long-Term Lumen, Photon, and Radiant Flux Maintenance of LED Light Sources

N. Code of Federal Regulations, Title 47, Part 15 - Radio Frequency Devices

1.5 PERFORMANCE REQUIREMENTS

A. All lighting systems shall be compatible with lighting controls shown on the drawings or specified in 26 09 16 - Electrical Control Components and/or 26 09 23 - Lighting Control Devices.

1.6 SUBMITTALS

A. Submit in accordance with Section 26 00 90 - Electrical Submittal Procedures.

1.7 PRODUCT DATA

A. Submit complete product information for the following:
1. Luminaires
2. LED arrays
3. LED drivers
4. Battery backup units
5. Product warranty documentation

B. Submit luminaires shown on the Luminaire Schedule on the drawings and those noted on the drawings but not on the schedule.

C. Include complete manufacturer’s part numbers.

D. Clearly highlight or otherwise indicate on the cut sheets all options and accessories.

E. Indicate if DLC listing applies only to certain color temperatures, beam spreads, or other luminaire options. Indicate if any luminaire options void the DLC listing.

F. Indicate the L70 rating and the number of LM-80 testing hours for all LED luminaires.

1.8 SAMPLES

A. Submit non-returnable samples of luminaires upon request. Include all components necessary for a working product.

1.9 QUALITY ASSURANCE/CONTROL SUBMITTALS

A. This project may require compliance with the Windstorm Inspection Program of the Texas Department of Insurance (TDI). Refer to Division 01 specifications to determine whether windstorm certification is required, and for submittal requirements of the TDI Windstorm Inspection Program.

1.10 CLOSEOUT SUBMITTALS

A. Provide owner a list of all luminaire types used on the project using manufacturer part numbers.

B. Provide owner a list of all LED array and LED driver types used on the project using ANSI and manufacturer codes. Provide on as-built drawings the location of all remote-mounted LED drivers.

C. Provide owner a list of battery backup, automatic transfer devices, etc. on the project using manufacturer part numbers. Provide on as-built drawings the location of all remote-mounted battery backups.

1.11 QUALIFICATIONS

A. All luminaires shall be from manufacturers who have been regularly engaged in the production of such products for the past five years.

1.12 REGULATORY REQUIREMENTS

A. All luminaires and components, including LED arrays, LED drivers, emergency battery packs and automatic transfer devices shall be UL listed.

B. This project may require compliance with the Windstorm Inspection Program of the Texas Department of Insurance (TDI). Refer to Division 01 specifications to determine whether windstorm certification is required, and for requirements of the TDI Windstorm Inspection Program.

1.13 STORAGE AND PROTECTION

A. Store all product in accordance with manufacturer’s storage requirements.

1.14 SPECIAL WARRANTY

A. Provide a 5-year manufacturer’s warranty for all LED luminaires. The warranty shall include all luminaire components including, but not limited to, LED arrays, LED drivers, luminaire body, and hardware. LED arrays will be considered defective if a total of 15% or more of the individual light emitting diodes fail to illuminate.

B. Provide a 5-year manufacturer’s full warranty for all battery packs.

C. The warranties shall cover the cost of materials and labor for repair and installation.

1.15 ADDITIONAL MATERIALS

A. Additional materials to be a dollar cost in the base bid. At the end of the project, the Contractor shall generate a dollar amount credited back to the Owner for any unused items. All attic stock shall be provided to the Owner at substantial completion. The base bid shall include all additional materials and attic stock.

B. Include in the base bid for additional materials:
   1. All costs to provide 2 additional lighting circuits, all required circuit breakers, wiring, conduit, labor, and devices as specified and directed by Architect. Each circuit to be priced with a rating of 20 amps and at a distance of 100 feet to furthermost device. Each circuit to include 15 luminaires equal in value to luminaire type “B5”.
   2. All costs to provide 10 additional exit lights equal in value to luminaire type “X” as noted on drawings, all required wiring, conduit, labor, and devices as specified and directed by the Architect. Wiring and conduit to be priced at a distance of 50 feet.

3. All costs to provide 10 additional luminaires with battery equal in value to luminaire type “B5E”.

C. Include in the base bid for attic stock:
1. Provide 4 luminaire type “B5”.
2. Provide 4 luminaire type “B5E”.
3. Provide 4 luminaire type “X”.
4. Provide 4 drivers for luminaire type “B5”.

D. See Sections 26 00 00 - Electrical and 26 09 23 - Lighting Control Devices for other additional materials and attic stock to be provided by this Contractor.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Only those manufacturers of luminaires listed on the Luminaire Schedule are acceptable.

2.2 EXISTING PRODUCTS

A. New luminaires must match existing luminaires in all areas including but not limited to style, finish color, orientation, mounting height, color temperature, driver type, switching capability, voltage, etc. The new luminaires must meet or exceed the quality of the existing luminaires and must meet all current codes and standards for efficiency.

2.3 LUMINAIRES

A. The following requirements apply to all luminaires. See following articles for additional requirements for specific types of luminaires.

B. Only those products listed on the Luminaire Schedule or noted in the drawings are acceptable.

C. Unless otherwise noted, consult Architect for luminaire color or finish.

D. All luminaires used in hazardous locations shall comply with UL 844 requirements and be UL listed.

E. All luminaires used for emergency lighting, including exit lights, shall be UL 924 listed.

2.4 LED LUMINAIRES

A. LED luminaires shall meet the following requirements in addition to the general requirements for luminaires listed above.

B. All LED luminaires shall comply with UL 8750 requirements and be UL listed.

C. All LED general-purpose luminaires shall be either Energy Star or DLC approved.

D. Expected life: All LED luminaires shall have a minimum L70 of 50,000 hours. The estimated L70 of LED luminaires shall be derived from LM-80 test data in accordance with TM-21 procedures. LM-80 test data shall be measured in accordance with LM-79 procedures.

E. Color rendering: All interior LED luminaires shall have a minimum CRI of 80 or as indicated on the Luminaire Schedule. All exterior LED luminaires shall have a minimum CRI of 70.

F. Color temperature: Unless specified to the contrary, all LED luminaires on the same project are to have the same correlated color temperature (CCT). See the Luminaire Schedule for LED CCT. LED luminaire CCT shall be within a 3-step SCDM (Standard Deviation Color Matching) in accordance with ANSI C78.377.

G. Maximum power: The maximum power input of all LED luminaires shall be as indicated on the Luminaire Schedule, with a tolerance of +5% / -10%.

H. Efficacy: All general-purpose LED luminaires shall have a minimum efficacy of 90 lumens/watt.

I. Lumen output: The lumen output of all LED luminaires shall be as indicated on the Luminaire Schedule, with a tolerance of plus or minus 8%.

2.5 HIGH BAY LED LUMINAIRES

A. LED high bay luminaires shall meet the following requirements in addition to the requirements for LED luminaires listed above.

B. All high bay luminaires located in gyms, play areas, multipurpose spaces, etc. shall have a wire guard.

C. Lens, if provided, or wire guard of high bay luminaires shall be hinged and shall have retainer latches for tool-less maintenance.

2.6 EXIT SIGNS

A. LED exit signs shall also meet the following requirements in addition to the general requirements for LED luminaires.

B. LED exit signs shall be rated for at least 10 years unless otherwise noted.

C. LED exit signs shall be provided with maintenance free batteries good for at least 90 minutes.

D. LED exit signs shall be provided with status indicator lamp and test switch.

E. Powered LED exit signs shall be UL tested and approved with 100’-0” visibility.

F. Non-LED self-luminous exit signs shall be good for at least 20 years and shall be UL tested and approved with 100’-0” visibility.

G. Exit signs in gyms, play areas, multipurpose spaces, etc. shall have a wire guard.

2.7 POLE-MOUNTED EXTERIOR LUMINAIRES

A. LED pole-mounted luminaires shall meet the following requirements in addition to the requirements listed above in the LED Luminaires article.

B. Pole mounted luminaires shall have an option for internal glare control or external glare shield where applicable.

C. All exterior surfaces of pole mounted luminaires shall be painted using powder coat finish.

D. See Section 26 56 23 - Area Lighting for additional site lighting requirements, including poles.

2.8 LED DRIVERS

A. The following requirements apply to all LED drivers.

B. Drivers shall be UL Type TL or UL Class P and bear such labels.

C. Drivers shall comply with UL 8750 and be UL listed.

D. Input power: Driver input wattage for the supplied driver must be the same or less than the input wattage listed on the Luminaire Schedule.

E. Voltage: Drivers shall be 60 Hz, universal input voltage (120V-277V) +/- 10% unless otherwise indicated in the Luminaire Schedule. Drivers shall demonstrate no visible change in light output with a variation of +/- 10% change in line voltage input.

F. Remote drivers: Remote drivers shall have remote wiring capability of up to 50 feet.

G. LED module compatibility: Drivers shall provide LED module starting conditions and operating parameters consistent with LED module manufacturer’s recommendations and shall be suitable for the luminaire operating conditions.

H. Wiring diagrams: Drivers shall have wiring diagrams and LED module connections displayed on the driver.

I. Sensor compatibility: Drivers shall be compatible with and not cause interference with the operation of occupancy sensors or other infrared control systems.

J. Power factor: Drivers shall have a power factor of 0.9 or greater.

K. Total harmonic distortion (THD): Drivers shall be 20% THD or less.

L. Dimming capability: Drivers shall dim to at least 10% or as noted in the Luminaire Schedule.

M. Driver efficiency: Drivers shall have an efficiency of 85% or greater.

N. Case temperature: Indoor drivers shall have a maximum case temperature rating of 75ºC. Exterior drivers shall have a maximum case temperature rating of 85ºC.

O. Noise: Drivers shall have an audible noise rating of 27dB Class A or less.

P. Electromagnetic compliance: Drivers shall comply with CFR Title 47 Part 15 Class A.

Q. Tandem wiring: Multiple luminaires shall not share a common driver (no tandem wiring).

2.9 ACCESSORIES

A. Lenses: Lenses for LED troffers shall be 100% virgin acrylic and have a nominal thickness of 0.125 inch.

B. Emergency Battery Packs: Emergency battery packs shall be factory installed. All emergency luminaire troffers shall operate at 1400 lumen or greater output for at least 90 minutes. All battery backups installed in exterior luminaires shall be rated for damp location and rated to operate at 32ºF.

2.10 FINISHES

A. Corrosion-resistant products for natatoriums: Where available, products used inside natatoriums shall be rated for use in corrosive indoor natatorium environments. Surfaces shall have a corrosion-resistant coating that is impervious to moisture and is unaffected by chloramines. Any uncoated products, such as nuts, bolts, screws, and other hardware, shall be one of the following.
   1. 317LMN (S31726) high alloyed austenitic stainless steel
   2. 904L (N08904) high alloyed austenitic stainless steel

PART 3 EXECUTION

3.1 SITE VERIFICATION OF CONDITIONS

A. Field verify existing conditions to determine luminaire quantities, spacing, location, orientation, mounting height, input voltage, color, switching arrangement, etc. to install in each space to properly serve the switching arrangement, lamp type, lamp quantity, voltage, feeder condition, etc. of existing luminaires to be replaced or added to. All replacement luminaires shall match these physical characteristics or the standard outlined in this specification, whichever is greater.

3.2 INSTALLATION

A. Provide all luminaires of the types indicated, in accordance with NEMA standards, manufacturer’s recommendations, and NEC requirements.

B. Install indoor lighting systems in accordance with NECA/IESNA 500.

C. Install exterior lighting systems in accordance with NECA/IESNA 501.

D. Provide luminaires complete with LED arrays, LED drivers, and other accessories necessary for proper installation in the building construction and listed for fire rated ceilings where required by code.

E. Provide parking lot, roadway, and walkway lights, if any, in accordance with section 26 56 23 - Area Lighting.

F. Lighting control: Provide switches with matching technology (line voltage dimming, 0-10V dimming, etc.) for dimming drivers in the locations shown on the drawings. Provide lighting controls in accordance with sections 26 09 16 - Electrical Control Components and/or 26 09 23 - Lighting Control Devices.

G. Emergency lighting: Provide a battery backup, transfer switch, internal wiring, etc. in each luminaire indicated as an emergency luminaire or night light. If a type designation is omitted from an emergency luminaire then furnish a battery backup or automatic transfer device in the standard luminaire and make it an emergency luminaire. If the unswitched hot leg needed for proper operation does not exist, provide a new unswitched hot leg to the luminaire as needed for proper operation. The unswitched hot wire must come from the same branch circuit that powers the

luminaire.

H. Verify that the specified luminaires are compatible with the specified ceiling systems as indicated on the Architectural drawings. Advise the Architect/Engineer of any discrepancies before placing the luminaire order.

I. Locate luminaires in mechanical and other similar equipment rooms to clear all obstructions. Obtain approval from the Architect or Engineer before placing luminaires where the location as shown on the drawings must be radically changed.

J. Support surface mounted luminaires from the building structure with a minimum of two 1/4 inch threaded rods per luminaire. Use 1½ inch x 1½ inch steel framing channel where required to span joists and otherwise facilitate structural support.

K. Mount recessed luminaires in the center of a ceiling tile or as shown on the drawings. Provide support for recessed luminaires by means of bar hangers extended across the main ceiling support members and also supported from the building structure.

L. Run lighting fixture whips (flex conduit/metal clad cable) from a junction box to each luminaire (not to exceed four luminaires per junction box) access plate. Lighting fixture whips between luminaires will not be accepted. Refer to luminaire installation details for more information.

M. Locate all remote drivers or battery packs above the ceiling above each luminaire or in an adjacent room with a low ceiling for easy access. Mount drivers on rubber insulators.

N. Exit signs: Exit signs are not to be switched.

O. Prior to final inspection, check all luminaires for damages during construction and replace damaged luminaires at no additional expense to the Owner. Test all emergency luminaires for proper operation, including exercising all transfer switching, battery backups, generator, etc. All luminaires shall be cleaned and completely operational at the time of final acceptance of the building.

P. All conduit, wiring, conductors, etc. serving underwater luminaires in a pool shall be installed in accordance with NEC 680.23 and NEC 680.24.

3.3 ADJUSTING

A. Move any luminaire up to six feet in any direction as directed at no additional cost.

END OF SECTION

SECTION 27 05 00

GENERAL COMMUNICATION SYSTEMS REQUIREMENTS

PART 1 GENERAL

1.1 WORK INCLUDES

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1, apply to this Section.

B. Communication Systems complete including cabling, special backboxes, hardware, and all other required devices and equipment.

C. Installation of system equipment per specifications.

D. To supply in a timely manner to the electrical contractor special backboxes for installation as required.

E. Coordinate wireway, raceway, power, and outlet requirements with the builder and the electrical contractor.

F. Communication Systems Contractors shall provide and install prior to cable installation plastic snap in bushings at each box opening, passage through a metal stud, and at the end of all open conduit stubs or sleeves to protect the cabling from damage.

G. Furnishing of all required materials, equipment, tools, scaffolding, labor, and transportation necessary for the complete installation of the communication systems as shown on the drawings and as specified herein.

H. Cable pathways, conduit, and cable support systems shall be complete with bushings, de-burred, cleaned, and secure prior to installation of cable.

I. It is the intent of these specifications to provide complete installations although every item necessary may not be specifically mentioned or shown.

1.2 WORK TO BE INCLUDED BY THE ELECTRICAL CONTRACTOR IN BASE CONTRACT PROPOSAL

A. Provide utility services conduit as outlined on drawings as required.

B. All required conduit for accessibility to attic space.

C. Furnishing and installation of all required standard back boxes and conduit.

D. Installation of special back boxes supplied by the Division 27 contractor(s).

E. Furnishing and installation of all floor boxes, surface raceways, and other wireways which are detailed or specified under Division 26.

F. Provide equipment-mounting boards as outlined on drawings.

G. Provide equipment grounding system, conductors, and bus bars as outlined in Division 26.

H. Provide 120-volt power and hook-up to equipment provided in Division 27.

I. Coordination of requirements of Division 27 with the Builder.

1.3 WORK NOT INCLUDED

A. Contractors shall make no agreement that obligates the Owner to pay any company providing communications, monitoring, or other services. Contractors shall not make selection, purchase, or installation of interconnect instruments/equipment to be used on this project.

1.4 RELATED SECTIONS

A. The conditions of Division 0, Division 1, and Division 26 requirements, and the contract requirements that include the General Conditions and the Supplementary Conditions apply to work of this division.

B. Section 26 00 00 – Electrical

1.5 OWNER FURNISHED CONTRACTOR INSTALLED (OFCI) EQUIPMENT

A. Refer to Responsibility Matrix on plans for equipment that applies.

B. The contractor shall verify that new and existing products and site conditions are satisfactory for installation or relocation of OFCI equipment. If unsatisfactory conditions exist or other discrepancies are identified, the contractor shall immediately document the conditions and notify the owner in writing.

C. The contractor shall coordinate all required equipment schedule quantities and any dimensions or variations required to adapt to field conditions with the owner at the earliest possible date.

D. The contractor shall verify compatibility, installation rough-in, mounting, and utility requirements for the scheduled OFCI equipment.

E. The owner shall coordinate delivery dates with the builder to meet the construction schedule.

F. The installation of items as identified in the plans and specifications as OFCI equipment shall conform to the provisions of the Contract Documents and shall be coordinated with the builder.

G. Installation shall be performed by competent and trained workers in accordance with all applicable codes and governing regulations.

H. Installation, testing, and startup shall comply with the manufacturer’s instructions.

I. The contractor shall provide all miscellaneous hardware, structural support, cabling, fittings, etc. that is not included by the manufacturer, but required for installation.

J. The contractor shall clean and adjust all relocated and new OFCI products as necessary.

K. All crating, packing materials, and debris shall be properly disposed of off-site.

L. Installation shall be subject to inspection by the architect, engineer, owner, and builder. The installer shall not proceed until any unsatisfactory conditions are corrected. Any damage caused by improper handling or installation procedures shall be corrected at no cost to the owner.

M. For drop shipped equipment, the builder shall be the consignee and shall have a representative on-site for coordination of delivery, receiving shipments, and inspect each shipment for obvious signs of damage or shortages. The builder shall be responsible for all shipping damage claims, including hidden damage, refusal of shipment, and Return Authorization procedures. The builder shall provide secure storage, handling, and protection from the elements, prior to the contractors' acceptance for installation.

N. For equipment stored at an owner's facility, the contractor shall load the equipment and provide transportation to the work site. Prior to loading, the contractor shall inspect the equipment for obvious signs of damage and document all quantities, noting shortages from the project requirements, indicating acceptance of the merchandise as is and in good order.

O. The contractor shall conduct and properly document testing of all installed equipment to verify proper operation. When appropriate, on-site operation and maintenance instruction shall be provided to the owner's personnel. This instruction shall include demonstration of proper use, maintenance, and cleaning procedures.

P. The nature of the equipment procurement shall determine responsibility for resolving any claims with the manufacturer or supplier relating to defects in material or workmanship and warranty claims. The party that purchased the equipment shall resolve these issues.

1.6 CODES, STANDARDS, AND THEIR ABBREVIATIONS

A. General:
   1. Perform all work in strict accordance with the requirements and recommendations stated in the codes and standards except when requirements are exceeded by the contract documents.
   2. In addition to the requirements outlined in other sections of the specifications the following standards are imposed as applicable to the work in each instance:
      a. OSHA Safety and Health Regulations for Construction.
      b. NFPA No. 70 - National Electrical Code.
      c. NESC - National Electrical Safety Code, ANSI Standard C2.
      d. NEiS - National Electrical Installation Standards.
      e. Local Codes and Ordinances.

B. Where local codes or practices exceed or conflict with the NEC, it shall be the Contractor's responsibility to perform the work in accordance with the local code prevailing and local interpretations thereof. Any such additional work shall be performed at no additional cost to the Owner.

C. Materials and components shall be UL listed and labeled by Underwriters Laboratories, Inc. for the intended use under the latest appropriate testing standard.

D. The Contractor shall obtain all permits required to commence work and, upon completion of the Work, obtain and deliver to the Owner's Representative a Certificate of Inspection and Approval from the State Board of Fire Underwriters, the City of Greenville, Texas, and other authorities having jurisdiction. The Contractor shall pay required permit fees.

1.7 LIST OF ASSOCIATIONS AND STANDARDS

ADA - Americans with Disabilities Act.

ANSI - American National Standards Institute, 1430 Broadway; New York, NY 10018.

ASTM - American Society for Testing and Materials, 1916 Race Street; Philadelphia, PA 19103.

BICSI - (RCDD5 Standards), 8610 Hidden River Parkway, Tampa, FL 33637

CBM - Certified Ballast Manufacturers Association, 2116 Keith Building; Cleveland, Ohio 44115.

IEEE - Institute of Electrical and Electronics Engineers, 345 East 47th Street; New York, NY 10017.

ICEA - Insulated Cable Engineers Association, P.O. Box P, South Yarmouth, MA 02664.

NEC - National Electrical Code; NFPA 70.

NECS - National Electrical Contractors Association, Inc., 7315 Wisconsin Ave.; Washington, DC 20014.

NEMA - National Electrical Manufacturers Association, 155 East 44th Street; New York, NY 10017.

NESC - National Electrical Safety Code, ANSI Standard C2.

NFPA - National Fire Protection Association, 60 Batterymarch Street; Boston, MA 02110.

OSHA - Occupational Safety and Health Administration, US Department of Labor; Washington, DC 20402.

TAS - Texas Accessibility Standards (TAS) Article 9102.

UL - Underwriters Laboratories, Inc., 333 Pfigsten Road; Northbrook, IL 60062.

A. Nothing in the Contract Documents shall be construed to permit work not conforming to these codes.

B. When two or more codes or standards are applicable to the same work, then the stricter code or standard shall govern.

C. The date of the code or standard is that in effect on the date of issue stated on the contract documents, except when a particular publication date is specified.

D. The Contractor shall comply with all State, Federal, NFPA, local codes, and ordinances that may alter any part of the plans or specifications. The Contractor shall bear all costs for correcting any deficiencies due to non-compliance.

E. Where local codes and ordinances are not in writing or on record but local precedence have been set, the Owner shall pay for any additional resulting cost.

1.8 DEFINITIONS

A. Approval: It is understood that approval must be obtained from the Architect in writing before proceeding with the proposed work. Approval by the Architect of any changes, submitted by the Contractor, will be considered as general only to aid the Contractor in expediting his work.

B. The Builder: The primary contractor engaged to oversee the construction project. They may be technically described as a Construction Manager, General C ontractor, Managing Construction Contractor, et cetera.

C. The Contractor: The Contractor engaged to execute the work included a particular section only, although he may be technically described as a Subcontractor to the Builder. If the Contractor, engaged to execute said work, employs Sub-Contractors to perform various portions of the work included under a particular Section, they shall be held responsible for the execution of this work, in full conformity with Contract Document requirements. The Contractor shall cooperate at all times and shall be responsible for the satisfactory cooperation of his Subcontractors with the other Contractors on the job so that all of the various sections and phases of work may be properly coordinated without unnecessary delays or damage.

D. The Electrical Contractor: The Electrical Contractor shall be engaged to execute the work included in Division 26 only.

E. PDF file or .pdf: The filename extension associated with “Portable Document Format” files, which are multi-platform computer files in the ISO 32000-1:2008 open standard format developed and licensed by Adobe Systems. These files are a digital electronic representation of text, documents, images, and technical drawings in a font and color-accurate fixed-layout format that is platform and display resolution independent. PDF files can be electronically transmitted, viewed, or printed with various free PDF reader application programs, and may allow markups/comments with various PDF editing application programs.

F. Provide: Defined as requiring both the furnishing and installation of the item or facility indicated, complete in all respects, and ready for operation unless otherwise specifically noted.

1.9 SCHEDULE OF VALUES, APPLICATION FOR PAYMENT

A. The Contractor shall in accordance with the General Provisions of the Contract, including General and Supplementary Conditions, and Division 1, complete a Schedule of Values and Applications for Payment. When a portion of this work separately funded, including donations or an E-Rate program, the contractor shall accommodate this in the Schedule of Values and Applications for Payment. For E-Rate eligible portions of this work, the contractor will be required to participate in the E-Rate program, comply with all E-Rate regulations, and provide billing as needed. The contractor shall coordinate with the Owner to file Form 471 or later edition and/or

other forms as may be required.

1.10 WARRANTY

A. The Contractor shall warranty his work against defective materials and workmanship for a period of one year from date of acceptance of the job.

B. Neither the final payment nor any provisions in Contract Documents shall relieve the Contractor of the responsibility for faulty materials or workmanship.

C. He shall remedy any defects due thereto and pay for any damage to other work resulting there from, which shall appear within a period of one year from date of substantial completion.

D. The Owner shall give notice of observed defects with reasonable promptness.

E. This Warranty shall not be construed to include the normal maintenance of the various components of the system covered by these specifications.

1.11 SITE VISIT

A. Before submitting a proposal, each proposed contractor shall examine all plans and specifications relating to the work, shall visit the site of the project, and become fully informed of the extent and character of the work required, including all required utilities.

B. No consideration will be granted for any alleged misunderstanding of the materials to be furnished or the amount of work to be done, it being fully understood that the tender of a proposal carries with it the agreement to all items and conditions referred to herein or indicated on the accompanying plans or required by nature of the site of which may be fairly implied as essential to the execution and completion of any and all parts of the work.

1.12 SUBMITTALS

A. Submittal procedures shall be per Division 1 - General Requirements.

B. Provide a complete submittal for each section as specified.

C. Submit complete submittal package within 30 calendar days after award of this work for approval. Equipment is not to be ordered without approval. Partial submittals are not acceptable for review. Each submittal shall include a dated transmittal.

D. Submittal may be electronically transmitted in PDF file format (preferred) or paper copies may be provided in quantities indicated in Division 1. Paper copies shall be organized including index tabs in a 3-ring black binder of sufficient size.

E. For each submittal provide a cover sheet with the name and location of the project, the name, address, and telephone number of the Contractor, and the name, address, and telephone number of the submitting sub-contractor. Include on or after the cover sheet sufficient space for review stamps.

F. Each Product data submittal shall include:
   1. A cover sheet with the name and location of the project, the name, address, and telephone number of the Contractor, and the name, address, and telephone number of the submitting sub-contractor. Include on or after the cover sheet

sufficient space for review stamps.

2. An indication of any deviations from Contract Document requirements, including variations and limitations. Show any revisions to equipment layout required by use of selected equipment.
3. A product data index and complete equipment list including for each product submitted for approval the manufactures name and part number, including options and selections.
4. Cut sheets or catalog data illustrating the physical appearance, size, function, compatibility, standards compliance, and other relevant characteristics of each product on the equipment list. Indicate by prominent notation (an arrow, circle, or other means) on each sheet the exact product and options being submitted.
5. Submit design data, when the scope of work requires, including calculations, schematics, risers, sequences, or other data.
6. When the contract requires extended product warranties, submit a sample of warranty language.
7. Any resubmittal shall include a complete revised equipment list and any product data that is revised.

G. Submit shop or coordination drawings, when specified or the required for the scope of work, which includes information that will allow the Contractor to coordinate interdisciplinary work and when necessary guide the manufacturer or fabricator in producing the product. Shop or coordination drawings shall be specifically prepared to illustrate the submitted portion of work, this may require diagrams, schedules, details, and accurate to scale equipment and device layouts prepared using a CAD or BIM engineering drawing program. Shop drawings shall be dedicated drawings by the contractor and include a border containing the contractors information.

H. The Engineer's review of submittals is only for confirmation of adherence to design of project and does not relieve the Contractor of final responsibility for furnishing all materials required for a complete working system and complying with the Contract Documents in all respects.

1.13 PROJECT RECORD DOCUMENTS

A. The Contractor shall keep a set of plans on the job, noting daily all changes made in connection with the final installation including exact dimensioned locations of all new and uncovered existing utility piping outside the building.

B. Upon submitting his request for final payment, he shall turn over to the Architect/Engineer, for subsequent transmittal to the Owner revised plans showing "as installed" work.

C. In addition to the above, the Contractor shall accumulate during the jobs progress the following data in PDF file format (preferred) or paper copies to be turned over to the Architect/Engineer for checking and subsequent delivery to the Owner:

1. All warranties, guarantees, and manufacturer's directions on equipment and material are covered by the Contract.
2. PDF file or paper copies of all Shop Drawing prints and CAD or BIM engineering drawing program files.
3. Any software programs, data/programming files, passwords, special interface cables, or keys that may be needed to maintain or access equipment.
4. Set of operating instructions. Operating instructions shall also include recommended maintenance and seasonal changeover procedures.

5. Any and all other data and/or plans required during construction.
6. Repair parts lists of all major items and equipment including name, address, and telephone number of local supplier or agent.
7. The first page, or pages, shall have the names, addresses, and telephone numbers of the following:
    a. Builder and all Contractors.
    b. Major Equipment Suppliers.
    c. Submit communication systems warranties.

1.14 TRAINING

A. Upon completion of the work and at a time designated by the Architect, provide formal training sessions for the Owner's operating personnel to include location, operation, and maintenance of all communication systems equipment and systems.

B. See other sections for time requirements.

1.15 PLANS AND SPECIFICATIONS

A. The intent of the project drawings is to establish the types of systems and functions, but not to set forth each item essential to the functioning of the system.

B. Electrical drawings are generally diagrammatic and show approximate location and extent of work.

C. Install the work complete including minor details necessary to perform the function indicated. Provide communication systems (including all hook-ups) complete in every respect and ready to operate.

D. If clarification is needed, consult the Architect/Engineer.

E. Review pertinent drawings and adjust the work to conditions shown. Where discrepancies occur between drawings, specifications, and actual field conditions, immediately notify the Architect/Engineer for his interpretation.

F. The Architect/Engineer reserves the right to make any reasonable change in the location of any part of this work without additional cost to the Owner.

1.16 PRODUCT SUBSTITUTIONS

A. Descriptions and details, acceptable manufacturers' names listed, and specific manufacturer and model number items indicated in the plans and specifications shall establish a standard of quality, function, and design. Manufacturers and model numbers listed "no exceptions" shall not be substituted without specific notice in an addendum. Otherwise, where a specific manufacturer's product is indicated, products of other manufacturers listed as acceptable may be submitted for approval based on the substitute product being, in the opinion of the Engineer, of equivalent or better quality than that of the product specified.

B. Proposed contractors wishing to propose systems which differ in manufacturer, features, functions, or operating characteristics from those outlined in these specifications must do so in writing to the specifying authority at least ten (10) days prior to the proposal opening.

C. For manufacturers equipment or models other than that specified, the proposed contractor shall supply proof that such substitute equipment equals or exceeds the features, functions, performance, and quality of the specified equipment. Proposals must include detailed information showing all deviations from the system as specified and include relevant technical and cost data. This shall include a complete description of the proposed substitution, drawings, catalog cuts, performance data, test data, or any other data or information necessary for evaluation.

D. The Engineer will consider all such submittals and the Architect will issue an addendum listing items that the Engineer considers acceptable. Only such items as specified or approved as acceptable will be installed on this project.

E. Substitute products for which the proposed contractor does not obtain prior approval will not be considered acceptable for this project. Final approval of the alternate system shall be based on the decision of the Owner and Architect. Prior approval to make a proposal for this project does not automatically ensure the system will be an acceptable equivalent.

F. The Contractors' proposal represents that the contract proposal price is based solely upon the materials, equipment, and labor described in the Contract Proposal Documents (including addenda, if any) and that he contemplates no substitutions or extras.

G. The manufacturer of the proposed substitute unit shall provide samples for evaluation, when required, at no charge and non-returnable.

H. Requests for substitution are understood to mean that the Contractor:
   1. Has personally investigated the proposed substitution and determined that it is equivalent or superior in all respects to that specified.
   2. Will provide the same guarantee for the substitution that he would for that specified.
   3. Will, at no cost to the Owner, replace the substitute item with the specified product if the substitute item fails to perform satisfactorily.
   4. After Award of the Contract, substitutions will be considered only under one or more of the following circumstances:
      a. The substitution is required for compliance with subsequent interpretations of code or insurance requirements.
      b. The specified product is unavailable through no fault of the Contractor.
      c. The manufacturer refuses to warranty the specified products as required.
      d. Subsequent information indicates that the specified product is unable to perform properly or to fit in the designated space.
      e. In the Engineer's sole judgment, the substitution would be in the Owner's best interest.
      f. Revisions to the electrical system caused by substitutions shall be under the supervision of the Engineer, at a standard hourly rate charged by the Engineer. Charges from the Engineer, Architect, and Electrical Contractor shall be paid by the Contractor originating the changes.

1.17 FUTURE USE CABLING

A. When cabling is installed for future use, it shall be identified with a tag of sufficient durability to withstand the environment involved.

B. Locations and Existing Conditions:
   1. Location and condition of any existing equipment or services, when shown, have been obtained from substantially reliable sources, are shown as a general guide only, without guarantees as to accuracy.
   2. The Contractor will examine the site, and verify all requirements, service points, and availability of all services required to complete this project. No consideration will be granted for any alleged misunderstanding of the materials and labor to be provided as necessitated by nature of the site including those items that may be fairly implied as essential to the execution and completion of any and all parts of this project.

1.18 EXISTING COMMUNICATION SYSTEMS SELECTIVE DEMOLITION AND EXPANSION FOR ADDITIONS AND RENOVATION

A. The communication contractor shall be responsible for selective demolition of the existing communication systems, including demolition of any devices and cabling previously abandoned. Demolition shall include:
   1. Disconnection and removal of all communication devices not to remain in service in walls, floors, and ceilings.
   2. Identification and verification of abandoned wiring and equipment. All disconnected or abandoned devices that are visible shall be removed, i.e. non-functional fire pulls, bells, speakers, signals, et cetera. Remove abandoned wiring to the source of the supply everywhere possible, the accessible portions of all inaccessible abandoned cabling shall be removed.
   3. Removal of exposed abandoned conduit and supports including brackets, stems, hangers, and other accessories located on walls and above accessible finished ceilings. Cut abandoned conduit flush with walls, floors, etc., and patch surfaces.
   4. Provide a blank cover for abandoned device backboxes that are impractical to remove from masonry construction without unnecessary damage.
   5. Confirm with Owner/Architect regarding the handling and disposal/reuse of removed material, equipment, devices, et cetera.
   6. Off-site disposal in a legal manner of all materials not requested to be turned over to the Owner. Comply with government regulations pertaining to environmental protection, and disposal of materials and equipment. Do not burn any materials on the site.
   7. Repair of any finishes or adjacent construction damaged during modification, extension, and demolition work.

1.19 EXAMINATION

A. Verify field conditions including existing systems, equipment models, configurations, circuiting arrangements, cabling, and devices. Adjust all circuiting, cabling, and materials to be provided as required by job conditions.

B. Project drawings are based on casual field observation and existing record documents when available, report any significant discrepancies to the Engineer before disturbing existing systems.

C. The Contractor accepts the existing conditions when beginning demolition.

1.20 IMPLEMENTATION

A. Verify phasing in regard to systems and coordinate before energizing any system.

B. When required during phases of construction to maintain existing systems in service in particular areas, provide temporary wiring and connections as necessary to accommodate construction.

1.21 OPERATION OF NEW EQUIPMENT PRIOR TO PROJECT COMPLETION

A. When the phasing of a project requires that communication systems are operable in certain areas and the Owner needs to operate the equipment the contractor shall make such provisions. The warranty period shall commence on new equipment when it is operated for the beneficial use of the Owner. Regardless of whether or not the equipment has or has not been operated, the Contractor shall properly clean the equipment, properly adjust, and complete all punch list items before final acceptance by the Owner. In these cases, the date of acceptance and the start of the warranty may be different dates.

1.22 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment in areas of renovation that are to remain or be reused.

1.23 PROTECTION OF EQUIPMENT AND MATERIALS

A. The Contractor shall take such precautions as may be necessary to protect his apparatus from damage.

B. This shall include the creation of all required temporary shelters to protect any apparatus above the floor of the construction and the covering of apparatus in the completed building with tarpaulins or other protective covering.

C. Failure to comply with the above to the satisfaction of the Owner's inspector will be sufficient cause for the rejection of the equipment in question and its complete replacement by the Contractor.

1.24 FINAL OBSERVATION

A. It shall be the duty of the Contractor to make a careful observation trip of the entire project, assuring themselves that the work on the project is ready for final acceptance before calling upon the Architect/Engineer to make a final observation.

B. To avoid delay of final acceptance of the work, the Contractor shall have all necessary bonds, warranties, receipts, affidavits, et cetera, called for in the various articles of these specifications, prepared and signed in advance, together with a letter of transmittal, listing each paper included, and shall deliver the same to the Architect/Engineer at or before the time of said final observation. The Contractor is cautioned to check over each bond, receipt, et cetera, before preparing for submission to verify that the terms check with the requirements of the specifications.

C. The following and other provisions of Division 1 General Conditions will be required at time of final completion:
   1. Final clean up completed.
   2. All systems are fully operational, all material and devices installed.
   3. As-built (as installed) drawings and operations manuals.

1.25 PROHIBITED MATERIALS

A. No new asbestos, lead, or materials containing these substances shall be permitted in this project. The Contractor shall consult the Architect concerning these materials if their presence is suspected. All work in or around existing asbestos or lead materials is at the sole risk of the Contractor and his personnel.

1.26 CUTTING AND PATCHING

A. Notify the Builder sufficiently ahead of construction of any floors, walls, ceiling, roof, et cetera, of any openings that will be required for his work.

B. The Contractor shall see that all sleeves required for his work are set at proper times to avoid delay of the job.

C. All necessary cutting of walls, floors, partitions, ceilings, et cetera, as required for the proper installation of the work under this Contract shall be done at the Subcontractor or at the Subcontractor's expense in a neat and workmanlike manner, and as approved by the Architect/Engineer.

D. Patching of openings and/or alterations shall be provided by the communications Subcontractor or at the Subcontractor's expense in an approved manner.

E. No joists, beams, girders, or columns shall be cut by any Contractor without first obtaining written permission of the Architect/Engineer.

F. All openings in firewalls and floors shall be completely sealed after installation for a completely airtight installation. Sealing material shall be non-combustible and UL approved. The installed sealing assembly shall not cause the fire rating of the penetrated structure to be decreased.

G. All openings in exterior walls shall be sealed watertight.

H. Seal voids around conduits penetrating fire-rated assemblies and partitions using fire stopping materials and methods in accordance with NFPA and local codes.

1.27 MANUFACTURERS' INSTRUCTIONS

A. All equipment and devices shall be installed in accordance with the drawings and specifications, manufacturer's instructions, and applicable codes.

B. Where specifications call for installation of a product to be in accordance with manufacturer's instructions and/or where manufacturer's instructions are required for installation of a product, it shall be the contractor's responsibility to obtain the necessary applicable manufacturer's instructions and install the product in accordance with the manufacturer's instructions.

C. It shall be the Contractor's responsibility to install all equipment, materials, and devices shown on the plans and as called out in these specifications even if manufacturer's instructions are absolutely unattainable.

1.28 INSTALLATION

A. Cooperation with trades of adjacent, related or affected materials or operations, and or trades performing continuations of this work under subsequent contracts are

considered a part of this work. In order to effect timely and accurate placing of work and to bring together, in the proper and correct sequence, the work of such trades, including work provided under a Division 1 allowance.

B. The Communications Contractor shall coordinate installation of the communication systems with the Builder, Electrical, Mechanical, and Plumbing Contractors to ensure a complete working system for the Owner.

C. Where required for accessibility all conduit and boxes for all communication systems shall be provided by the Electrical contractor as specified, including systems in Division 27, any and all allowances shall be included. Normally low voltage wiring shall run open and supported in accessible attic space. All low voltage wiring in exposed areas such as gyms, stages, shops, and field houses shall be enclosed in conduit. Coordinate with, and verify with Division 26 to provide required conduit and boxes at locations and heights as required.

D. Conduit, innerduct, track, or raceway shall conceal and protect wiring in exposed areas, within walls, through in accessible areas, floors, chases, under slab, crawlspaces, or underground.

E. All conduit, duct, track, and raceway runs shall be spaced apart to allow for maintenance, such as the installation of couplings, without disturbing adjacent pathways.

F. All work must be performed by workers skilled in their trade. The installation must be complete whether the work is concealed or exposed.

G. Provide stainless screw/bolt hardware wherever stainless devices are used and in potentially wet areas.

H. Coordinate the actual locations of devices and outlets and equipment with building features and mechanical equipment as indicated on construction drawings. Review with the Architect any proposed changes in outlet or equipment location. Relocation of devices, before installation, of up to 3 feet from the position indicated, may be directed without additional cost. Remove and relocate outlets placed in an unsuitable location when so requested by the Architect.

1.29 ADDITIONAL MATERIALS: INCLUDE IN THE BASE CONTRACT PROPOSAL

A. All costs to provide 5 additional communication voice and/or data outlet locations including all cable and devices as directed by the Architect. Conduit and standard back boxes by Division 26 Electrical Contractor.

B. All costs to provide 5 additional intercom ceiling speakers with call device including all cable and devices as directed by the Architect. Conduit and standard back boxes by Division 26 Electrical Contractor.

PART 2 PRODUCTS

NOT APPLICABLE

PART 3 EXECUTION

NOT APPLICABLE

END OF SECTION

SECTION 27 10 30

DATA AND TELEPHONE CABLE PLANT

PART 1 GENERAL

1.1 WORK INCLUDES

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1, apply to this Section.

B. Provide all equipment, materials, labor, supervision, and services necessary for or incidental to the installation and testing of a complete data (computer network) and telephone cable plant providing all permanent premise cabling and wiring devices required to support a facility wide computer network system and telephone system and as shown or indicated on the drawings and/or as specified.

C. All electronic equipment, telephone-switching units, and cross connect; telephone sets, network switching equipment, transceivers, routers, network interface cards, computers, and software are not included in this section.

D. The station (horizontal) cabling shall extend from each designated data or telephone jack to the nearest IDF or the MDF.

E. Refer to Data and Telephone Cable Plant System Schedule on plan for part numbers and additional information.

F. It shall be the responsibility of the Electrical Contractor to provide and install all conduit systems, standard boxes, ground bus bars (See Division 26), and operating power for the data and telephone cable plant as outlined on the project drawings. The Data and Telephone Cable Plant Contractor shall coordinate all system requirements with and provide any special back boxes to the Electrical Contractor prior to installation of conduit.

G. Provide all documentation and training as outlined in these specifications.

H. Provide an extended warranty as outlined in these specifications.

1.2 RELATED SECTIONS

A. The conditions of the Division 0, Division 1, Division 26 requirements, and the contract requirements that include the General Conditions and the Supplementary Conditions apply to work of this division.

B. Section 26 00 00 – Electrical.

C. Section 27 05 00 - General Communication Systems Requirements.

1.3 CODES AND REGULATIONS

A. Perform all work in strict accordance with the requirements and recommendations stated in the codes and standards except when requirements are exceeded by the contract documents.

B. The equipment, materials, and installation shall confirm to the latest version, revision, addendums, and amendments of all applicable codes, industry standards, and the regulations of authorities having jurisdiction including the following:
   1. NFPA 70, National Electrical Code.
   2. NFPA 101, Code for Safety to Life from Fire in Buildings and Structures.
   3. IEEE-SA 802.3, 803.11, and 803.16 series Standards for Ethernet, PoE, and Wi-Fi Information Technology.
   4. ANSI/TIA-568 series and ISO/IEC 11801 Standards for Structured Telecommunications Cabling Installations.
   5. ANSI/TIA-569-D Telecommunications Pathways and Spaces.
   6. ANSI/TIA-606-C Administration Standard for Telecommunications Infrastructure.
   7. ANSI/TIA-1152-A Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling.
   8. All applicable parts will be Underwriters Laboratories, Inc. approved.
   9. All applicable parts will be FCC Class B approved.
   10. International Building Codes (IBC).
   11. Americans with Disabilities Act.
   12. Texas Accessibility Standards.
   13. Local and State Building Codes.
   14. All requirements of the local Authority Having Jurisdiction (AHJ).\

1.4 SITE VISIT

A. Before submitting a proposal, each proposed contractor shall examine all plans and specifications relating to the work, shall visit the site of the project, and become fully informed of the extent and character of the work required, including all required utilities.

B. No consideration will be granted for any alleged misunderstanding of the materials to be furnished or the amount of work to be done, it being fully understood that the tender of a proposal carries with it the agreement to all items and conditions referred to herein, or indicated on the accompanying plans or required by nature of the site of which may be fairly implied as essential to the execution and completion of any and all parts of the work.

PART 2 PRODUCTS

2.1 GENERAL

A. All cable and wiring devices provided shall be listed and labeled by Underwriters Laboratories, Inc. for the intended use under the latest appropriate testing standard.

B. Refer to Data and Telephone Cable Plant System Schedule on plan for part numbers and additional information.

C. Label the cable run designator on both ends of all cables, patch panel jacks, termination cabinet connectors, and all jack wall plates and housings. In addition, label the cable run designator(s) on the ceiling grid bar at jack locations that are concealed above a drop ceiling; including those for wireless access points, cameras, projectors, etc. Labels shall be polymer film Turn-Tell flexible non-smear, or equivalent, machine printed labels complying with ANSI/TIA-606-C standards.

D. Only equipment devices have been shown on the contract drawings. Specific wiring between equipment has not been shown.

E. All equipment and components shall be new, and the manufacturers' current model. All like devices shall be of the same manufacturer and model number.

F. All equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place (e.g., cable shall not be supported by or lay on suspended ceilings). Fasteners and supports shall be adequate to support the required load.

G. The installation shall be subject to inspection and approval by the Architect/Engineer.

2.2 ACCEPTABLE MANUFACTURES

A. Descriptions and details, acceptable manufacturers' names listed and specific manufacturer and model number items indicated in the plans and specifications shall establish a standard of quality, function, and design. Manufacturers and model numbers listed "no exceptions" shall not be substituted without specific notice in an addendum. Otherwise, where a specific manufacturer's product is indicated, products of other manufacturers listed as acceptable may be submitted for approval based on the substitute product being, in the opinion of the Engineer, of equivalent or better quality than that of the product specified.

B. Proposed contractors wishing to propose any product substitution must do so in writing to the specifying authority at least ten (10) days prior to the proposal opening.

C. For manufacturers equipment or models other than that specified, the proposed contractor shall supply proof that such substitute equipment equals or exceeds the features, functions, performance, and quality of the specified equipment. Proposals must include detailed information showing all deviations from the system as specified.

D. Substitute products for which the proposed contractor does not obtain prior approval will not be considered acceptable for this project. Final approval of alternate products shall be based on the decision of the Owner and Architect. Prior approval to make a proposal for this project does not automatically ensure products will be an acceptable equivalent.

E. It is the responsibility of the Contractor to provide all features and functions as outlined in these specifications. The functions and features specified are vital to the operation of this facility; therefore, inclusion in the list of acceptable manufacturers does not release the contractor from strict compliance with the requirements of this specification.

F. The selected contractor must be a certified Integrator/Installer authorized by one of the Manufacturers listed below to provide an extended warranty to the Owner covering all network cable and connectivity hardware products comprising this installation site. All UTP cable, fiber optic cable, and all wiring devices installed shall be products of one approved manufacturer or joint manufacturers program and approved for use in their extended warranty program. The Contractor and Manufactured shall jointly provide the Owner an extended warranty of the installed system against defects in material or workmanship; provide a copy of contractor certification.

G. The district standard manufacturers model numbers, functions, and features described in this specification section are those of the Panduit Certification Plus System 25 year warranty, and this shall constitute the quality and performance of the equipment to be furnished, no exceptions.

2.3 SYSTEM DESCRIPTION

A. Each data or telephone jack shall be terminated and mounted in a suitable faceplate for all wall, enclosure, millwork, floor box, modular furniture, etc. locations.

B. All jack wall plates and housings shall have machine printed labels meeting ANSI/TIA-606-C standards inserted behind built-in clear plastic windows, or engraved plastic nameplates permanently attached, indicating cable run identification number(s).

C. All outlets shall be Category 6 or Category 6A RJ-45 style jacks. All cabling and connectors provided will meet and be tested to ANSI/TIA-568 Style B Pin/Pair assignment (T568B) requirements.

D. The data and telephone cable plant will provide the permanent part of the building wiring (cable plant) required to provide connection for telephones or network computers.

2.4 WALL PLATE COLOR

A. Color of device/wall plates to best match project light switches and electrical outlets, coordinate with the Electric Contractor.

2.5 COLOR-CODING

A. Provide color-coded horizontal cabling jackets, jack insert faces in wall plates, patch panels, and patch cords. Patch panels are to be separated with grouped patch panels for each designated color and use (blue only in the data patch panels, white only in the voice patch panels, etc.):

Blue	Data (General use Computer Ethernet network)
Yellow	Sped Cameras
Green	Wireless Access Point
Red	Security Cameras

2.6 FIBER OPTIC SYSTEM COLOR CODING

A. Each type of fiber optic cabling shall feature distinctively colored labeling and jumper connectors:
   1. Any Single Mode cabling and jumper connectors shall be Yellow.
   2. Any Multi Mode cabling and jumper connectors shall be Aqua.

2.7 CABLE RUN DESIGNATOR LABELING SCHEME

A. Each patch panel jack, wall plate jack, terminal cabinet connector, both ends of each cable run and on the ceiling grid bar at jack locations that are concealed above a drop ceiling shall be labeled with a cable scheme run designator machine printed labels installed according to EIA/TIA 606 standards. All labeling shall conform to industry standards and best practices.

B. Labeling types and scheme shall be verified and coordinated with the Owner prior to any installation. Contractor to submit labeling scheme to Engineer and Owner for approval prior to installation.

2.8 DATA/TELEPHONE CABLING PLANS

A. Provide adjacent to the equipment rack in each MDF and IDF a plan view of all building areas covered by the equipment closet meeting the following requirements:
1. Framed and secured to the wall and plan covered with clear acrylic panel.
2. Size to clearly show all required information.
3. "YOU ARE HERE" indicator with arrow.
4. Room names and numbers. Verify with Owner.
5. Show each device with symbol and identification address number as designated by owner.
6. Symbol legend.
7. True north arrow
8. Scale indicator

2.9 DATA/DESK TELEPHONE STATION WALL PLATES AND JACK INSERTS

A. Provide single or multiple jack modular wall plates where shown on plans or required. The number next to symbol on plans indicates the quantity of data lines/jacks at that location, single outlets are not numbered. Where a desk telephone jack (D/#) is designated on plans the faceplate to include a telephone jack along with the data jacks. Each data or telephone jack shall be terminated and mounted in a suitable faceplate for all wall, enclosure, millwork, floor box, modular furniture, etc. locations. All terminations shall be made per the manufacturers' instructions. Jack type to match colors above. Refer to System Schedule on plan for part numbers and additional information.

B. Use a single gang faceplate with label window for all standard wall outlets, use NEMA duplex or Decora style frames as required for floor boxes, surface raceway, etc. Refer to System Schedule on plan for part numbers and additional information.

2.10 EMERGENCY SERVICE/VOICE LINES

A. Provide connectivity for emergency service/voice lines from the MDF, one line to each elevator phone and 911 emergency telephone, two lines to each alarm system digital communicator (DC).

2.11 19" OPEN EQUIPMENT RACKS

A. Rack location shall be verified by owner and engineer prior to installation.

B. Where shown on drawings provide one Wall Mounted Rack, rack space to be reserved for server equipment provided and installed by the Owner.

C. Ladder type cable tray shall be routed over all floor mounted racks from wall to wall.

D. Mount fiber termination cabinets in the top portion of the rack and then the patch panels. Reserve the lower 50% of rack space for mounting of network electronics by the Owner.

2.12 CABLE ROUTING AND INSTALLATION

A. System wiring and equipment installation shall be in accordance with good engineering practices as established by the EIA and the NEC. Wiring shall meet all state and local electrical code requirements.

B. Cable pathways, conduit, and cable support systems shall be complete with bushings, de-burred, cleaned, and secure prior to installation of cable.

C. All wiring shall test free from opens, grounds, or shorts. All communications cable shall be supported from the building structure and bundled. Do not attach any supports to joist bridging or other lightweight members.

D. The support system shall provide a protective pathway to eliminate stress that could damage the cabling. The cable shall not be crushed, deformed, skinned, crimped, twisted, or formed into tight radius bends that could compromise the integrity of the cabling.

E. Communications cable must not be fastened to electrical conduits, mechanical ductwork/piping, sprinkler pipes, or routed to obstruct access to hatches, doors, utility access panels, or service work areas. Do not route cables through fire doors, ventilation shafts, grates, or parallel with line voltage electrical conductors. Communication cables shall not be run loose on ceiling grid or ceiling tiles.

F. Support shall be provided by mounting appropriate fasteners that may be loaded with multiple cables. Provided that the weight load is carried by the support rod or wire, the support assembly may attach to the ceiling grid for lateral stabilization. The required support wires for the ceiling grid or light fixtures shall not be utilized. Any fastener attached to the ceiling grid shall not interfere with inserting or removing ceiling tiles. The cable pathway of supports must be positioned at least 12 inches above the ceiling grid.

G. Communication cables shall be run in conduits, where stubs are provided, from wall or floor jacks to accessible areas above finished ceilings. Conduit shall be required only within walls and concealed spaces to provide access.

H. Provide bushings to protect the cable from damage for conduit ends, box openings, and passage through metal studs.

I. Communication cables shall be run in bundles above accessible ceilings and supported from building structure. Cabling shall be loosely bundled with cable Velcro hook ties randomly spaced at 30 to 48 inches on center, cable ties shall not be tight enough to deform cabling and shall not be used to support the cabling.

J. Each cable run shall include a three-foot service loop with Velcro hook ties located in the ceiling above the rack. This is to allow for future re-termination or repair.

K. All cabling shall be placed with regard to the environment, EMI/RFI interference, and its effect on communication signal transmission.

L. Non-conductive fiber optic cable is immune from EMI/RFI interference. Give priority when selecting a route to minimize exposure to possible cable damage from maintenance or service of all systems in the attic space.

M. Do not route any data cable within two feet of any light fixture, HVAC unit, service access area, electric panel, or any device containing a motor or transformer.

N. Communication cable will not be installed in the same conduit, raceway, tray, duct, or track with line voltage electrical cable without a metallic barrier meeting NEC requirements.

O. Maximum cable pulling tension should not exceed 25 pound-force (110 N) or the manufactures recommendation, whichever is less.

P. Any pulling compounds utilized must be approved by the cable manufacturer and shall not degrade the strength or electrical characteristics of the cable.

Q. No terminations or splices shall be installed in or above ceilings, other than in designated end point housings.

R. Cable bends shall not be tighter that the manufacturers' suggested bend radius.

S. Mount all equipment firmly in place. Route cable in a professional, neat and orderly installation.

T. Provide for adequate ventilation to all equipment racks and take precautions to prevent electromagnetic or electrostatic hum.

2.13 UTP CABLE TERMINATION PRACTICES

A. Insulation Displacement Contact (IDC) connectors shall be used and installed per the manufactures' recommendations.

B. Strip back only as much cable jacket as required to terminate.

C. Preserve wire-pair twists as closely as possible to point of termination (0.5" maximum) to keep signal impairment to a minimum.

D. Avoid twisting cable jacket during installation.

E. Take care to ensure all data UTP wiring devices are designed for T568B wiring, T568A devices use a different pair assignment and should not be mixed.

F. Data and Telephone Cable UTP T568B, Identical to AT&T 258A and WECO, Pin/Pair Assignments (All RJ-45 modular jacks):
1. Line/Pair: Color:
2. Tx 2 White/Orange Band
3. Rx 2 Orange
4. Tx 3 White/Green Band
5. Rx 1 Blue
6. Tx 1 White/Blue Band
7. Rx 3 Green
8. Tx 4 White/Brown Band
9. Rx 4 Brown

2.14 OPTICAL FIBER CABLE INSTALLATION AND TERMINATION PRACTICES

A. The following fiber optic connector installation methods are acceptable; fusion splice connection of factory made pigtail connectors, epoxy/polish style connectors, or non-

epoxy compression cam gel style connectors. In each case, the connector manufactures' instructions shall be followed and the recommended tools and supplies, including break out kits when required, shall be used for termination and testing. All Fiber strands to be terminated including future use pairs.

B. As per industry standard - IEC 61300-3-35 during optical fiber connector termination, certify, all terminations with a 200-power microscope (minimum). Follow all of the connector manufacturers' recommendations. Unacceptable flaws in the termination's will include, but not be limited to, scratches, full or partial cracks, bubbles, pits, or residual dirt, dust, oil, moisture, grinding or sanding debris in the connector. The acceptable final inspection shall show a connector tip that is properly aligned and free of imperfections in 100% of the core and 80% of the cladding. Any connectors that fail testing shall be inspected and re-tested after rework.

C. During installation of optical fiber cable, do not allow pulling tension to exceed cable manufacturers' specification for the cable being installed. Only the strength member of the cable shall be subjected to the pulling tension.

D. Clean all optical fiber connector tips prior to inserting them into mating receptacles or bulkheads and re-install dust covers. Clean the tester launch cord prior to each insertion, as well.

2.15 CABLE SUPPORT

A. Conduit, duct, or track shall be used for communication cable in exposed areas.

B. Cable fill shall not exceed the manufacturers' instructions for each type of support.

C. All conduit, ducts, track, and raceways shall be supported from the structure at industry standard intervals for the size specified, utilizing proper anchoring devices.

D. Solid, ladder, or mesh cable tray/duct shall be required for narrow depth cable routes that would allow sags to rest upon the ceiling, electrical conduits, HVAC equipment, ducts, or lighting fixtures.

E. Vertical cable runs exceeding 12" in equipment closets shall require ladder or mesh type cable support tray. Attachment shall utilize appropriate mounting hardware and accessories for vertical placement and allow a minimum of 2" clearance between the wall and runway. Cable attachment shall be made by Velcro hook ties in a basket type configuration.

F. All vertical supports shall be attached to the building support structure or concrete ceiling with anchors load rated for 100-lbs. minimum. Down rods shall be a minimum of 1/4" diameter. Steel uni-strut cross supports shall be 2" minimum.

G. Cable runway or tray shall be grounded to an appropriate building ground at each end and bonded at each joint.

H. Rubber or plastic boots shall be installed at the ends of horizontal support rails to prevent cable damage or injuries to personnel.

2.16 BUSHINGS

A. Provide a plastic snap in bushing at each box opening, passage through a metal stud, and at the end of all open conduit stubs or sleeves prior to cable installation to protect the cabling from damage:

1. Box openings - Thomas & Betts Knockout Bushing Series 3210, or equivalent.
2. Metal stud passage - Thomas & Betts Twist It Bushing Catalog Number SB1216-SC, or equivalent.
3. Conduit ends - Thomas & Betts Anti-Short Bushing Series 390 or Tite-Bite Combination couplings Series 442, or equivalent.

2.17 J-HOOKS

A. Attachments for cabling support shall be spaced at approximately 48 to 60 inches on center. Cable bundles shall not be allowed to sag down more than 12-inches mid-span between attachments.

B. Category 6, all attachments shall be approved for Category 6 cabling. Attachments shall be Caddy part numbers as follow, or equivalent, sized as follows:
1. Capacity 15 Category 6 cables.
2. Capacity 40 Category 6 cables.
3. Capacity 60 Category 6 cables.
4. Split bundles greater than 2" dia. or provide cable tray.

C. Category 6A, all attachments shall be approved for Category 6A cabling. Attachments shall be Caddy part numbers as follow, or equivalent, sized as follows:
1. Capacity 7 to 10 Category 6A cables.
2. Capacity 12 to 24 Category 6A cables.
3. Capacity 25 to 35 Category 6A cables.
4. Capacity 48 Category 6A cables.
5. Split bundles greater than 48 cables (maximum allowed bundle size) or provide cable tray.

D. Do not mix different signal strength cables on the same J-Hook (i.e. fire alarm with data and telephone cable). Multiple J-Hooks can be placed on the same attachment point, up to the rated weight load of the attachment device.

2.18 CABLE TIE WRAPS (PLENUM RATED)

A. Plenum rated Velcro hook cable ties shall be furnished and installed to attach wire bundles to supports and for appropriate wire management as required. Provide and install Panduit TAK-TY HLTP series cable ties with UL 94-V2 flammability rating, or equivalent.

B. Hard plastic or metal tie wraps will not be allowed on any data cable (Category rated UTP).

2.19 MEASURING PULLING TAPE (MULE TAPE)

A. All future use innerduct and conduit cable pathways shall include a Measuring Pulling Tape (Mule Tape) made of woven Polyester, Aramid, Kevlar, or an equivalent fiber blend. Measuring Pulling Tape shall have a minimum tensile strength of 1250 lbf. or as required and shall be pre-lubricated for prevention of burn though and marked for measuring in feet. Measuring Pulling Tape installed in underground pathways shall incorporate a 22 gauge minimum solid corrosion resistant copper conductor for use in radio signal locating procedures.

2.20 LADDER TYPE CABLE TRAY

A. Ladder type cable tray shall be routed over all floor mounted racks from wall to wall, provide all necessary hardware to attach the ladder rack to the top of the floor rack and to the walls. All field cuts shall be filed smooth, dressed square, and painted to match with CPI Part No. 25401-700 Black Touch-up Paint. Utilize tray splicing, support, and coupling hardware supplied by and installed as recommended by the manufacturer. Cable tray and rack shall be securely supported and grounded. Cable tray shall be of heavy-duty tubular steel construction with black powder coat finish, 12" wide, with cross members at 12" intervals. Chatsworth Product Inc. (CPI) Part No. 10250-712 Tubular Runway. At each ladder rack joint, provide a CPI Part No. 40164-001 Grounding Kit. Provide CPI Part No. 10642-001 fire-retardant flat black colored rubberized material end caps to cover all exposed ends of ladder rack. At the top of each rack, provide a CPI Part No. 10595-712 Rack-to-Runway Mounting Plate, CPI Part No. 10506-702 Cable Runway Elevation Kit, and CPI Part No. 12100-712 Cable Runway Radius Drop. At each wall, provide a CPI Part No. 11421-712 Horizontal Wall Angle Support. Provide CPI 12362-712 Cable Runway Center Support hanger brackets and similar and 5/8” all-thread rod hanger supports from the building structure at any span that exceeds 60” from other support (rack and wall mounting locations), at intervals of 60” on center maximum.

2.21 MESH CABLE TRAY

A. Mesh constructed cable tray systems shall be utilized for high capacity and special pathway support requirements. Mesh cable tray shall be constructed from steel wires. All edges and welds are to be smooth and free of burs or sharp edges. Mesh tray assemblies shall be zinc plated after fabrication. All field cuts shall be filed smooth, dressed square, and touched up with zinc bearing paint to prevent rust formation. Mesh openings shall not exceed 2” x 4”. Provide sizes from 3” wide x 2” deep up to 24” wide x 4” deep as required for a 50% maximum initial fill rate. Provide straight sections, vertical offsets, tees, crosses, radiused bends, reducers, and radiused dropouts as required. Utilize tray splicing, support, and coupling hardware supplied by and installed as recommended by the manufacturer. Support from building structure. Provide Mono-Systems Inc. Mono-Mesh Cable Tray MM2-12-118 series as required or equivalent.

2.22 FIRE OR DRAFT STOPPING, PENETRATIONS, AND CORING

A. UL Listed fire stopping methods that match the fire rating of the wall or floor being penetrated are to be used at all fire barrier penetrations. Seal the interior of the conduit sleeve around the cables and around the outside of the sleeve on each side of the penetration with fire-stop caulk or putty, install according to the manufacturers’ instructions.

B. All penetrations through fire rated walls or floors shall feature a suitable length of metal conduit. Hole diameter shall not exceed ½” larger than the conduit or sleeve to be installed. The hole shall be neatly cut, not oversize or irregular. Do not share wall/floor penetrations with ductwork, piping, line voltage electrical conduits, etc.

C. All gypsum board or plaster penetrations shall tool cut using an appropriate hole saw / mandrel or manufactured assembly.

D. Draft/Noise Stopping - This Contractor prepares for and applies draft/noise stopping to all non-rated wall penetrations. Draft/Noise stopping shall minimize the movement of air and sound from enclosed areas to other parts of the building. This shall include but not limited to:
   1. Neatly cutting all non-rated wall/floor penetrations with a 1” maximum clearance. All gypsum board or plaster penetrations shall tool cut using an appropriate hole saw / mandrel or manufactured assembly. The hole shall be neatly cut, not oversize or irregular. Do not share wall/floor penetrations with two types of ductwork, piping, line voltage electrical conduits, communications cabling, etc.
   2. Provide and install non-combustible mineral wool, fiberglass, cellulose insulation, caulk, and sealant as required. Seal the interior of conduit sleeves around the cables and around the outside of the sleeve on each side of the penetration with caulk or putty, install according to the manufacturers’ instructions.

E. The Contractor shall make every effort to coordinate with the building Architect, Engineer, Builder and Electrical Contractor to have sleeves placed in new construction so that later coring or drilling of building structural members will not be required. The Contractor must consult with the building Architect, Engineer, and Builder prior to drilling, coring, or sawing of any wall, floor, etc. All penetrations shall be made at approved, appropriate, locations.

F. Upon approval, the Contractor shall be required to supply all labor, equipment, tools, and materials to create any additional penetrations, and shall provide the sleeve, temporary and final fire stopping. Special care shall be taken not to stress, overheat, or penetrate any building support member. Coring shall be made with equipment appropriate for the dry penetration of concrete and block materials. Under no circumstances shall penetrations be made utilizing a chisel or percussion type equipment. Concrete, block, or plaster cores shall be made by dry saw/core methods only.

PART 3 EXECUTION

3.1 WARRANTY, SERVICE, TESTING, CERTIFICATION

A. The Contractor must provide an extended warranty that is inclusive of the Manufacturer’s warranty to the Owner covering all network cable and connectivity hardware products comprising this installation site. The Contractor and Manufactured shall jointly provide the Owner an extended warranty of the installed system against defects in material or workmanship for a period of no less than twenty years (period as is customary for the Manufacturer) from the date of substantial completion. Any equipment or cabling shown to be defective shall be replaced, repaired, or adjusted free of charge. All labor and materials shall be provided at no expense to the Owner.

B. The System Contractor shall make a thorough inspection of the complete installation to ensure the following:
   1. Complete and functional system.
   2. Installed in accordance with manufacturers’ instructions.
   3. All cabling shall test free from all grounds, opens, and shorts.
   4. A representative of the Owner shall have an opportunity to be present for all final testing. Coordinate final testing with Owner, schedule as near as possible to acceptance date.

3.2 UTP CABLES AND LINK TESTING

A. Acceptance Testing: Test each conductor of every cable on the reel to verify length and continuity. Cables that have been damaged in transit must be replaced. Installed cable that proves to be defective will be replaced at the contractor's expense.

B. Final Testing: All UTP cabling will be certified to meet and or exceed the specifications as set forth for Permanent Link Testing of all Power over Ethernet electrical parameters including alien crosstalk performance. Mechanical requirement testing and test methods shall meet ANSI/CEA S–90–661 or ANSI/CEA S–102–732. Certified cable channel performance shall meet or exceed the requirements of ANSI/TIA-568, ANSI/TIA-1152-A, and ISO/IEC 11801 Standards for Structured Telecommunications Cabling Installations in a configuration up to 100 meters at swept frequencies of:
   1. 1 to 250 MHz Level III Class E for Category 6
   2. 1 to 500 MHz Level IIIe Class EA for Category 6A.

C. Test alien crosstalk (near-end and far-end loss) for a cabling system using a network analyzer with 100-Ω pair terminations as follows;
   1. The test device consists of two jacks; one jack is connected to a main test unit and the other to a remote test unit; the main test unit and the remote test unit are connected with a field tester communication channel (patch cord or link);
   2. Six-around-one cable-bundle configuration throughout the tested length;
   3. Cable ties placed 12 inches apart for the entire length of the bundle, except the last 3.2 feet from each end; no cable-tie-induced deformation of the bundle;
   4. Modeling four-connector channel configurations using the worst-case maximum and minimum configurations to determine the worst-case for different parameters;
   5. Long channels with 90 meters of permanent link, 5 meters between the consolidation point and the telecommunications outlet, 10 meters of patch cords used to connect active equipment and cross-connect panels;
   6. Measurement of alien crosstalk (near-end and far-end loss) between all pairs of the middle disturbed cable and each pair of all adjacent cables;
   7. Measurement of power sum of all 24 adjacent pair cables.

D. The cable tester shall be ETL verified to IEC Level V accuracy or equivalent with the latest version of firmware and shall produce an electronic or printed report, noting label information, for each cable run. These reports are to be included in the close-out documentation. Testing shall be conducted with a Fluke DSX-5000 with OLTS and OTDR functions, or equivalent, permanent link adapters, high-performance channel adapters, termination plugs, 8-pin modular couplers and analysis software. Certifications shall include the following parameters for each pair of each cable installed:
   1. Characteristic Impedance 100 Ω +/- 15%
   2. Wire map (pin to pin and ground connectivity)
   3. Cable Length Permanent Link Test, station (horizontal) cable from patch panel to jack, should not exceed 295 feet (Channel length not to exceed 328 feet)
   4. DC Loop Resistance
   5. DC Resistance Unbalanced (Difference in DC Resistance between conductors of the same pair)
   6. DC Resistance Unbalanced (Difference in DC Resistance between conductors between pairs)

7. Return Loss
8. Insertion Loss
9. Near End Crosstalk Loss (NEXT)
10. Power Sum Near End Crosstalk Loss (PSNEXT)
11. Far End Crosstalk Loss (FEXT)
12. Attenuation Crosstalk Ratio Far End (ACRF)
13. Power Sum Attenuation Crosstalk Ration Far End (PSACRF)
14. Transverse Conversion Loss (TCL)
15. Equal Level Transverse Conversion Transfer Loss (ELTCTL)
16. Coupling Attenuation
17. Propagation Delay
18. Propagation Delay Skew
19. Power Sum Alien Near–End Crosstalk Loss (PSANEXT)
20. Average Power Sum Alien Near End Crosstalk Loss (Average PSANEXT)
21. Power Sum Alien Far–End Crosstalk Loss (PSAFEXT)
22. Power Sum Alien Attenuation to Crosstalk Ratio Far–End (PSAACRF)

3.3 OPTICAL FIBER TESTING

A. Acceptance Testing: Test each strand of every optical fiber cable on the reel with an OTDR, to verify length and continuity. Fiber cables that have been damaged in transit must be replaced. Installed fiber cable that proves to be defective will be replaced at the contractor’s expense.

B. Final Testing: After termination, each individual fiber of each cable segment shall be tested bi-directionally using an OTDR, both to determine the installed length and continuity. All individual fibers of each cable segment will be tested using a power meter to determine the actual loss. These readings will be taken at the 850 nm and 1300 nm windows for Multi-mode and 1310 nm and 1550 nm windows for single-mode. Testing will be in both directions. The final readings shall be listed in the certification report. These readings must not be higher than the “Optimal Attenuation Loss.” The OAL will be calculated using the manufacturers’ factory certified test results, (dB/Km) converted to the actual installed lengths plus the manufacturers’ best published attenuation losses for the connector and/or splice installed on this project. (0.20 for Connectors and 0.10 for splices.) The OAL shall be used for comparison with the end to end power loss test results prior to acceptance by the construction manager.

C. Fiber optic cable shall be subjected to bi-directional testing meeting ANSI/TIA-568 requirements. The cable tester shall produce a printed report, noting label information, for each cable run. These reports are to be included in the close-out documentation.

3.4 DRAWINGS, MANUALS, AND TRAINING

A. As-built drawings and operating and maintenance manuals may be electronically transmitted in PDF file format.

B. Upon completion of the installation, and prior to final inspection, the Contractor shall furnish as-built drawings.

C. In addition, the contractor shall furnish complete operating and maintenance manuals listing the manufacturer's name(s), including technical data sheets. Manuals shall include wiring diagrams to indicate internal wiring for each device and the

interconnections between the items of equipment. Provide a clear and concise description of operation that gives, in detail, the information required to properly operate the equipment and system. Provide a parts list with manufacturer and model number for commonly replaced parts. Include complete instructions for the inspection, testing, and maintenance of the system. Place final cable certification test results in manuals.

D. All cable paths and wiring methodology shall be documented. All cables shall have both ends labeled and included in the as-built documentation. Provide an MS Excel worksheet compatible format spreadsheet file cross referencing all cable run numbers, architectural room number, and owners room number for the origin and destination of each cable run.

E. A formal on-site training session shall be provided by the Contractor to the Owners Representative / Maintenance personnel and shall include instruction on the documentation, location, inspection, maintenance, testing, and operation of all system components. Provide a minimum of two (2) hours of documented general instruction.

END OF SECTION

SECTION 27 41 30

INTEGRATED AUDIO-VISUAL SYSTEMS

PART 1 GENERAL

1.1 SCOPE OF WORK

A. Provide new A/V system(s) and devices as noted on plans, schedules and specified in this section.

1.2 WORK INCLUDES

A. General provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section. Reference all Division 0, Division 1, Division 26 Division 27 specifications, Electrical Drawings, Audio-Visual Drawings, and Technical drawings for additional information. The specification and the drawings are complementary and must be understood together.

B. Refer to System Schedules on plan for part numbers and additional information.

C. The work of this section also includes:
1. Required licenses, insurance, and permits including payment of charges and fees
2. Verification of dimensions and conditions at the job site
3. Preparation and delivery of submittal information within 30 days of contract award
4. Pick-up of Owner Furnished Equipment (OFE) and incorporation into project if applicable
5. Development and implementation of AV control system software code and control panel layouts, which shall become the property of the Owner
6. Installation in accordance with the contract document, manufacturer's recommendation, and in conformity with applicable codes and authority having jurisdiction (AHJ)
7. Extension of electrical service, including ground, to equipment locations if required.
8. Final tests and adjustments, written report, and documentation.
9. Instruction of operating personnel
10. Provision of manuals
11. Maintenance services and warranty

1.3 RESPONSIBILITY

A. OTHER MATERIALS
1. All materials, equipment, transportation, equipment rental, and labor necessary to achieve a complete and functionally working system as shown or inferred on the Drawings and in the Specifications. Supply accessories and minor equipment items (such as, but not limited to: power strips, adapters, connectors, mounting hardware, etc.) as needed for the complete system, even if not specifically mentioned in these Specifications or on associated Drawings, without claim for additional payment.

B. DISCREPANCIES
1. Notwithstanding any detailed information in the Contract Documents, it is the responsibility of the Contractor to supply a complete working, tested, and calibrated system or systems. Notify the Architect of any discrepancies in part numbers or quantities before bid. Failing to provide such notification, the Contractor must supply items, and quantities according to the intent of the Specification and Drawings, without claim for additional payment.

C. CONSTRUCTION DOCUMENTS
1. Specifications and Drawings are complementary. Work called for by one is binding as if called for by both. Any discrepancies between the Specifications and Drawings shall be brought to the attention of the Architect for clarification during the bidding period. No allowance shall subsequently be made to the contractor by reason of his failure to have brought said discrepancies to the attention of the Architect. It is the contractor's responsibility to know the specification and the plans for the project, and to verify that specified or drawn systems will function as intended.

D. COMPLIANCE
1. Execute all work in accordance with the National Electrical Code (NEC), the National Electrical Safety Code, the Occupational Safety and Health Act (OSHA) and all applicable State and Local codes, ordinances, and regulations. If a conflict develops between the contract documents and the appropriate codes and is reported to the Architect prior to the bid opening, the Architect shall prepare the necessary clarification. Where a conflict is reported after contract award, propose a resolution of the conflict and, upon approval, perform Work, without claim for additional payment, unless authorized by the Architect.

E. RELATED WORK SPECIFIED ELSEWHERE
1. Electrical Work
   a. Conduit, wireways, floor boxes, wall boxes, pull boxes, junction boxes, AC power circuits, and ground wiring to be provided by the awarded electrical contractor. Do not attempt to connect any equipment that does not simply "plug-in" to an electrical circuit. The jobsite's licensed electrical contractor is responsible for all high voltage work.
2. Structural Work
   a. Any structural alterations of the building structure must be approved by the Structural Engineer and Architect before any work can be performed. Once approved, the proper rigging contractor, erection contractor, steel contractor, or others need to perform the work. This does not relate to connecting unistrut, threaded rod, clamps, or similar devices to the structural steel. However, loads must be taken into account. Verify with the Architect that all loads have been reported to the Structural Engineer and have been approved prior to suspending equipment.
3. Drywall/Paint Work
   a. If the contractor must open a space that has been covered with drywall and/or paint, communicate this with the drywall and/or paint contractor and the general contractor to make sure that the work is properly covered up once complete.

1.4 REFERENCES

A. Published specification standards, tests, or recommended methods of trade, industry, or governmental organizations apply to Work in this section where cited below:
   1. American National Safety Institute (ANSI)
   2. American Society of Testing and Materials (ASTM)
   3. Electronics Industries Association (EIA)
   4. Federal Communications Commission (FCC)
   5. National Electrical Manufacturer's Association (NEMA)
   6. National Electrical Code (NEC)
   7. Underwriters Laboratories (UL)
   8. Occupational Safety and Health Administration (OSHA)
   9. Building Industry Consulting Service International (BISCI)

1.5 DEFINITIONS

A. In addition to those Definitions of Division 1, the following list of terms as used in these specifications shall be defined as follows:
   1. Furnish - To purchase, procure, acquire, and deliver complete with related accessories
   2. Install - To set in place, join, attach, link, setup, or otherwise connect together and test until complete before turning over to the Owner, all parts, items, or equipment supplied by Contractor.
   3. Provide - To furnish and install

1.6 LIST OF ASSOCIATIONS AND STANDARDS

A. ADA: Americans with Disabilities Act.

B. ANSI: American National Standards Institute, 1430 Broadway; New York, NY 10018.

C. ASTM: American Society for Testing and Materials, 1916 Race Street; Philadelphia, PA 19103.

D. BICSI: (RCDD5 Standards), 8610 Hidden River Parkway, Tampa, FL 33637

E. CBM: Certified Ballast Manufacturers Association, 2116 Keith Building; Cleveland, Ohio 44115.

F. IEEE: Institute of Electrical and Electronics Engineers, 345 East 47th Street; New York, NY 10017.

G. ICEA: Insulated Cable Engineers Association, P.O. Box P, South Yarmouth, MA 02664.

H. NEC: National Electrical Code; NFPA No. 70.

I. NECA: National Electrical Contractors Association, Inc., 7315 Wisconsin Ave.; Washington, DC 20014.

J. NEMA: National Electrical Manufacturers Association, 155 East 44th Street; New York, NY 10017.

K. NESC: National Electrical Safety Code, ANSI 2.

L. NFPA: National Fire Protection Association, 60 Batterymarch Street; Boston, MA 02110.

M. OSHA: Occupational Safety and Health Administration, US Department of Labor; Washington, DC 20402.

N. TAS: Texas Accessibility Standards (TAS) Article 9102.

O. UL: Underwriters Laboratories, Inc., 333 Pfigsten Road; Northbrook, IL 60062
1. Nothing in the Contract Documents shall be construed to permit work not conforming to these codes.
2. When two or more codes or standards are applicable to the same work, then the stricter code or standard shall govern.
3. The date of the code or standard is that in effect on the date of issue stated on the contract documents, except when a particular publication date is specified.
4. The Contractor shall comply with all State, Federal, NFPA, local codes and ordinances that may alter any part of the plans or specifications. The Contractor shall bear all costs for correcting any deficiencies due to non-compliance.
5. Where local codes and ordinances are not in writing or on record but local precedence have been set, the Owner shall pay for any additional resulting cost.

1.7 SUBMITTALS

A. Provide submittals in accordance with Conditions of the Contract and Division 1, Submittal Procedures section unless otherwise indicated.

B. Supplementary submittal requirements:
1. Provide the following in one electronic submission for review within thirty days of issuance of Notice to Proceed (NTP) and prior to commencement of Work:
a. Complete schedule of submittals.
b. Chronological schedule of Work in bar chart form.
c. Manufacturer's Data Sheets:
1) Provide a complete table of contents with the following information:
(a) Project title
(b) Submittal number
(c) Date of submission
(d) Provide a list of Manufacturer's data sheets on products to be incorporated with Work. Where a data sheet shows more than one product, indicate the model being proposed with an arrow or other appropriate symbol.
(e) Submit manufacturer's product literature for each type of fire stop material.
(f) Submissions that do not follow the format and configuration described above, shall be returned without review.
d. Shop Drawings
1) Functional Diagrams/Schematics:
(a) Detailed, redrawn wiring diagrams showing interconnection of components and products, wiring and cabling diagrams depicting cable types and designators, and device designators for each system. Provide connector designations and terminal strip identifications, along with color codes for cables connecting to these devices. Give each component a unique designator and use

this designator consistently throughout the project.

e. Coordination Drawing
   1) Prepare and submit a set of coordination drawings showing major elements, components, and devices of the audio and video system in relationship with other building components. Prepare drawings to an accurate scale of 1/8" = 1'-0" or larger on suitable sized media.
   2) Prepare floor plans, reflected ceiling plans, elevations, sections, and details to conclusively coordinate and integrate all equipment. Indicate locations where space is limited, and where sequencing and coordination of installations is of importance to the efficient flow of the Work including but not necessarily limited to the following:
      (a) Equipment housings
      (b) Wall mounted devices
      (c) Ceiling mounted devices
f. Equipment:
   1) Location of equipment within racks, consoles, or on tables with dimensions; wire routings, and cabling within housings; AC power outlet and terminal strip locations.
g. Patch Panel(s):
   1) Layouts and designation (labeling) strips, including color schemes.
h. Full fabrication details of any custom enclosures and millwork indicating size, material, finish and openings for equipment.
i. Projector, loudspeaker, camera mounting details, include hardware types and load capacity.
j. Fabricated Plates and Panels:
   1) Provide complete drawings on custom fabricated plates or panels. Drawings shall include dimensioned locations of components, component types, engraving information, plate material and color, and bill of material.
k. Labeling: Equipment and cabling labeling scheme - include font sizes and styles, explanation of scheme, and designator schedule.
l. Schedules: Wiring schedule showing source and destination of wiring and indicating which wiring is in conduit. Junction box schedule showing type of box, size, mounting, and location. Include this information with remainder of wiring diagrams.
m. Consultant's project documents in electronic format shall not be supplied to the contractor for their use as part of the submittals.
n. Detail drawings executed at an appropriate scale, but not smaller than 1/8" = 1'-0".
o. Submissions that do not follow the format and configuration described above shall be returned without review.
p. Any other pertinent data which is necessary to provide the work.

2. Control Systems Software
   a. Provide electronic copies of proposed control system user interfaces within (60) days of issuance of Notice to Proceed (NTP).
3. Structural rigging and mounting details:
   a. Structural rigging and mounting details of all loudspeakers suspended from or mounted to the building structure. These drawings shall identify all types of hardware, fittings and material to be used. Detail the product manufacturer, part numbers, and load capacities of the hardware, fittings, and materials selected. All loudspeaker structural rigging and mounting

detail drawings shall be signed and sealed by a professional engineer licensed to practice in the State of Texas and shall include a copy of the design calculations.

b. The signed and sealed drawings noted above to include the following:
   1) Attachment method to building structure for suspended loudspeakers or mounted brackets.
   2) Any secondary steel required for attachment to the building structure.
   3) All fittings, hardware, materials, and cable used for suspended loudspeakers.
   4) All custom brackets, mounts, suspension grids or trusses and loudspeaker cabinet frames or brackets not supplied by the manufacturer of the specific loudspeakers to be mounted or suspended.

c. Loudspeaker Pole details: Include foundation, material types, load capacity and wind loading information. Structural information to include design calculation and copy of engineer's seal licensed to practice in the State of Texas.
   1) Custom Control Software programming for review: It is anticipated that the Owner and Owner's Representative shall have a significant role in originating and reviewing certain software items although it is the Contractor's responsibility to develop this.
   2) Any other pertinent data generated which is necessary to provide the Work.

C. Resubmission requirements
   1. Make all requested corrections or change in submittals required. Resubmit for review until no exceptions are taken.
   2. Indicate all changes that have been made other than those requested.

1.8 CONTRACT CLOSE-OUT DOCUMENTS

A. Provide submittals in accordance with Conditions of the Contract and Division 1, Submittal Procedures section unless otherwise indicated, after substantial completion but prior to final observation.

B. Supplementary submittal requirements:
   1. Provide the following in one electronic submission for review
   2. Equipment Manuals:
      a. Manufacturer's owner/instruction manual for each type of Product by manufacturer and model or part number unless specified otherwise herein.
      b. Supply an equipment log for each system including brands, model/part numbers, and serial numbers for each piece of equipment.
      c. For custom circuits or modifications, a description of the purpose, capabilities, and operation of each of them
      d. Separately bind list by manufacturer and model or part number of Products incorporated within the Work, arranged in alpha numeric order. When applicable, bind Manufacturer's warranty statements separately.
   3. Test Reports: Recorded findings and Commissioning.
   4. System Operation and Instructions; Prepare a complete and typical procedure for the operation of the equipment as a system, organized by subsystem or activity.
      a. This procedure should describe the operation of system capabilities.

b. Assume the intended reader of the manual to be technically inexperienced and unfamiliar with the components and the facility.

5. Service Information, including service phone number(s) and hours; service schedule; description of products recommended or provided for maintenance purposes, and instructions for the proper use of these products.
6. Any other pertinent data generated during the Project or required for service.
7. Within three weeks of final observation, submit the following in one electronic submission for review. Upon Owners and/or Consultant's request, provide (3) copies of the following:
   a. Record drawings: Final rendition of Shop Drawings depicting what is actually incorporated within the Work.
   b. Hardcopy full size set of Record drawings
   c. Three compact disc or DVD's containing Record drawings in AutoCAD editable DWG format and Adobe PDF format. Resolution to be sufficient to permit Owner's technician to be able to clearly read all notes and text on screen.
   d. One set of signed proof-of-training documents
8. Submittal Format:
   a. Record Drawings: Drawings executed at an appropriate scale, but not smaller than 1/8" = 1'-0".
   b. Segregate documents into separate binders containing data relevant to operational, maintenance, and warranty issues. Appropriately duplicate data within the separate bindings when it shall reasonably clarify procedures, e.g., operational data in maintenance binding.
   c. Bind Project Record Manual in titled three ring D style binders sized for 150 percent of the material. Maximum size: three-inch spine. Use multiple volumes as required. Separate major grouping with labeled binder tabs.

C. Resubmission requirements
1. Make all requested corrections or change in submittals required. Resubmit for review until no exceptions are taken.
2. Indicate all changes that have been made other than those requested.

1.9 CUSTOM SOFTWARE (AS REQUIRED)

A. Introduction:
1. Proprietary software provided for the Technical Systems shall be subject to this software license between the Contractor and the Owner as an essential element of the system as defined in the system specification and associated documents, drawings and agreement.
2. Contractor shall agree that 3rd party proprietary software provided with the system shall be subject to this agreement.
3. Contractor and Owner agree that this software license is deemed to be part of, and subject to, the terms of the Agreement applicable to both parties; and shall supersede any standard manufacturer or Contractor's standard license agreement.
4. Proprietary software shall be defined to include, but not be limited to, device and system specific software and firmware designed to run on conventional computer based operating platforms as well as all micro-processor-based hardware used to program, setup, or operate the system or its components.
5. For sake of this agreement, MS Windows® shall not be considered "proprietary" software, unless a non-public version of Windows® or any of its components are

critical to the operation of the system in which case it shall be deemed proprietary.

B. License Grant and Ownership:
   1. Contractor hereby grants to Owner a perpetual, non-exclusive, site license to all software for Customer's use in connection with the establishment, use, maintenance and modification of the system implemented by Contractor. Software shall mean executable object code of software programs and the patches, scripts, modifications, enhancements, designs, concepts or other materials that constitute the software programs necessary for the proper function and operation of the system as delivered by the Contractor and accepted by the Owner.
   2. Except as expressly set forth in this agreement, Contractor shall at all times own all intellectual property rights in the software. Any and all licenses, product warranties or service contracts provided by third parties in connection with any software, hardware or other software or services provided in the system shall be delivered to Owner for the sole benefit of Owner.
   3. Owner may supply to Contractor or allow the Contractor to use certain proprietary information, including service marks, logos, graphics, software, documents and business information and plans that have been authored or pre-owned by Contractor. All such intellectual property shall remain the exclusive property of Owner and shall not be used by Contractor for any purposes other than those associated with delivery of the system.

C. Copies, Modifications, and Use:
   1. Source code shall be available to Owner for a period of not less than 10 years.
   2. Owner may make copies of the software for archival purposes and as required for modifications to the system. All copies and distribution of the software shall remain within the direct control of Owner and its representatives.
   3. Owner may make modifications to the source code version of the software, if and only if the results of all such modifications are applied solely to the system. In no way does this Software License confer any right for Owner to license, sublicense, sell, or otherwise authorize the use of the software, whether in executable form, source code or otherwise, by any third parties.
   4. All express or implied warranties relating to the software shall be deemed null and void in case of any modification to the software made by any party other than Contractor.

D. Warranties and Representations:
   1. Contractor represents and warrants to Owner that:
      a. It has all necessary rights and authority to execute and deliver this Software License and perform its obligations hereunder and to grant the rights granted under this Software License to Owner;
      b. The goods and services provided by contractor under this Software License, including the software and all intellectual property provided hereunder, are original to Contractor or its subcontractors or partners; and
      c. The software, as delivered as part of the system, shall not infringe or otherwise violate the rights of any third party, or violate any applicable law, rule or regulation.
   2. Contractor further represents and warrants that, throughout the System Warranty Period, the executable object code of software and the system shall perform substantially in accordance with the System Specifications and Agreement. If the

software fails to perform as specified and accepted all remedies are pursuant to the policies set forth in the Specification and in the Agreement. No warranty of any type or nature is provided for the source code version of the software which is delivered as is, following final approval by Owner, Architect, and Engineer of design and function of the system at the end of the project.

3. Except as expressly stated in this Agreement, there are no warranties, express or implied, including, but not limited to, the implied warranties of fitness for a particular purpose, of merchantability, or warranty of no infringement of third party intellectual property rights.

1.10 CONTRACTOR REQUIREMENTS

A. The Proposed Contractor must be experienced in the installation and service of similar systems, as those in this specification and the contract drawings. The proposed contractor should also possess the following:
   1. A minimum of five (5) years of experience with the similar equipment and systems to those listed in this specification.
   2. Have a minimum of three (3) similar sized and scoped projects with the past three (3) years.
   3. Maintain active and authorized dealership with all brands listed in this specification.
   4. Employ sufficient staff to complete the entire project and to honor the warranty period.
   5. Employ CTS and CTS-I staff (certified by AVIXA) and assigned to, and active on this project.
   6. A minimum of one (1) CTS employee to supervise each project, and on site during the construction phase.

1.11 QUALITY ASSURANCE

A. Work: Perform Work in compliance with the applicable standards listed herein and governing codes and regulations of the authorities having jurisdiction and the Contract Documents.
   1. Drawings and specification requirements govern where they exceed Code and Regulation requirements.
   2. Where requirements between governing Codes and Regulations vary, the more restrictive provision applies.
   3. Nothing in the Contract Documents grants authority or permission to disregard or violate any legal requirements.

B. Coordinate exact location and installation of equipment, power, grounding, and raceway requirements with the Architect.

1.12 DELIVERY, STORAGE & HANDLING

A. Ship Products in its original container, to prevent damaging or entrance of foreign matter.

B. Handling and shipping in accordance with Manufacturer's recommendation.

C. Provide protective covering during construction of all installed devices, to prevent damaging or entrance of foreign matter.

D. Wrap and/or cover all wiring to after installation to prevent other trades from damaging wires.

E. Replace at no expense to Owner, General Contractor, Engineer, or Architect, Products damaged during storage, handling or the course of construction.

1.13 PROJECT CONDITIONS

A. Verify conditions on the job site applicable to this work. Notify Architect in writing of discrepancies, conflicts, or omissions promptly upon discovery.

B. The Drawings diagrammatically show cabling and arrangements of equipment fitting the space available without interference. If conditions exist which make it impossible to install work as shown, recommend solutions and/or submit drawings to the Architect for approval, showing how the work may be installed.

C. Any employees of the awarded contractor are required to clean up the jobsite after himself/herself. The awarded contractor is to ensure that the jobsite is keep clean and free of clutter so as not to hinder other contractors from performing their work. Should the general contractor be required to clean up after the contractor, the general contractor can issue an invoice for work performed to clean up the jobsite.

D. Adhere to all jobsite safety regulations, including but not limited to, those set by the general contractor, OSHA, Architect, and others. Delays due to being removed from a jobsite for unsafe procedures will not be the responsibility of the General Contractor, Engineers, or Architect.

E. Use of equipment, including but not limited to, scissor lifts, boom lifts, fork trucks, sky-tracks, and more, are the responsibility of the contractor owning or renting the equipment. Any damage caused by use of equipment by the contractor is the contractor’s responsibility.

1.14 WARRANTY

A. Warrant labor and equipment for one year following the date of substantial completion to be free of defects and deficiencies, and to conform to the drawings and specifications as to kind quality, function, and characteristics. Repair or replace defects occurring in labor or equipment within the Warranty period without charge.

B. This warranty is in addition to any specific warranties issued by manufacturers for greater periods of time

C. Within the warranty period, answer service calls within twenty-four (24) hours during normal working hours and correct the deficiency within forty-eight (48) hours.

D. Provide Owner with the name and telephone number of the person to call for service. This information to be part of Project Closeout Documents.

E. Thirty days prior to the end of the warranty period provide a complete checkout of all system components. Repair or replace any defective equipment discovered during the testing. Correct any defects in wiring or other functional problems reported by Owner. Warranty replacement and service of equipment shall not apply to Owner furnished equipment (OFE). Coordinate observation visit with the Owner.

PART 2 PRODUCTS

2.1 GENERAL

A. Refer to System Schedules on plan for part numbers and additional information.

B. Only representative equipment symbols have been shown on the contract drawings. Specific devices and wiring between equipment may not be shown.

C. Equipment and materials shall be new and shall be the latest product of a manufacture. All like devices shall be of the same manufacturer and model number. Equipment and materials shall conform to applicable UL or ANSI provisions.

D. Both ends of all cables shall be labeled utilizing self-laminating polymer film non-smear, machine printed labels.

E. All equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place (e.g., cable shall not be supported by or lay on suspended ceilings). Fasteners and supports shall be adequate to support the required load.

F. Where required, provide manufacturer's rack mount adapter or one manufactured by Middle Atlantic unless specified elsewhere.

G. Remove or blank out all manufacturer's names, logos, or other symbols from loudspeakers or other objects placed in view of the public. If logos are removable, remove and repaint to the color of the adjacent surface reattach.

2.2 INTENTION AND SCOPE OF WORK

A. Provide new A/V system(s) and devices as noted on plans, system schedules and specified in this section.

2.3 ACCEPTABLE MANUFACTURERS

A. Descriptions and details, acceptable manufacturers' names listed and specific manufacturer and model number items indicated in the plans, schedules and specifications shall establish a standard of quality, function, and design. Manufacturers and model numbers listed "no exceptions" shall not be substituted without specific notice in an addendum. Otherwise, where a specific manufacturer's product is indicated, products of other manufacturers listed as acceptable may be submitted for approval based on the substitute product being, in the opinion of the Engineer, of equivalent or better quality than that of the product specified.

B. If a specified product has been discontinued by a manufacturer, provide the replacement model (as certified by the manufacturer) at no additional cost.

C. Proposed contractors wishing to propose any product substitution must do so in writing to the specifying authority at least ten (10) days prior to the proposal opening. The proposed contractor shall supply proof that such substitute equipment equals or exceeds the features, functions, performance, and quality of the specified equipment. Proposals must include detailed information showing all deviations from the system as specified.

D. Refer to General and Supplementary Conditions and Division 1 Specifications Sections for equipment substitution procedure.

E. Acceptable Manufacturers Include:

Allen and Heath	United Kingdom
Atlas IED	Phoenix, AZ
BSS Audio	South Jordan, UT
Community Professional Loudspeakers	Chester, PA
Crestron Electronics	Rockleigh, NJ
Crown Audio	Elkhart, IN
Danley Sound Labs	Gainesville, GA
Denon Professional	Cumberland, RI
Electro-Voice	Fairport, NY
Extron	Anaheim, CA
Furman Contractor	Petaluma, CA
JBL Professional	Northridge, CA
Listen Technologies Corporation	Bluffdale, UT
Lowell Mfg.	Pacific, MO
Middle Atlantic Products	Fairfield, NJ
Neutrik	Charlotte, NC
QSC	Costa Mesa, CA
Octasound	Ajax, ON
Radio Design Labs	Prescott, AZ
Sennheiser	Old Lyme, CT
Shure Incorporated	Niles, IL
Soundcraft	Northridge, CA
West Penn Wire	Washington, PA

F. Other manufacturers must be approved by Architect/Engineer, unless indicated by these specifications.

2.4 CABLES & WIRING

A. All electrical conductors installed under this contract, except where otherwise specified, shall be soft drawn annealed stranded copper having a conductivity of not less than 98% of pure copper, and meet appropriate ratings (e.g. CMR, CMP, etc.)

B. Cable shall carry appropriate fire rating (e.g. CMR, CMP, OFNR, OFNP, etc.) on jacket of cable.

C. Where cables are routed through cable tray, provide tray rated cable of equal specification.

D. Where speaker cables are run exposed through a return air plenum, provide plenum rated cable of equal specification.

E. Shielded cables located in raceways shall have aluminum foil shield with drain wire.

F. The West Penn cables listed below are approved for use on this project and are listed to set the acceptable standard of performance. If field conditions or actual cable pathway requires tray or plenum cable, provide version of cable that meets required rating. Cables from Liberty, Commscope, Gepco, Windy City Wire, and Belden are also acceptable provided they meet the performance specifications of the approved listed cables.

G. Loudspeaker Cables adhere to table below

Wire Size	2Ω Load	4Ω Load	8Ω Load	70-Volt Load
22 AWG	Up to 3 Feet	Up to 7 Feet	Up to 13 Feet	Up to 661 Feet
20 AWG	Up to 5 Feet	Up to 11 Feet	Up to 21 Feet	Up to 1,068 Feet
18 AWG	Up to 8 Feet	Up to 17 Feet	Up to 34 Feet	Up to 1,694 Feet
16 AWG	Up to 13 Feet	Up to 27 Feet	Up to 53 Feet	Up to 2,687 Feet
14 AWG	Up to 20 Feet	Up to 43 Feet	Up to 87 Feet	Up to 4,380 Feet
12 AWG	Up to 31 Feet	Up to 69 Feet	Up to 138 Feet	Up to 6,950 Feet
10 AWG	Up to 52 Feet	Up to 110 Feet	Up to 219 Feet	Up to 11,072 Feet
8 AWG	Up to 78 Feet	Up to 174 Feet	Up to 349 Feet	Up to 17,598 Feet
6 AWG	Over 78 Feet or Relocate Amp Rack with approval	Over 174 Feet or Relocate Amp Rack with approval	Over 349 Feet or Relocate Amp Rack with approval	Over 17,598 Feet or Relocate Amp Rack with approval

1. Minimum of CMR Rated, but CMP Rated where required
2. Jacket color: black
3. Approved products:
   a. West Penn 454 (22 AWG)
   b. West Penn 25454 (22 AWG Plenum Rated where required)
   c. West Penn 222 (20 AWG)
   d. West Penn 25222 (20 AWG Plenum Rated where required)
   e. West Penn 224 (18 AWG)
   f. West Penn 25224 (18 AWG Plenum Rated where required)
   g. West Penn 225 (16 AWG)
   h. West Penn 25225 (16 AWG Plenum Rated where required)
   i. West Penn 226 (14 AWG)
   j. West Penn 25226 (14 AWG Plenum Rated where required)
   k. West Penn 227 (12 AWG)
   l. West Penn 25227 (12 AWG Plenum Rated where required)
   m. West Penn HA210 (10 AWG)
   n. West Penn 25210 (10 AWG Plenum Rated where required)
   o. West Penn C208 (8 AWG)
   p. Or approved equivalent(s)

H. Microphone/Line Level Wire:
   1. Provide shielded 22 AWG cable

2. Bonded jacket
3. Minimum of CMR Rated, but CMP Rated where required
4. Jacket color: black
5. Acceptable Product:
    a. West Penn 454
    b. West Penn 25454 (Where required)
    c. Or approved equivalent

I. Twisted Pair Cable:
1. Digital Media Shielded Twisted Pair:
    a. 350 MHz ultra-high-performance shielded CAT5e (F/UTP)
    b. NEC® Type CM and CSA® Type CMR rated
    c. Meets HDBT requirements.
    d. Color: Blue
    e. Acceptable Product:
        1) Crestron DM-CBL-8G-NP
        2) Crestron - DM-CBL-8G-P (where required)
        3) Or approved equivalent
2. Low-Skew/Skew-Free Video Twisted Pair
    a. Acceptable Product:
        1) Extron Skew-Free UTP 22-141-03
        2) Extron Skew-Free UTP-P 22-142-03 (where required)
        3) Or approved equivariant
3. Ethernet/LAN Cable (UTP):
    a. Enhanced category 5e
        1) 4 pair, 24-AWG Bare Copper
        2) Minimum of CMR Rated, but CMP Rated where required
        3) Standard Termination T-568-B
        4) Color - Yellow
        5) Acceptable Product:
            (a) West Penn 4245
            (b) West Penn 254245 (Where required)
            (c) Or approved equivalent
    b. Enhanced category 6
        1) 4 pair, 23-AWG Bare Copper
        2) Minimum of CMR Rated, but CMP Rated where required
        3) Standard Termination T568B
        4) Color - Yellow
        5) Acceptable Product:
            (a) West Penn 4246
            (b) West Penn 254246 (Where required)
            (c) Or approved equivalent
    c. Enhanced category 6A
        1) 4 pair, 23-AWG Bare Copper
        2) Minimum of CMR Rated, but CMP Rated where required
        3) Standard Termination T568B
        4) Color - Yellow
        5) Acceptable Product:
            (a) West Penn 4246A
            (b) West Penn 254246A (Where required)

(c) Or approved equivalent

J. RF Antenna Cables (as required by manufacturer's specifications)
1. RG-58/U Type
a. Minimum of CMR Rated, but CMP Rated where required
b. 20 (19x32) Tinned Copper Conductor
c. 100% Bi-Foil, Tinned Copper Braid Shield with 95% or better coverage
d. Nominal Impedance of 50Ω
e. Acceptable Products:
1) West Penn 812
2) West Penn 25812 (Where required)
2. RG-213/U Type
a. Minimum of CMR Rated, but CMP Rated where required
b. 13 (7x21) Tinned Copper Conductor
c. Bare Copper Braid Shield with 95% or better coverage
d. Nominal Impedance of 50Ω
e. Acceptable Products:
1) West Penn 810
2) West Penn 25810 (Where required)
3. RG-8/U Type
a. Minimum of CMR Rated, but CMP Rated where required
b. 10 AWG Solid Tinned Copper Conductor
c. 100% Bonded Bi-Foil + 90% Tinned Cu Braid Shield
d. Nominal Impedance of 50Ω
e. Acceptable Products:
1) West Penn 98G8
2) West Penn 2598G8 (Where required)

K. Other Misc. Cables:
1. Acceptable Product:
a. As per manufacturer specifications

PART 3 EXECUTION

3.1 GENERAL

A. Coordinate incorporation of the Work specified herein with other project work so as to facilitate a cohesive final Products.

B. The installation recommendations contained within ASDI and Telecommunications Distribution Methods Manual are mandatory minimum standards and requirements.

C. Mount equipment and enclosures plumb and level.

D. Permanently installed equipment to be firmly and safely held in place. Design equipment supports to support loads imposed with a safety factor of at least five. Seismic bracing shall be installed on appropriate equipment where local codes require such installation.

E. Verify all locations of equipment in all rooms with Owner's Representative, Owner, and Consultant.

3.2 INSTALLATION

A. Installation of cable and wiring
   1. Cabling and Wiring:
      a. Install cable in a manner to adhere to manufacturer's specifications for maximum cable pulling tension, minimum bend radius, and restrictions.
      b. Provide appropriate support at all horizontal-to-vertical transitions in order to keep the weight of the cable from degrading at the point of transition.
      c. If a J-hook or trapeze system is used to support cable bundles, all horizontal cables shall be supported at a maximum of 48-inch (1.2 meter) intervals. At no point shall the cables rest on light fixtures, acoustic ceiling grids, panels, conduits, sprinkler pipe, water pipe and/or HVAC system ducting.
      d. Horizontal distribution cables shall be bundled in groups of no more than 50 cables when being supported by J-Hook or trapeze systems. Cable bundle quantities in excess of 50 cables may cause deformation of the bottom cables within the bundle and degrade cable performance. An exception to this rule is when cable is installed in cable tray systems.
      e. Cable shall be installed above fire-sprinkler systems and shall not be attached to the system or any ancillary equipment or hardware. The cable system and support hardware shall be installed so that it does not obscure any valves, fire alarm conduit, boxes, or other control devices
      f. Cables shall not be attached to ceiling grid or lighting fixture wires. Where support for horizontal cable is required, install appropriate carriers to support the cabling.
      g. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced prior to final acceptance at no cost to the Owner.
      h. Cables shall be identified by a self-adhesive machine label in accordance with the System Documentation Section of this specification and ANSI/TIA/EIA-606-A. The cable label shall be applied to the cable behind the faceplate on a section of cable that can be accessed by removing the cover plate.
      i. Unshielded twisted pair cable shall be installed so that there are no bends smaller than four times the cable outside diameter at any point in the run and at the termination field.
      j. Provide splice free wiring and cabling from origination to destination. Cables shall be installed in continuous lengths from origin to destination (no splices). Properly designed transition points, or consolidation points are not considered 'splice points.
      k. Make joints and connections with rosin-core 60/40 solder or with mechanical connectors specifically intended for the type and class of cable being used. Where spade lugs are used, crimp properly with ratchet type tool.
      l. Take precaution to prevent and guard against electromagnetic and electrostatic hum. For line-level audio signal, float cable shield at one end. Shield not connected to be folded back over cable jacket and covered with heat-shrink tubing. Do not cut off unused shield.
      m. Isolate cables and wires of different signals or different levels; and separate, organize, and route to restrict channel crosstalk or feedback oscillation in any amplifier section. Keep wiring separated into groups for microphone level circuits, line level circuits, loudspeaker circuits, and power circuits.

n. Connect cable to active components through XLR connections whenever multiple formats are available. Make connections to speaker transformers with properly sized closed end connectors crimped with factory approved ratchet type tool. Wire nut or "Scotchlock" connectors are not acceptable. Do not wrap audio cable splices or connections with adhesive backed tape.
o. Cover edges of cable and wire pass-through holes in chassis, housings, boxes, etc., with rubber grommets or Brady GRNY nylon grommetting.
p. Execute wiring in strict adherence to:
   1) Phillip Giddings. Audio System Design and Installation. Indianapolis: Howard W. Sams & Co., 1990.
   2) Don Davis and Carolyn Davis. Appendix II, Recommended Wiring Practices. Sound System Engineering, 2nd Edition. Indianapolis: Howard W. Sams & Co., 1989.
   3) AV Installation Handbook Second Edition: The Best Practices for Quality Audiovisual Systems, Infocomm, 2009

2. Equipment Housing Cabling and Wiring:
   a. Lace, tie, or harness wire or cable as required herein, and in accordance with accepted professional practice. Dress, lace or harness all wire or cable to prevent mechanical stress on electrical connections; no wire or cable shall be supported by a connection point. Install cable and wire neatly tied in manageable bundles with cable lengths cut to minimize excess cable slack but still allow for service and testing. Provide horizontal support bars if cable bundles sag. Reference photos below for standard of quality.
   b. Provide adequate service loops so that equipment mounted on rack slides may be pulled fully out, to their locked position without straining cable.
   c. Neatly bundle excess AC power cable from housing mounted equipment with plastic cable ties.
   d. Provide plastic cable ties or Velcro straps to bundle cabling and wiring. Electrical tape and adhesive backed cable tie anchors are not acceptable.
   e. Install with connections completely visible and labeled.
   f. Provide termination resistors, if required, of 5 per cent tolerance; fully visible and not concealed.
3. Approved Products
   a. Cabling and Wire
      1) The Contractor shall provide and install new and unused ASTM bare solid copper conductor wire per ANSI/NEMA codes. Follow the manufacturer's instructions. All wire shall be UL listed for communication and control circuits. All wire exposed in attic spaces shall be plenum rated.
      2) All cable shall have labels on both ends utilizing self-laminating, flexible vinyl film and non-smear nylon marking pens. Utilize Tyton Corporation Part No. RO175 Rite-On labels and Part No. FTP1 nylon marking pens, machine printed labels, or equivalent.
      3) Microphone and line level cable runs shall be NEC type CMP Plenum, 22 AWG, 2-conductor twisted pair with 100% coverage foil shield, and 24 AWG stranded drain wire, West Penn Wire Number 25291 or equivalent.
      4) 25-volt or 70-volt speaker wire shall be 16-gauge twisted pair, NEC type FPLP, West Penn Wire Number 25225 or equivalent.
      5) 8-ohm full range, mid or high speaker wire shall be 12-gauge stranded THHN wiring fully enclosed in metallic conduit, West Penn Wire Number

25227 or equivalent.

6) 8-ohm sub-woofer speaker wire shall be 12-gauge stranded THHN wiring fully enclosed in metallic conduit, West Penn Wire Number 25227 or equivalent.
7) Furnish an insulated #6 copper ground wire run from all amplifier racks/housings to the building earth ground system.
8) Wireless Microphone Antenna wire shall be a 20-gauge tinned copper conductor insulated by a Foam FEP insulator 0.102" in diameter. The insulator shall be surrounded by a 100% aluminum foil, which shall be surrounded by a 90% tinned coper braid. West Penn Wire Number 25812 or equivalent.
9) Wires shall not be painted. Any wires found to be painted shall cause wire warranty to be voided, and therefore the wire must be replaced. Replacement of the wire shall be the responsibility of the contractor responsible for painting it.

b. Cable Ties
   1) It is preferred that Velcro be used to support and secure wires. Velcro all wires not run in conduits, above and off ceiling grids, sprinkler pipes, conduits, and other trades work.
   2) Nylon cable ties may be used in equipment racks. Nylon cable ties shall be furnished and installed to attach wire bundles to supports and for appropriate wire management as in equipment racks.
      (a) Nylon wire tie, 3.9", miniature - Panduit PLT1M-C or equivalent.
      (b) Nylon wire tie, 5.6", miniature - Panduit PLT1.5M-C or equivalent.

c. Installation of connectors, plates & panels:
   1) Install panel mounted connectors rigidly attached to panels, plumb and level.
   2) Custom rack panels shall be 1/8-inch-thick aluminum, standard EIA sizes, brushed black anodized finish (brushed in direction of aluminum grain only), unless otherwise noted.
   3) otherwise noted or specified. However, verify plate finish with the Architect.
   4) Install XLR type connectors in accordance with IEC-268 standard, with a wiring scheme of pin 2 hot (high), pin 3 (low), and pin 1 screen (shield).
   5) Other Plates and Panels may be required to satisfy the requirements of the Work.

d. Installation power and grounding:
   1) Coordinate final connection of power and ground wiring to housings.
   2) Hardwire power wiring directly to internal AC receptacles to ensure uninterrupted operation.
   3) Provide 3-conductor, isolated ground, 120 VAC outlets as required within each housing. Provide a minimum of two spare outlets in each rack.
   4) Provide a copper ground buss top to bottom in each housing, insulated from the housing. Ground equipment chassis not having a three-wire power cord to these busses using 6/32 nuts, bolts and lock-washers with No. 12 wire. Connect green ground wire from each AC outlet in housing to this buss bar.
   5) Replace manufacturers supplied 18-gauge IEC power cords with UL listed 18-gauge pre-molded 6", 12", 18", or 24". Use minimum length required. No looped or cable tied IEC power cords shall be permitted

within the equipment rack.

6) Replace manufacturers supplied 14-gauge IEC power cords with UL listed 14-gauge pre-molded 18" or 36" for all equipment IEC capable. Use minimum length required and minimize looped or cable tied IEC power cords present in the equipment Rack.

e. Installation of electronic equipment:
   1) Take appropriate precautions against electrostatic discharge (ESD). Establish a personal ground before handling electronic equipment through the use of a grounded wrist wrap and/or an anti-static floor pad.
   2) Take appropriate precautions to protect the equipment from damage during installation. Equipment to be installed free of damages, scratches, dents, etc.
   3) Mount trim potentiometers, custom circuit cards, relays, and transformers (except large 70V units) in shielded enclosures and mark their function and connections with engraved Lamicoid labels.
   4) Mount equipment plumb and level, firmly and safely held in place.

f. Installation of equipment housing:
   1) Mount equipment in racks and consoles and fully wire and test before delivery to job site. If field conditions prevent prior assembly of racks, notify Owner in writing that racks shall be fabricated on site and the reasons for the change.
   2) Provide rear support for housing mounted equipment greater than 15 inches deep.
   3) Provide blank panels to fill unused panel space within the equipment housing.
   4) If Key door locks are required, key each housing type alike.
   5) Looking at the rack from the rear, locate AC power and speaker wiring on the left; line level audio, video, and RF wiring on the right.
   6) Provide shaft locks or security covers on non-user operated equipment having front panel controls. These panels are to be installed at the conclusion of testing.
   7) Products "Controlling the Temperature Inside Equipment Racks".
   8) Panels or equipment mounted on the rear rack rails shall not block access to any front mounted components.
   9) If equipment rack is not equipped with casters, provide two-inch-high wood base to isolate equipment rack from floor. Wood base should be capable of supporting the load.

3.3 GENERAL INSTALLATION PRACTICES

A. This contractor shall supply all speakers, racks, wire, cabinets, connectors, materials, parts, equipment and labor necessary for the complete installation of the system, in full accordance with the recommendations of the equipment manufacturers and with the requirements of the specifications and drawings.

B. All wiring shall test free from opens, grounds, or shorts.

C. Cable pathways, conduit, and cable support systems shall be complete with bushings, de-burred, cleaned, and secure prior to installation of cable.

D. All installation shall follow broadcast wiring and installation practice, with particular note given to installation instructions given in the equipment section of these

specifications and drawings.

E. Sound system wires of dissimilar signal types (microphone level, line level, speaker level) shall not share any common conduit with each other or with any other wiring.

F. Route all cable and wiring within equipment racks and cabinets according to function, separating wire of different signal levels (microphone, line level, amplifier output, AC, intercom, etc.) by as much distance as possible. Neatly arrange and bundle all cable loosely with plastic ties.

G. No cables shall be wired with a polarity reversal between connectors at either end, unless specifically detailed in the one-line diagrams from the Engineer. Special care shall be taken when wiring microphone cables, to ensure that constant polarity is maintained.

H. Provide all circuits balanced and floating, except as noted in the Specifications.

I. All system wire, except spare wire, after being cut and stripped, shall have the wire strands twisted back to their original lay and be terminated by approved soldered or mechanical means. No unterminated wire ends shall be accepted. Heat-shrink type tubing shall be used to insulate and dress the ends of all wire and cables including a separate tube for the ground or drain wire.

J. Splicing Cables or Wires is unacceptable, no matter the reason. If a Cable or Wire is too short, pull another Cable or Wire. If the Cable or Wire is a manufacturer Cable or Wire, replace the Cable or Wire with another approved Cable or Wire of proper length.

K. All solder connections shall be made with rosin-core solder. Temperature-controlled soldering irons rated at least 60 watts shall be used for all soldering work. No soldering guns or temperature unregulated irons shall be used on the job site.

L. All mechanical connections shall be made with approved non-insulated crimp lugs of the correct size and type for the connection. Wire nuts are not permitted. Each connector shall be attached with the proper size controlled-duty-cycle ratcheting crimp tool, which has been approved by the manufacturer of the connectors. Conventional non-ratcheting type crimping tools are unacceptable, and shall not be used on the job site.

M. Clearly and permanently label ALL jacks, controls, connections, and so forth, with engraved laminated plastic labels supplied with adhesive backing. Do not use embossed or printed label tape. All labeling shall be completed prior to final system acceptance. Black background with white lettering.

N. All cable shall have a label on both ends utilizing self-laminating, flexible vinyl film, Brady IDXPERT XSL-30-427 labels (or similar), with a White on Black Contrast, 1-1/2” in height and 0-3/4” wide. The laminate shall complete wrap around the printed area of the label, and secure smoothly without rippling. Handwritten labels and electrical wire maker labels will not be accepted. Do not write on the cable.

O. All equipment shall be held firmly in place with proper types of mounting hardware. All equipment shall be installed to provide reasonable safety to the operator. Supply adequate ventilation for all enclosed equipment items that produce heat.

P. Shields of audio cables shall be grounded at one end only, at the inputs of the various equipment items in the system.

Q. System wiring and equipment installation shall be in accordance with good engineering practices as established by the EIA and the NEC. Wiring shall meet all state and local electrical code requirements.

R. All wiring shall test free from opens, grounds, or shorts. All communication cable shall be supported from the building structure and bundled. Do not attach any supports to joist bridging or other lightweight members.

S. The support system shall provide a protective pathway to eliminate stress that could damage the cabling. The cable shall not be crushed, deformed, skinned, crimped, twisted, or formed into tight radius bends that could compromise the integrity of the cabling.

T. In all exposed areas such as stages, gymnasiums, shops, field houses, janitors' closets, or mechanical / electrical rooms all communication cable shall be fully enclosed in conduit.

U. Communication cables shall be run in conduit stubs from wall boxes to accessible areas above finished ceilings. Conduit shall be required only within walls and concealed spaces to provide access.

V. Provide bushings to protect the cable from damage for conduit ends, box openings, and passage through metal studs.

W. Communication cables shall be run in bundles above accessible ceilings and supported from building structure. Cabling shall be loosely bundled with cable ties randomly spaced at 30 to 48 inches on center, cable ties shall not be tight enough to deform cabling and shall not be used to support the cabling.

X. Communication cable must not be fastened to electrical conduits, mechanical ductwork/piping, sprinkler pipes, or routed to obstruct access to hatches, doors, utility access panels, or service work areas. Do not route cables through fire doors, ventilation shafts, grates, or parallel for more than four-feet with line voltage electrical conductors. Communication cables shall not be run loose on ceiling grid or ceiling tiles. Communication cable bundles shall not be cinched with zip ties, damaging the cable.

Y. Support shall be provided by mounting appropriate fasteners that may be loaded with multiple cables. Provided that the weight load is carried by the support rod or wire the support assembly may attach to the ceiling grid for lateral stabilization. The require support wires for the ceiling grid or light fixtures shall not be utilized. Any fastener attached to the ceiling grid shall not interfere with inserting or removing ceiling tiles. The cable pathway of supports must be positioned at least 12 inches above the ceiling grid.

Z. All cabling shall be placed with regard to the environment, EMI/RFI interference, and its effect on communication signal transmission.

AA. Do not route any data communication cable within two feet of any light fixture, HVAC unit, service access area, electric panel, or any device containing a motor or transformer.

BB. Communication cable will not be installed in the same conduit, raceway, tray, duct, or track with line voltage electrical cable without a metallic barrier meeting NEC requirements.

CC. Maximum cable pulling tension should not exceed 25 pounds force (110 N) or the manufactures recommendation, whichever is less.

DD. Any pulling compounds utilized must be approved by the cable manufacturer and shall not degrade the strength or electrical characteristics of the cable.

EE. No terminations or splices shall be installed in or above ceilings.

FF. Cable bends shall not be tighter that the manufacturers' suggested bend radius.

GG. Mount all equipment firmly in place such that vibration or jarring will not activate an alarm, supervisory, or trouble signal. Route cable in a professional, neat and orderly installation.

HH. Provide for adequate ventilation to all equipment and take precautions to prevent electromagnetic or electrostatic hum.

II. All conduit, ducts, track, and raceways shall be supported from the structure at industry standard intervals for the size specified, utilizing proper anchoring devices. Cable fill may not exceed the manufacturers' instructions for each type of support.

JJ. All installation hardware shall be Grade 5 or higher and must be rated for overhead rigging where applicable. Verify grade of each nut, bolt, and other hardware prior to installation.

KK. Use Locktite "ThreadLocker" on nuts and bolts to make the connect tighter.

LL. Use lock or "split" washers inside of every nut. Double nutting and lock nuts are allowed, but lock or "split" washers are required.

MM. All eyebolts or eye nuts must be forged steel, not turned or welded.

NN. Shackles and Turnbuckles shall be used as necessary. All shackles and turnbuckles must be rated for overhead rigging and lifting. Secure shackle and turnbuckle pins with Locktite "ThreadLocker". Carabiners, Quick Links, and other similar devices are not to be used under any circumstances.

OO. 3/16" Aircraft Cable/Wire Rope is to be used to mount speakers, unless otherwise noted. Aircraft cable is to be secured using aluminum 3-16" x 1" wire rope swage sleeves, not copper. Avoid using wire rope clips.

PP. Aircraft Cable/Wire Rope is preferred, but 3/8-Inch chain may be used as an alternate.

QQ. In either case, Wire Rope or Chain, **DO NOT** wrap a beam, perlin, truss, or other structural element without using a Web Sling or Roundsling properly rated for the load being installed. If a sling is not available, use Unistrut, Unistrut Beam Clamps, Forged Eyebolts, and other Grade 5 and Higher Hardware to properly attach to the structural element, and then attach the Wire Rope or Chain to the Eyebolt using proper Shackles and Turnbuckles. Connecting Links, Quick Links, Snap Links, Spring Clip Links, Snap Links, or any other type of non-welded or non-forged shall be accepted. If

these are used, the contractor will be required to reinstall the equipment properly at the contractor's expense.

RR. DO NOT penetrate any steel structure to install bolts or other hardware. Again, attach unistrut to the steel, and attach the equipment to the unistrut. Penetrating steel can weaken the steel structure.

SS. Perform Work in compliance with the applicable standards listed herein and governing codes and regulations of the authorities having jurisdiction and the Contract Documents.
1. Drawings and specification requirements govern where they exceed Code and Regulation requirements.
2. Where requirements between governing Codes and Regulations vary, the more restrictive provision applies.
3. Nothing in the Contract Documents grants authority or permission to disregard or violate any legal requirements.
4. Coordinate with other trades as called for in the specifications and/or drawings, and as needed for any, and all associated work as required.
5. Submit Requests for Information (RFI) for any major changes or changes requiring additional cost. All RFIs must be submitted in a timely fashion. Do not wait until the end of the project to notify the engineer of issues that will hold up the project.

3.4 TERMINATION PRACTICES

A. Use Neutrik standards for all stripping and soldering practices.

B. Preserve wire twists as closely as possible to point of termination (0.5" maximum) to keep signal impairment to a minimum.

C. Avoid twisting cable jacket during installation.

D. Install Teflon tubing on drain or ground wires, to prevent the drain or ground wire making incorrect contact with other wires or the connector.

E. Install Heat Shrink on the end of the PVC jacket surrounding the wire pairs.

F. The Contractor shall observe proper circuit polarity and loudspeaker wiring polarity. Properly and clearly label all connections and wires as to function and polarity. Connectors shall be wired as follows:

1. 3-Pin XLR connectors

Pin Number	Connection	Wire Color
1	Ground (shield)	Bare
2	Positive + (High)	Red
3	Negative - (Low)	Black

2. 5-Lug Screw Terminals

Pin Number	Connection	Wire Color
1	Ground (shield)	Bare
2	Positive + (High)	Red
3	Negative - (Low)	Black
4	RVC	White

Pin Number	Connection	Wire Color
5	RVC Ground	Green

3.5 BUSHINGS

A. Provide a plastic snap in bushing at each box opening, passage through a metal stud, and at the end of all open conduit stubs or sleeves prior to cable installation to protect the cabling from damage:
   1. Box openings - Thomas & Betts Knockout Bushing Series 3210, or equivalent
   2. Metal stud passage - Thomas & Betts Twist It Bushing Catalog Number SB1216-SC, or equivalent
   3. Conduit ends - Thomas & Betts Anti-Short Bushing Series 390 or Tite-Bite Combination Couplings Series 442, or equivalent

B. Bushings must be put on boxes, stud passages, and conduits prior to wires being run in the space. Bushings that are cut indicate that the bushing was put on after the wires were pulled, and the wires may be damaged. Therefore, the wire must be replaced. Verifying that the bushings are in place is the responsibility of the contractor pulling the wire.

3.6 J-HOOKS

A. Attachments for cabling support shall be spaced at approximately 48 to 60 inches on center. The cable bundle shall not be allowed to sag more than 12 inches mid-span between attachments. Attachments shall be sized as follows:

Single cables or bundles up to four cables may be supported directly by the building structure.

Bundles up to 1/2" dia. (Ten 1/4" cables)	2" bridle ring, Caddy #4BRT32 or equivalent
Bundles up to 3/4" dia. (Sixteen 1/4" cables)	3/4" J-Hook, Caddy #CAT12 or equivalent
Bundles up to 1-5/16" dia. (Fifty 1/4" cables)	1-5/16" J-Hook, Caddy #CAT21 or equivalent
Bundles up to 2" dia. (Eighty 1/4" cables)	2" J-Hook, Caddy #CAT32 or equivalent

B. Do not mix different signal strength cables on the same J-Hook (i.e. fire alarm with telephone/data cable). Multiple J-Hooks can be placed on the same attachment point, up to the rated weight load of the attachment device.

C. J-Hooks must be attached directly to structure where possible.

3.7 FIRESTOP

A. A fire-stop system is comprised of the item or items penetrating the fire rated structure, the opening in the structure and the materials and assembly of the materials used to seal the penetrated structure. Fire-stop systems comprise an effective block for fire, smoke, heat, vapor and pressurized water stream.

B. All penetrations through fire-rated building structures (walls and floors) shall be sealed with an appropriate fire-stop system. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire rated structure).

C. Any penetrating item i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc. shall be properly fire-stopped.

D. Fire-stop systems shall be UL Classified to ASTM E814 (UL 1479) and shall be approved by a qualified Professional Engineer (PE), licensed (actual or reciprocal) in the state where the work is to be performed.

E. A drawing showing the proposed fire-stop system, stamped/embossed by the PE shall be provided to the Owner's Technical Representative prior to installing the fire-stop system(s).

F. All fire-stop systems shall be installed in accordance with the manufacturer's recommendations and shall be completely installed and available for observation by the local authorities prior to cable system acceptance.

3.8 LABELING OF EQUIPMENT

A. Provide each terminal strip with a unique descriptor and a numerical designator for each terminal. Show terminal strip descriptor and designator on system schematic drawing.

B. Provide logical and legible cable and wiring label permanently affixed for easy identification.
   1. Labels on cables to be adhesive strip type covered with clear heat-shrink tubing. Factory stamped heat shrink tubing may be used in lieu of the adhesive strip style.
   2. Wiring designator to be an alpha-numeric code unique for each cable. Actual cable designation assignments to be determined by Contractor. Add cable designation codes to system schematic drawings.
   3. Locate the cable designator at the origination and destination of each circuit within 3 inches of the point of termination or connection. Provide cable designator on circuits with intermediate splice points with an additional suffix to indicate each segment.

3.9 ENGRAVING

A. Text font: 1/8-inch block sans serif characters unless noted otherwise.

B. On dark materials, provide white characters; on stainless steel or brushed natural aluminum plates, or light-colored materials, provide black characters.

C. Provide at least two lines of text with first line listing the general device name, e.g., amplifier. Second line to include schematic reference of the device, e.g., AMP-1.

D. Equipment label: black with white characters except where indicated.

3.10 COMMISSIONING

A. Prior to energizing or testing the system, ensure the following:
   1. All products are installed in proper and safe manner according to manufacturer's instructions.
   2. Insulation and shrink tubing are present were required.
   3. Dust, debris, solder splatter, etc. is removed.
   4. Cable is dressed, routed, and labeled; connections are consistent with regard to polarity.

5. Labeling has been provided.
6. Temporary facilities and utilities have been properly disconnected, removed and disposed of off-site.
7. Products are neat, clean and unmarred and parts securely attached.
8. Broken work, including glass, raised flooring and supports, ceiling tiles and supports, walls, doors, etc. have been replaced or properly repaired, and debris cleaned up and discarded.

B. Prior to energizing the System verify and perform the following tests and adjustments in compliance with applicable EIA standards.
1. Electronic devices are properly grounded.
2. Test each AC power receptacle with a circuit checker for proper hot, neutral and ground connections.
3. Verify each individual component is operating properly.
4. Verify each individual component's performance meets the manufacturer's published performance for this unit.
5. Measure and record the DC resistance between the technical ground in any equipment rack or console and the main building ground. Resistance should be 0.15 ohms or less.

C. Audio Signal Paths
1. Verify operation from each source device through all switching, amplification and distribution devices.

D. Remote Input Verification Test
1. Using a microphone or portable signal generator, connect to each microphone/line level receptacle throughout the facility.
2. Verify that the receptacle under test appears at the correct input and is operating properly.
3. In a similar manner, check all remote tie-lines and media related lines for correct wiring and labeling.

E. RFI and Parasitic Oscillation
1. With systems operating check to ensure that all systems are free from spurious oscillation and radio frequency interference in the absence of audio signal.

F. Buzzes, Rattles and other Distortions
1. Adjust the system for normal operating level in the space. Apply a slow sine wave sweep from 60 Hz to 3 kHz and listen carefully for buzzes, rattles and other objectionable distortions.
2. Correct the cause of the defect. If the cause is not from the system. Bring the cause to the attention of the GC, indicating cause and suggestive corrective actions. 41

3.11 FINAL OBSERVATION & TESTING

A. Upon completion of installation, initial adjustments, tests and measurements specified in Part 3, and submission and review of the results, a final observation and test shall be performed by the Owner or Owner's representative no earlier than two weeks after receipt of the written results.

B. Provide a minimum of one (1) person for observation and testing familiar with aspects of the System to assist the Owner.

C. The process of testing the System may necessitate moving and adjusting certain components.

D. Testing includes operation of each major system and any other components deemed necessary. Perform tests and provide required test equipment, tools and material required to make any necessary repairs, corrections, or adjustments.

E. The following procedures shall be performed on each System:
   1. Observation of the methods and means employed to incorporate the System within the facility.
   2. Verification of proper operation, from controlling devices to controlled devices.
   3. Verification of proper adjustment, balance, and alignment of equipment for optimum quality and to meet the manufacturer's published specifications. Establish and mark normal settings for each level control, and appropriately record these settings within the Record Documents.
   4. Other tests on equipment or systems deemed appropriate.

F. In the event the need for further adjustment or work becomes evident during testing, the Contractor is to continue his work until the System is acceptable at no addition to the contract price. If approval is delayed because of defective equipment, or failure of equipment or installation to meet the requirements of these specifications and any extension of the observation and testing period is required, the Contractor shall pay for additional time and expenses of the Owner at the standard rate in effect at that time.

3.12 TEST EQUIPMENT

A. Thirty days prior to start of testing, provide a list to the Owner of test equipment make, model numbers and calibration dates that shall be set.

B. The following equipment shall be available on site for the entire test period through final system testing.
   1. Sound Level Meter: ANSI S1.4-1971 Type S1A with digital or analog display. Meter to provide ranges of 40 to 120 dBA.
   2. Pink Noise Source - Equal energy per octave bandwidth 20 Hz to 20,000 Hz, ±1 dB (long-term average) at 0 dBm output. Stability: ±2 dB per day.
   3. Impedance Meter - Capable of testing audio lines at three frequencies, minimum, between 250 Hz and 5k Hz. Measurement Range: 1 ohm to 100k ohms.
   4. Audio Oscillator: bandwidth 20 Hz to 20k Hz ±.5 dB at 0 dBm output. Output to be balanced. Oscillator to include adjustable output level over the range from -30 dBu to +10 dBu.
   5. Multimeter - Measurement range, DC to 20k Hz, 100 mV to 300 V, 10 ma to 10 A, dB.
   6. NTSC Test generator
   7. Real time analyzer with LED or CRT display. The unit shall meet the filter requirements of ANSI S1.11 Class III for one third octave filters.
   8. Ladders and scaffolding necessary to inspect elevated equipment, junction boxes, etc.

3.13 INSTRUCTION OF OWNER PERSONNEL

A. Provide 8 hours instruction to Owner designated personnel focusing on the use, operation and maintenance of the systems, scheduled as a minimum of two separate

sessions, by an instructor fully knowledgeable and qualified in system operation. The System Reference

B. Manuals should be complete and on site at the time of this instruction. Coordinate schedule of demonstration with Owner's Representative.

C. Video record all training sessions and compile a training video to be provided to the Owner on DVD.

D. Provide sign in sheet to document the attendee's presence.

E. If Contractor is not properly equipped to conduct Owner training on particular equipment, arrange for factory representatives of the equipment to be present to provide training at no additional cost to the Owner.

3.14 CLEANUP AND REPAIR

A. Upon completion of the work, remove refuse and rubbish from and about the premises. Leave areas and equipment clean and in an operational state. Repair any damage caused to the premises by the installation of systems at no cost to the Owner.

3.15 WARRANTY AND SERVICE

A. All equipment shall carry a minimum one-year warranty or manufacturer’s warranty whichever is greater.

B. A qualified representative of the contractor shall supervise the final connections and testing of the system(s) and it shall be subject to the final acceptance of the Architect/Engineer and Owner.

C. The contractor shall provide a warranty of the installed system(s) against defects in material and/or workmanship for a minimum period of one (1) year from the date of substantial completion, unless otherwise indicated. Any equipment or wiring shown to be defective shall be replaced, repaired, or adjusted free of charge. All labor and materials shall be provided at no further expense to the Owner.

D. The contractor shall make available a service contract offering continuing factory authorized service of the system(s) after the initial warranty period. This contract shall automatically renew each year at the owner’s discretion. Contractor will submit the cost of the renewal to the owner thirty (30) days prior to the expiration of the contract after the first year.

E. The system manufacturer shall maintain engineering and service departments capable of rendering advice regarding installation and final adjustment of the system.

3.16 DRAWINGS, MANUALS, AND TRAINING

A. As-built drawings and operating & maintenance manuals may be electronically transmitted in PDF format (preferred) or paper copies may be provided in quantities indicated in Division 1. Paper copies shall be printed 8-1/2”x11” copies of the manuals, organized including index tabs in a 3-ring black binder of sufficient size. Manuals that are shipped with the product WILL NOT be accepted as a substitute.

B. Upon completion of the installation, and prior to final inspection, the Contractor shall furnish as-built drawings. Reissuance of the Architect/Engineer drawings as the “as-

built" drawings WILL NOT be accepted.

C. In addition, the contractor shall furnish complete operating & maintenance manuals listing the manufacturer's name(s), including technical data sheets. Manuals shall include wiring diagrams to indicate internal wiring for each device and the interconnections between the items of equipment. Provide a clear and concise description of operation that gives, in detail, the information required to properly operate the equipment and system. Provide a parts list with manufacturer and model number for commonly replaced parts. Include complete instructions for inspection, testing, and maintenance of the system including wiring diagrams. Include manufacturer's operation, maintenance, and troubleshooting manuals. Include copies of manuals for each item that is powered or passive that impacts the system from an operational value or from a troubleshooting value. Also, copies of all programming sheets used to program the system. Maintain one (1) complete and up-to-date manual at the contractor's place of business for the life of the system.

D. All cables shall have both ends labeled and included in the as-built documentation. All cable paths and wiring methodology shall be documented.

E. The Contractor shall conduct formal on-site training sessions. The sessions shall be conducted by the contractor. The personnel conducting the training shall have the proper qualifications to conduct said training. Provide documented general instructions as follows:
   1. Provide Instruction to the maintenance personnel to include the location, inspection, maintenance, testing, and operation of all system components. Provide a minimum of one (1) hour per system.
   2. Provide instruction to the designated users on the operation of the system(s) and how to utilize the system to their best benefit. Provide a minimum of two (2) hours per system.
   3. A log of each attendee of the training shall be included with the final documentation. Each attendee shall print and sign their name and include their email address and phone number as a record of their attendance.
   4. The individual conducting the training shall provide their direct contact information, including but not limited to, phone number and email address, for direct contact from anyone involved in the training.

END OF SECTION

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SECTION 27 51 40

INTERCOM COMMUNICATION SYSTEM

PART 1 GENERAL

1.1 WORK INCLUDES

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1, apply to this Section.

B. Refer to Intercom System Schedule on plan for part numbers and additional information.

C. Furnish and install all equipment, accessories, cabling, devices, and materials in accordance with the project specifications and drawings to ensure a fully operational intercom, master clock, secondary clock, and class change time tone communication system of the highest quality.

D. Equipment specified herein is designed to provide specific functional and operational characteristics. It is the responsibility of the Intercom System Contractor to provide all features and functions as outlined in these specifications.

E. It shall be the responsibility of the Electrical contractor to provide and install all conduit systems, standard electrical boxes, and operating power for the communication system as outlined on the project drawings.

F. The Intercom Communication System Contractor (The Contractor) shall coordinate all system requirements with and provide special back boxes to the Electrical Contractor prior to installation of conduit.

G. Provide testing, as described in Part 3, for all requirements shall be performed with all cable runs and wiring devices in place.

H. Provide a service contract and warranty as outlined in Part 3 of these specifications.

I. Provide all documentation and training as outlined in these specifications.

1.2 RELATED SECTIONS

A. Section **26 00 00 – Electrical**.

B. Section 27 05 00 - General Communication Systems Requirements.

1.3 CODES AND REGULATIONS

A. Perform all work in strict accordance with the requirements and recommendations stated in the codes and standards except when requirements are exceeded by the contract documents.

B. The equipment, materials, and installation shall conform to the latest version of all applicable codes, standards, and regulations of authorities having jurisdiction including the following:
   1. NFPA 70, National Electrical Code.

2. NFPA 101, Code for Safety to Life from Fire in Buildings and Structures.
3. FCC Rules, Part 76.
4. UL 50, Enclosures for Electrical Equipment.
5. All applicable parts will be FCC Class B approved.
6. All equipment, cable, devices, and accessories provided shall be listed and labeled by Underwriters Laboratories, Inc. for the intended use under the latest appropriate testing standard.
7. Americans with Disabilities Act.
8. Texas Accessibility Standards.
9. International Building Codes (IBC).
10. State and Local Building Codes with Amendments.
11. All requirements of the local Authority Having Jurisdiction (AHJ).

1.4 SUBMITTALS

A. Submittal procedures: See Section 27 05 00.

B. Submit a complete submittal package within 30 calendar days after award of this work for approval. Equipment is not to be ordered without approval. Partial submittals are not acceptable for review. Each submittal shall include a dated transmittal.

C. Submittal may be electronically transmitted in PDF file format (preferred) or paper copies may be provided in quantities indicated in Division 1. Paper copies shall be organized including index tabs in a 3-ring black binder of sufficient size.

D. Quality Assurance Submittal:
1. Letter from Intercom Equipment Manufacturer stating that the Contractor is an Authorized Factory Distributor for the area where the project is located.

E. Product Data Submittal including special boxes, cable, and other material as requested by the Architect including:
1. A cover sheet with the name and location of the project, the name, address, and telephone number of the Contractor, and the name, address, and telephone number of the submitting sub-contractor. Include on or after the cover sheet sufficient space for review stamps.
2. An indication of any deviations from Contract Document requirements, including variations and limitations. Show any revisions to equipment layout required by use of selected equipment.
3. A product data index and complete equipment list including for each product submitted for approval the manufactures name and part number, including options and selections.
4. Cut-sheets or catalog data illustrating the physical appearance, size, function, compatibility, standards compliance, and other relevant characteristics of each product on the equipment list. Indicate by prominent notation (an arrow, circle, or other means) on each sheet the exact product and options being submitted.
5. Submit design data, when the scope of work requires, including calculations, schematics, risers, sequences, or other data.
6. Any resubmittal shall include a complete revised equipment list and any product data that is revised.

F. Submit shop drawings locating all components of the intercom system and indicating circuit routing, cable type, and gauge. Shop or coordination drawings shall include information that will allow to the Contractor to coordinate interdisciplinary work and when necessary guide the manufacturer or fabricator in producing the product. Shop

or coordination drawings shall be specifically prepared to illustrate the submitted portion of work, this may require diagrams, schedules, details, and accurate to scale equipment and device layouts prepared using a CAD or BIM engineering drawing program.

1.5 QUALIFICATIONS OF A PROPOSED CONTRACTOR

A. Proposed contractors who do not currently possess the necessary qualifications, trained and experienced personnel, financial capacity, and meet the other requirements herein described will be disqualified.

B. The proposed contractor, as a business entity, shall be an authorized distributor and designated representative of the equipment manufacturer, with full warranty privileges. The proposed contractor shall have been actively engaged in the business of selling, installing, and servicing commercial building commercial communication systems for a period of at least 5 years.

C. Recently formed companies are acceptable only if specific pre-approval is requested, and granted by the Architect/Engineer, based on experience of key personnel, current and completed projects, and all licensing requirements are met 10 working days prior to the contract proposal date.

D. The proposed Contractor shall have an office within 150-miles of the job site, staffed with trained technicians who are qualified and licensed to supervise the installation, to be responsible that the system is installed as submitted, to conduct system start up and perform a 100 percent operational audit of all installed devices, to instruct the Owners representatives in the proper operation of the system, and to provide service throughout the warranty period. The contractor shall be capable of dispatching technicians to repair a system within six hours of a service request.

E. The proposed contractor shall be fully experienced in the design and installation of the type of system herein specified, and shall furnish with the contract proposal an itemized list of the installations of the type specified herein. The list shall include the name of the project, date of completion, the amount of the contract, the name, and telephone number of a qualified person to contact for reference. This list must contain at least two (2) projects within a 150-mile radius of the school district to allow school administration officials to visit the job site for review of the system installation and service. Each reference project listed must utilize equipment by the same manufacturer as the proposed system.

F. The Contractor shall employ factory-trained technicians capable of supporting the maintenance of the system. No contract employees are allowed unless they have been to the factory service school within the last 18 months. A certificate of this training shall be provided with the contractors' submittal.

G. The Proposed Contractor shall not have any grievances or complaints of record regarding workmanship, code compliance, or service response. A Proposed Contractor that has any prior finding(s) of a code violation or has any litigation in process concerning the installation of a communication system is unacceptable.

H. The ability of a proposed Contractor to obtain plans and provide a performance bond shall not be regarded as the sole qualification of the Contractors' competency and responsibility to meet the requirements and obligations of the contract.

I. The Builder shall be satisfied that a proposed Contractor meets all the requirements expressed herein before including the Contractor's proposal in the project.

J. The Owner may investigate, as they deem necessary to determine the ability of the proposed Contractor to perform the work. The proposed Contractor shall furnish to the Owner with any information or data requested for this purpose.

K. The Owner reserves the right to reject any contract proposal if the evidence submitted, or their investigation, fails to indicate that the Contractor is qualified to fulfill of any part of the contract or to complete the work contemplated therein.

L. The Owner reserves the right to reject the proposal of any Contractor who has previously failed to perform properly, or complete on time, contracts of a similar nature.

PART 2 PRODUCTS

2.1 GENERAL

A. Refer to Intercom System Schedule on plan for part numbers and additional information.

B. Provide only materials that are new, of the type and quality specified. All like devices provided shall be of the same manufacturer and model number.

C. All basic equipment for which there are Underwriters' Laboratories Standard requirements shall be listed by Underwriters' Laboratories and be so labeled, or shall conform to their requirements, in which case, certified statements to the effect shall be furnished by the manufacturer with a copy of an examination report by a recognized laboratory acceptable to the Local Authority Having Jurisdiction.

D. All equipment and components shall be installed in strict compliance with manufacturers' recommendations and the requirements of the components UL listing. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, electrical requirements, cable types, and physical equipment sizes, etc., before beginning system installation.

E. All date keeping hardware, firmware, and software provided shall be fully compliant with the calendar year designated in four-digit date format. Any time equations must function normally, leap year, and daylight savings time must be supported.

F. All equipment shall be new and shall be the latest product of a manufacturer of established reputation and experience of quality electronic equipment. Model numbers indicate current equipment types; if later models exist, the Contractor shall provide those. All like devices shall be of the same manufacturer and model number. The manufacturer shall have supplied similar apparatus to comparable installations rendering satisfactory service for at least three (3) years.

G. It is the responsibility of the Intercom Communication System Contractor to provide all features and functions as outlined in these specifications. The intercom shall accept standard DTMF signals from the building telephone system through an analog port.

H. All wire shall be UL listed for audio/video applications. Follow the manufacturer's instructions. All wire exposed in attic spaces shall be rated non-conduit per NEC.

I. All cable shall have labels on both ends utilizing self-laminating, flexible vinyl film and non-smear nylon marking pens. Utilize Tyton Corporation part number RO175 Rite-On labels and part number FTP1 nylon marking pens or equivalent.

J. All equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place (e.g., speakers shall not be supported solely by suspended ceilings). Fasteners and supports shall be adequate to support the required load.

K. Only equipment devices have been shown on the contract drawings. Specific wiring between equipment has not been shown.

L. The installation shall be subject to approval, inspection, and test of the Architect/Engineer.

2.2 ACCEPTABLE MANUFACTURERS

A. Descriptions and details, acceptable manufacturers' names listed, and specific manufacturer and model number items indicated in the plans and specifications shall establish a standard of quality, function, and design. Manufacturers and model numbers listed "no exceptions" shall not be substituted without specific notice in an addendum. Otherwise, where a specific manufacturer's product is indicated, products of other manufacturers listed as acceptable may be submitted for approval based on the substitute product being, in the opinion of the Engineer, of equivalent or better quality than that of the product specified.

B. Proposed contractors wishing to propose any product substitution must do so in writing to the specifying authority at least ten (10) days prior to the proposal opening.

C. For manufacturers equipment or models other than that specified, the proposed contractor shall supply proof that such substitute equipment equals or exceeds the features, functions, performance, and quality of the specified equipment. Proposals must include detailed information showing all deviations from the system as specified.

D. Substitute products for which the proposed contractor does not obtain prior approval will not be considered acceptable for this project. Final approval of alternate products shall be based on the decision of the Owner and Architect. Prior approval to make a proposal for this project does not automatically ensure products will be an acceptable equivalent.

E. It is the responsibility of the Contractor to provide all features and functions as outlined in these specifications. The functions and features specified are vital to the operation of this facility; therefore, inclusion in the list of acceptable manufacturers does not release the contractor from strict compliance with the requirements of this specification.

F. The model numbers used are those of Dukane Corporation CareHawk (Travis Grade Center and Greenville MS) and Bogen Communications, Inc (LP Waters). This shall constitute the quality and performance of the equipment to be furnished, no exceptions.

2.3 INTERCOM AND PUBLIC ADDRESS SEQUENCE OF OPERATION

A. Each classroom shall be equipped with a call button and an intercom ceiling speaker with a station call number.

B. Each office and special use area (conference room, gym, cafeteria, library, etc.) shall be equipped with intercom ceiling speaker(s) with a station call number.

C. Common zone intercom speakers shall serve all corridors, passageways, and janitors' closets.

D. Zone exterior speakers separately.

E. The system shall allow the classroom call switch to place a normal call by pressing the call button once. It shall be possible to place an emergency call by pressing the call button three times in quick succession.

F. All speakers: classroom, office, corridor, exterior, gymnasium, cafeteria, and common areas shall produce clear human voice reproduction at 10 dBA over fully occupied ambient noise levels minimum (i.e. corridors at class change) but never less than 65 dBA or more than 110 dBA throughout all normally occupiable areas.

G. Provide as indicated on plans an Intercom Administrative Phone Desksets "AS" with digital readout to provide the following functions:
   1. The digital readout displays shall identify incoming calls by their designated numbers. The display shall show visually, in the order received, three (3) calls at a time. Emergency calls shall override normal calls and shall annunciate with the letters "EMER" and the calling station number. There shall be an audible indication of incoming intercom calls. Emergency calls shall initiate a distinctive audible alert and be indicated on the display.
   2. Provide facilities for answering calls registered in the display by pressing a single "response" button on an authorized administrative telephone.
   3. Provide the capability to broadcast all-call or zoned intercom announcements and class change time tones over all interior, exterior, and corridor speakers. Zone exterior speakers separately.
   4. The system shall provide facilities for calling a staff (classroom) station or making page announcements from any administrative system telephone.

H. The system shall provide facilities for calling a staff (classroom) station by dialing the station number. User programmable room station numbers for any combination of 2 to 4 numeric digits.

I. The central microprocessor control equipment shall be of modular design, expandable to 250 stations. All programming shall be alphanumerical menu driven. The system shall be equipped with self-diagnostics.

J. The system shall provide the capability of assigning speaker locations to any one or more of the eight (8) software programmable zones for zone paging or time signal reception.

K. Systems amplifiers shall be capable of providing sufficient power for emergency paging of all speakers with a 30 percent reserved capacity for future expansion.

L. System central control equipment shall be Underwriters Laboratory listed under Commercial Audio Systems and Accessories UL 813 and installed in a 19" rack cabinets and located where shown on the drawings or as directed by the Architect.

M. Provide an Uninterruptible Power Supply (UPS) with sufficient standby battery capacity to operate the intercom clock system without AC power for two hours of

normal operation (no announcements) and thirty minutes of all-call announcement operation (full load) at the end of this period.

2.4 TELEPHONE SYSTEM INTERFACE FUNCTIONS

A. The functions described below are accomplished through the connection of the intercom system to an owner provided enrollment of the analog telephone adapter to the building telephone system and program a designated station number to allow each telephone to access this port.

B. In order for these functions to operate, the Owner should provide licensing and telephone system enrollment for the Analog Telephone Adapter for connection to the intercom DTMF port. If the Owner elects not to provide a telephone system with these capabilities, then provide a labeled intercom service jack at the main telephone backboard for future connection.

C. Any administrative system telephone shall be able to answer normal or emergency calls initiated from a classroom call button.

D. Any administrative system telephone shall be able to page on an all-call, and zone basis to any of the eight paging zones.

E. Any administrative system telephone shall be able to initiate an emergency announcement to all locations. Emergency announcements override all other programs.

F. Any administrative system telephone shall be able to initiate manual time tones to any combination of time zones.

G. Any administrative system telephone shall be able to initiate emergency evacuation and signal tones.

2.5 TELEPHONE SYSTEM INTERFACE FUNCTIONS (REQUIRES TELEPHONE ANALOG TELEPHONE ADAPTER PORT NOT IN CONTRACT.)

A. In order for these functions to operate, the Owner must provide licensing and system enrolment into the building telephone system for the below SIP Analog Telephone Adapter and programing it with a designated station number to allow each building system telephone set to access this port. If the Owner elects not to provide a telephone system with these capabilities, then provide a labeled intercom service jack at the main telephone backboard for future connection.

B. Provide one (1) Cisco SPA112 Two Port Phone Adapter, a SIP Analog Telephone Adapter (ATA) interface. This interface shall provide transparent access from the building telephone system to the intercom DTMF analog port. The intercom system shall feature a distinctive dial tone and DTMF touch tone recognition to provide this transparent interface.

C. Any administrative system telephone shall be able to answer normal or emergency calls initiated from a classroom call button.

D. Any administrative system telephone shall be able to page on an all-call, and zone basis to any of the eight paging zones.

E. Any administrative system telephone shall be able to initiate an emergency announcement to all locations. Emergency announcements override all other programs.

F. Any administrative system telephone shall be able to initiate manual time tones to any combination of time zones.

G. Any administrative system telephone shall be able to initiate emergency evacuation and signal tones.

2.6 EMERGENCY SIGNAL TONE OPERATION

A. Provide facility through both rack mounted switches and dial-up operation through the telephone system interface the ability to distribute various emergency signal tones through all intercom speakers. Verify exact requirements with Owner. Provide the following functions each with a distinctive signal:
   1. Take Cover (Hazardous Weather Conditions) European siren or similar.
   2. Evacuate (Hazardous Condition within Building) stutter tone or similar.
   3. Security Alert (Suspicious Person on Campus, keep students in class and lock doors) chime or similar.

2.7 COLOR OF DEVICE/WALL PLATES

A. Color of device/wall plates to be off-white, ivory, etc. to best match project light switches and electrical outlets, coordinate with the Electric Contractor.

2.8 CABLE

A. The Contractor shall provide and install new and unused ASTM bare solid copper conductor wire per ANSI/NEMA codes. Follow the manufacturer's instructions. All wire shall be UL listed for communication and control circuits.

B. All cable shall have labels on both ends utilizing self-laminating, flexible vinyl film and non-smear nylon marking pens. Utilize Tyton Corporation Part No. RO175 Rite-On labels and Part No. FTP1 nylon marking pens or equivalent.

C. Cabling between buildings shall be fully enclosed in rigid threaded conduit, including underground and over canopy installations. Cable used between buildings shall be rated for direct burial. Cable shall be moisture, abrasion, and crush resistant. Use shielded or unshielded cabling as recommended by the manufacturer. When recommended, shielded cable should be utilized to minimize electrical noise interference with signal transmission. All between building wiring shall be West Penn Wire Aquaseal or equivalent water blocked construction.

D. For RJ-45 modular cable system connections utilize data grade UTP eight conductor cabling, NEC type CM or MP, Category 6 minimum, at lengths up to 2700 feet using a single home run cable.

E. Each call button shall be wired with data grade Category 6 cable and punched down on 110 type blocks to allow flexibility for future equipment. Cable shall be NEC type CM or MP, West Penn Wire No. WP52995, 24 AWG, unshielded twisted pair, 4-pair - (8) conductor. Equivalent by Belden, Carol or Comtran.

F. Each speaker cable shall be NEC type CMR, West Penn Wire No. 291, 22 AWG, overall shielded, two (2) conductor, plus one (1) drain wire. Equivalent by Belden,

Carol, or Comtran.

G. Secondary clock wire shall be NEC type CMR, West Penn Wire No. 222, 20 AWG, two conductor unshielded, or equivalent by Belden, Carol, or Comtran.

H. Microphone cable runs shall be West Penn Wire No. 77291, NEC type CM, 22 AWG, 2 conductor twisted pair with 100% coverage foil shield and 24 AWG stranded drain wire.

I. Furnish an insulated #6 copper ground wire run from the amplifier to an earth ground, attached securely to the amplifier case, and terminated at each end to bare metal.

2.9 CABLE TIES

A. Nylon cable ties shall be furnished and installed to attach wire bundles to supports and for appropriate wire management as required.
1. Nylon wire tie, 3.9”, miniature - Panduit PLT1M-C or equivalent.
2. Nylon wire tie, 5.6”, miniature - Panduit PLT1.5M-C or equivalent.
3. Nylon wire tie, 11.4”, intermediate - Panduit PLT3I-C or equivalent.
4. Nylon wire tie, 14.6”, intermediate - Panduit PLT4I-C or equivalent.

2.10 CABLE (PLENUM RATED)

A. The Contractor shall provide and install new and unused ASTM bare solid copper conductor wire per ANSI/NEMA codes. Follow the manufacturer's instructions. All wire shall be UL listed for communication and control circuits. All wire exposed in attic spaces shall be plenum rated.

B. All cable shall have labels on both ends utilizing self-laminating, flexible vinyl film and non-smear nylon marking pens. Utilize Tyton Corporation Part No. RO175 Rite-On labels and Part No. FTP1 nylon marking pens or equivalent.

C. Cabling between buildings shall be fully enclosed in rigid threaded conduit, including underground and over canopy installations. Cable used between buildings shall be rated for direct burial. Cable shall be moisture, abrasion, and crush resistant. Use shielded or unshielded cabling as recommended by the manufacturer. When recommended, shielded cable should be utilized to minimize electrical noise interference with signal transmission. All between building wiring shall be West Penn Wire Aquaseal or equivalent water blocked construction.

D. For RJ-45 modular cable system connections utilize data grade UTP eight conductor cabling, NEC type CMP, Category 6 minimum, at lengths up to 2700 feet using a single home run cable.

E. Each call button shall be wired with data grade Category 6 cable and punched down on 110 type blocks to allow flexibility for future equipment. Cable shall be NEC type CMP or MPP plenum cable, West Penn Wire No. WP54854, 24 AWG, unshielded twisted pair, 4-pair - (8) conductor. Equivalent by Belden, Carol, or Comtran.

F. Each speaker cable shall be NEC type CMP plenum cable, West Penn Wire No. 25291, 22 AWG, overall shielded, two (2) conductor, plus one (1) drain wire. Equivalent by Belden, Carol, or Comtran.

G. Secondary clock wire shall be NEC type CMP, West Penn Wire No. 25222, 20 AWG, two conductor unshielded, or equivalent by Belden, Carol, or Comtran.

H. Microphone cable runs shall be West Penn Wire No. 25291, NEC type CMP plenum cable, 22 AWG, 2 conductor twisted pair with 100% coverage foil shield and 24 AWG stranded drain wire.

I. Furnish an insulated #6 copper ground wire run from the amplifier to an earth ground, attached securely to the amplifier case, and terminated at each end to bare metal.

2.11 CABLE TIES (PLENUM RATED)

A. HALAR Fluoropolymer cable ties shall be furnished and installed to attach wire bundles to supports and for appropriate wire management as required.
1. HALAR wire tie, 4.0”, miniature - Panduit PLT1M-C702 or equivalent.
2. HALAR wire tie, 7.4”, standard - Panduit PLT2S-C702 or equivalent.
3. HALAR wire tie, 11.6”, standard - Panduit PLT3S-C702 or equivalent.

2.12 CABLE ROUTING, INSTALLATION, AND SUPPORT

A. System wiring and equipment installation shall be in accordance with good engineering practices as established by the NEC and the TIA/EIA. Wiring shall meet all state and local electrical code requirements.

B. Cable pathways, conduit, and cable support systems shall be complete with bushings, de-burred, cleaned, and secure prior to installation of cable.

C. All wiring shall test free from opens, grounds, or shorts. All communication cable shall be supported from the building structure and bundled. Do not attach any supports to joist bridging or other lightweight members.

D. The support system shall provide a protective pathway to eliminate stress that could damage the cabling. The cable shall not be crushed, deformed, skinned, crimped, twisted, or formed into tight radius bends that could compromise the integrity of the cabling.

E. In all exposed areas such as gymnasiums, shops, field houses, janitors’ closets, or mechanical / electrical rooms all communication cable shall be fully enclosed in conduit.

F. Ring and String: For low voltage Class 2 devices, indoor use in non-corrosive environments, in non-fire rated fishable walls only, ring and string open cable placement may be utilized with a metal bracket/mounting plate with wing attachments in the drywall opening, provide in wall cable management where cable passes through metal studs and top plates, and a pull wire in lieu of an electrical back box and conduit stub. Mounting plate brackets shall be Caddy MP1S single gang or MP2S two gang for attachment to wall studs, and for cut-in Caddy MPLS single gang or MPLS2 two gang, no exceptions. Plastic or flimsy thin metal brackets are not acceptable.

G. In wall cable management for open cables may include, but shall not be limited to:
1. Arlington Industries SB series non-metallic stud bushings and 440# plastic snap-in bushings.
2. Caddy ESG series easy snap grommets.
3. Carlon Plenum-Gard plenum rated lightweight corrugated conduit.
4. Panduit MSG and CSM series cable stud managers and grommets.

H. Communication cables shall be run in conduit stubs from wall boxes to accessible areas above finished ceilings. Conduit shall be required only within walls and concealed spaces to provide access.

I. Provide bushings to protect the cable from damage for conduit ends, box openings, and passage through metal studs.

J. Communication cables shall be run in bundles above accessible ceilings and supported from building structure. Cabling shall be loosely bundled with cable ties randomly spaced at 30 to 48 inches on center, cable ties shall not be tight enough to deform cabling and shall not be used to support the cabling.

K. Communication cable must not be fastened to electrical conduits, mechanical ductwork/piping; sprinkler pipes, or routed to obstruct access to hatches, doors, utility access panels, or service work areas. Do not route cables through fire doors, ventilation shafts, grates, or parallel for more than four-feet with line voltage electrical conductors. Communication cables shall not be run loose on ceiling grid or ceiling tiles.

L. Support shall be provided by mounting appropriate fasteners that may be loaded with multiple cables. Provided that the weight load is carried by the support rod or wire, the support assembly may attach to the ceiling grid for lateral stabilization. The required support wires for the ceiling grid or light fixtures shall not be utilized. Any fastener attached to the ceiling grid shall not interfere with inserting or removing ceiling tiles. The cable pathway of supports must be positioned at least 12 inches above the ceiling grid.

M. All cabling shall be placed with regard to the environment, EMI/RFI interference, and its effect on communication signal transmission.

N. Do not route any data communication cable within two feet of any light fixture, HVAC unit, service access area, electric panel, or any device containing a motor or transformer.

O. Communication cable will not be installed in the same conduit, raceway, tray, duct, or track with line voltage electrical cable without a metallic barrier meeting NEC requirements.

P. Maximum cable pulling tension should not exceed 25 pound-force (110 N) or the manufactures recommendation, whichever is less.

Q. Any pulling compounds utilized must be approved by the cable manufacturer and shall not degrade the strength or electrical characteristics of the cable.

R. No terminations or splices shall be installed in or above ceilings.

S. Cable bends shall not be tighter that the manufacturer’s suggested bend radius.

T. Mount all equipment firmly in place such that vibration or jarring will not activate an alarm, supervisory, or trouble signal. Route cable in a professional, neat, and orderly installation.

U. All cable shall have a label on both ends utilizing self-laminating, flexible vinyl film and non-smear nylon marking pens. Utilize Tyton Corporation Part number RO175 Rite-On labels and Part number FTP1 nylon marking pens or equivalent.

V. Each cable run shall include a three-foot service loop with wire tie located in the ceiling above the control unit panel. This is to allow for future re-termination or repair.

W. Provide for adequate ventilation to all equipment racks and take precautions to prevent electromagnetic or electrostatic hum.

X. All conduit, ducts, track, and raceways shall be supported from the structure at industry standard intervals for the size specified, utilizing proper anchoring devices. Cable fill may not exceed the manufacturers' instructions for each type of support.

Y. Devices mounted on a drop ceiling shall feature a backbox fitted with a support hanger (Caddy #512 or #512A for deep boxes), or equivalent with independent drop wires to support the weight of the device.

2.13 TERMINATION PRACTICES

A. Strip back only as much cable jacket as required to terminate.

B. Preserve wire twists as closely as possible to point of termination (0.5" maximum) to keep signal impairment to a minimum.

C. Avoid twisting cable jacket during installation.

2.14 BUSHINGS

A. Provide a plastic snap in bushing at each box opening, passage through a metal stud, and at the end of all open conduit stubs or sleeves prior to cable installation to protect the cabling from damage:
   1. Box openings - Thomas & Betts Knockout Bushing Series 3210, or equivalent.
   2. Metal stud passage - Thomas & Betts Twist It Bushing Catalog Number SB1216-SC, or equivalent.
   3. Conduit ends - Thomas & Betts Anti-Short Bushing Series 390 or Tite-Bite combination couplings Series 442, or equivalent.

2.15 J-HOOKS

A. Attachments for cabling support shall be spaced at approximately 48 to 60 inches on center. The cable bundle shall not be allowed to sag more than 12 inches mid-span between attachments. Attachments shall be sized as follows:
   1. Single cables or bundles up to four cables may be supported directly by the building structure.
      a. 2" bridle ring, Caddy #4BRT32 or equivalent.
         1) 3/4" J-Hook, Caddy #CAT12 or equivalent.
         2) 1-5/16" J-Hook, Caddy #CAT21 or equivalent.
         3) 2" J-Hook, Caddy #CAT32 or equivalent.
      b. Split bundles greater than 2" dia. or provide cable tray.

B. Do not mix different signal strength cables on the same J-Hook (i.e. intercom with telephone/data cable). Multiple J-Hooks can be placed on the same attachment point, up to the rated weight load of the attachment device.

2.16 COMMUNICATIONS CIRCUIT SURGE PROTECTION

A. Provide surge protection shall be provided for all exterior devices, communications service, or antenna entrance connections, and for each circuit that connects one

building to another (i.e. any other portion of a building complex not under one continuous roof) at both entry/exit points to prevent damage to equipment.

B. Each surge protector shall be mounted in a standard grounded metallic electric box or equipment backboard with a separate ground wire ran directly to the ground bus bar or equipment panel ground stud, do not daisy chain ground wires.

C. Surge protectors for low voltage communications signal and control circuits with a data rate from 200kbps to 2Mbps, nominal voltage as listed below AC or DC. Each module shall protect up to two pairs using hybrid design multi-stage SAD technology, shall be Ditek 2MHLP series field replaceable modules with MB Series mounting bases for one to five modules, or equivalent, model numbers as follows:
   1. 70 to 75 Volt circuit, 4 wire protector with base DTK-2MHLP75BWB.
   2. 48 to 50 Volt circuit, 4 wire protector with base DTK-2MHLP48BWB.
   3. 36 Volt circuit, 4 wire protector with base DTK-2MHLP36BWB.
   4. 24 Volt circuit, 4 wire protector with base DTK-2MHLP24BWB.
   5. 12 Volt circuit, 4 wire protector with base DTK-2MHLP12BWB.
   6. 0 to 6 Volt circuits, 4 wire protector with base DTK-2MHLP5BWB.

D. Surge protectors for Ethernet network runs rated up to Category 6A and operating at up to 10-Gigabit data rates. Each module shall protect up all four pairs using hybrid design multi-stage SAD technology which shall automatically reset to protect against multiple surges, Ethernet surge protectors shall be Ditek DTK-CAT6A series as follows:
   1. DTK-110RJC6APOE with 110 to RJ-45 connections with PoE.
   2. DTK-110C6APOE with 110 to 110 connections with PoE.
   3. DTK-110RJC6A with 110 to RJ-45 connections without PoE.
   4. DTK-110C6A with 110 to 110 connections without PoE.

E. Surge protectors for analog copper pair PSTN telephone service POTS/Trunk/C.O. line alarm Digital Communicator service lines shall be Ditek DTK-2MHTPWB, or equivalent, 2-pair/lines, maximum ring-up voltage 110V, includes base. In addition, At Telco service connection demarcation point locations servicing an alarm Digital Communicator, provide per line a Suttle Solutions Part # 635B-48, or equivalent, RJ31X surface mount jack with 8-conductor screw terminal board input and factory wired DATA and VOICE labeled, non-keyed RJ-45 output ports, with line seizure port shorting bar (1&4, 5&8) for alarm reporting device service.

2.17 FIRE STOPPING, DRAFT/NOISE STOPPING, PENETRATIONS, AND CORING

A. UL Listed fire stopping methods that match the fire rating of the wall or floor being penetrated are to be used at all fire barrier penetrations. Seal the interior of the conduit sleeve around the cables and around the outside of the sleeve on each side of the penetration with fire-stop caulk or putty, install according to the manufacturers' instructions.

B. All penetrations through fire rated walls or floors shall feature a suitable length of metal conduit. Hole diameter shall not exceed ½" larger than the conduit or sleeve to be installed. The hole shall be neatly cut, not oversize or irregular. Do not share wall/floor penetrations with ductwork, piping, line voltage electrical conduits, etc.

C. All gypsum board or plaster penetrations shall tool cut using an appropriate hole saw / mandrel or manufactured assembly.

D. Draft/Noise Stopping - All penetrations through non-rated walls shall include draft/noise stopping to minimize the transfer of air and sound between enclosed areas. This shall include but not limited to:
   1. Neatly cutting all non-rated wall penetrations with a 1" maximum clearance. All gypsum board or plaster penetrations shall be tool cut using an appropriate hole saw / mandrel or manufactured assembly. The hole shall be neatly cut and not oversize or irregular. Do not share wall penetrations with other types of ductwork, piping, line voltage electrical conduits, communications cabling, etc.
   2. Provide and install non-combustible mineral wool, fiberglass, cellulose insulation, caulk, and/or sealant as required. Seal the interior of conduit sleeves around the cables and around the outside of the sleeve on each side of the penetration with caulk or putty, install materials according to the manufacturers' instructions.

E. The Contractor shall make every effort to coordinate with the building Architect, Engineer, Builder, and Electrical Contractor to have sleeves placed in new construction so that later coring or drilling of building structural members will not be required. The Contractor must consult with the building Architect, Engineer, and Builder prior to drilling, coring, or sawing of any wall, floor, etc. All penetrations shall be made at approved, appropriate, locations.

F. Upon approval, the Contractor shall be required to supply all labor, equipment, tools, and materials to create any additional penetrations, and shall provide the sleeve, temporary and final fire stopping. Special care shall be taken not to stress, overheat, or penetrate any building support member. Coring shall be made with equipment appropriate for the dry penetration of concrete and block materials. Under no circumstances shall penetrations be made utilizing a chisel or percussion type equipment. Concrete, block, or plaster cores shall be made by dry saw/core methods only.

PART 3 EXECUTION

3.1 REVISION AND DEMOLITION OF THE EXISTING INTERCOM SYSTEM FOR RENOVATION

A. The intercom contractor shall be responsible for selective removal and rework of portions of the existing intercom system. This shall also include demolition of any devices and cable previously abandoned. Demolition shall include disconnection and removal of all devices not to be reused and off-site disposal, in a legal manner, of all materials not requested to be turned over to the Owner. Comply with government regulations pertaining to environmental protection, and disposal of materials and equipment. Do not burn any materials on the site.

3.2 EXAMINATION

A. Verify existing field conditions, circuiting arrangements, cabling, and devices served in areas as shown on the Drawings. Adjust all circuiting, cabling, and materials to be provided as required by job conditions.

B. Identify and verify abandoned equipment, wiring, and devices. All visible disconnected or abandoned devices and cabling shall be removed i.e. non-functional bells, speakers, call buttons, etc.

C. Drawings are based on casual field observation and existing record documents. Report discrepancies to the Engineer before disturbing existing installation.

D. The Contractor accepts the existing conditions when beginning demolition.

3.3 PREPARATION

A. Disconnect intercom devices in walls, floors, and ceilings as shown or required.

B. Provide temporary wiring and connections as required to maintain the operation of existing systems during construction.

C. When work must be performed on energized equipment or circuits, use personnel experienced in such operations. Verify phasing on existing equipment and coordinate new phasing before energizing revised service.

D. Remove, relocate, and extend existing installations to accommodate new construction as required.

E. Remove abandoned wiring to the source of the supply.

F. Remove exposed abandoned conduit, including abandoned conduit, brackets, stems, hangers, and other accessories above accessible ceiling finishes. Cut conduit flush with walls, floors, and patch surfaces.

G. Disconnect and remove abandoned devices. Remove abandoned devices if conduit servicing them is abandoned and removed. Provide blank cover for abandoned devices that are removed in masonry construction.

H. Disconnect and remove intercom devices and equipment serving equipment that has been removed.

I. Repair adjacent construction and finishes damaged during demolition and extension work.

J. Confirm with Owner/Architect regarding the handling and disposal/reuse of removed material, equipment, devices, etc.

3.4 OPERATION PRIOR TO COMPLETION

A. When the phasing of a project requires that intercom systems are operable in certain areas and the Owner needs to operate the equipment, such provisions shall be made by the contractor. The warranty period shall commence when the equipment is operated for the beneficial use of the Owner. Regardless of whether or not the equipment has or has not been operated, the Contractor shall properly clean the equipment, properly adjust, and complete all punch list items before final acceptance by the Owner. The date of acceptance and the start of the warranty may not be the same date.

3.5 OCCUPANCY ADJUSTMENTS

A. On-Site Assistance: Engage a factory-authorized service representative to provide on-site assistance in adjusting sound levels, resetting transformer taps, and adjusting controls to meet occupancy conditions. Provide up to three on-site assistance visits within one year of Substantial Completion.

3.6 TESTING, CERTIFICATION, WARRANTY, SERVICE

A. A factory trained service technician shall supervise the final connections and testing of the system and it shall be subject to the final acceptance of the Architect, Engineer, and local authorities. Testing shall ensure the following:
   1. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.
   2. Complete and functional system.
   3. Installed in accordance with manufacturer's instructions.

B. Upon completion of the testing, the manufacturer or his representative shall issue to the Owner a letter of certification attesting to the fact that he has tested and adjusted the system, that all components are properly installed and free of defects, and that the system is in compliance with this specification.

C. The contractor shall provide a warranty and service contract for the installed system. The warranty shall be against defects in material or workmanship for a period of one (1) year from the date of substantial completion. Any equipment or wiring shown to be defective shall be replaced, repaired, or adjusted free of charge. All labor and materials shall be provided at no expense to the Owner. All equipment will carry a one year warranty or manufacturer's warranty whichever is greater.

D. The service contract shall provide a minimum of the following:
   1. Diagnostics of the system should a problem occur.
   2. Reprogramming - Desired changes to class of service of any device or to the master clock schedule. The Intercom Communications System Contractor will provide this service with an unlimited number or frequency of the changes.
   3. The Communication Systems Contractor will provide service software upgrades to the system that become effective during the period of the service contract.

E. The contractor shall make available a service contract offering continuing factory authorized service of this system after the initial warranty period. This contract shall automatically renew each year at the owner's discretion. Contractor will provide the cost of renewal to the owner thirty (30) days prior to the expiration of the contract after the first year.

F. The system manufacturer shall maintain engineering and service departments capable of rendering advice regarding installation and final adjustment of the system.

G. The contractor shall provide a warranty and service contract for all system devices. The warranty shall be against defects in material or workmanship for a period of one (1) year from the date of substantial completion. Any equipment or wiring shown to be defective shall be replaced, repaired, or adjusted free of charge. All labor and materials shall be provided at no expense to the Owner. All equipment will carry a one year warranty or manufacturer's warranty whichever is greater.

H. The contractor shall provide a warranty and service contract for all newly installed system devices. The warranty shall be against defects in material or workmanship for a period of one (1) year from the date of substantial completion. Any new equipment or wiring shown to be defective shall be replaced, repaired, or adjusted free of charge. All labor and materials shall be provided at no expense to the Owner. All new equipment will carry a one year warranty or manufacturer's warranty whichever is greater.

3.7 DRAWINGS, MANUALS, AND TRAINING

A. The contractor shall furnish complete operating and maintenance manuals listing the manufacturer's name(s), including technical data sheets. Manuals shall include wiring diagrams to indicate internal wiring for each device and the interconnections between the items of equipment. Provide a clear and concise description of operation that gives, in detail, the information required to properly operate the equipment and system. Provide a parts list with manufacturer and model number for commonly replaced parts. Include complete instructions for the inspection, testing, and maintenance of the system. Include copies of all programming sheets used to configure the system.

B. The Contractor shall conduct formal on-site training sessions. Provide documented general instruction as follows:
   1. Provide instruction to the maintenance personnel to include the location, inspection, maintenance, testing, and operation of all system components. Provide a minimum of four (4) hours--two 2-hour sessions separated by a minimum of two weeks.
   2. Provide instruction to designated personnel on the functions and operation of the intercom and master clock system including emergency and service request procedures. Provide a minimum of four (4) hours--two 2-hour sessions separated by a minimum of two weeks.

END OF SECTION

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SECTION 28 05 00

GENERAL ELECTRONIC SAFETY AND SECURITY SYSTEM REQUIREMENTS

PART 1 – GENERAL

1.1 WORK INCLUDES

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1, apply to this Section.

B. Electronic Safety and Security Systems complete including renovation of existing systems to be expanded, including cabling, structured cabling systems, special backboxes, hardware and all other required devices and equipment.

C. Installation of system equipment per specifications.

D. Supply in a timely manner to the Electrical Contractor special backboxes for installation as required.

E. Coordinate conduits, raceways, power, and outlet requirements with the builder and the electrical contractor.

F. Furnishing of all required materials, equipment, tools, scaffolding, labor, and transportation necessary for the complete installation of the Electronic Safety and Security systems as shown on the drawings and as specified herein.

G. It is the intent of these specifications to provide complete installations although every item necessary may not be specifically mentioned or shown.

1.2 WORK TO BE INCLUDED BY THE ELECTRICAL CONTRACTOR IN BASE CONTRACT PROPOSAL

A. Provide utility services conduit as outlined on drawings as required.

B. All required conduit for accessibility to attic space.

C. Furnishing and installation of all required standard back boxes and conduit.

D. Installation of special back boxes supplied by Division 28 contractor(s).

E. Furnishing and installation of all floor boxes, surface raceways, and other wireways which are detailed or specified under Division 26.

F. Provide equipment-mounting boards as outlined on drawings.

G. Provide equipment grounding system, conductors, and bus bars as outlined in Division 26.

H. Provide 120-volt power and connections to equipment provided in Division 28.

I. Coordination of requirements of Division 28 with the Builder.

1.3 WORK NOT INCLUDED

A. Contractors shall make no agreement that obligates the Owner to pay any company providing communications, monitoring, or other services.

B. Contractors shall not make selection, purchase, or installation of interconnect instruments and/or equipment to be used on this project.

1.4 RELATED SECTIONS

A. The conditions of the Division 0, Division 1, Division 26 requirements, and the contract requirements that include the General Conditions and the Supplementary Conditions apply to work of this division.

B. Section 26 00 00 - Electrical.

1.5 CODES, STANDARDS, AND THEIR ABBREVIATIONS

A. General:
   1. Perform all work in strict accordance with the requirements and recommendations stated in the codes and standards except when requirements are exceeded by the contract documents.
   2. In addition to the requirements outlined in other sections of the specifications the following standards are imposed as applicable to the work in each instance:
      a. OSHA Safety and Health Regulations for Construction.
      b. NFPA No. 70 National Electrical Code.
      c. NESC National Electrical Safety Code, ANSI Standard C2.
      d. NEiS National Electrical Installation Standards.
      e. Local Codes and Ordinances.

B. Where local codes or practices exceed or conflict with the NEC, it shall be the Contractor`s responsibility to perform the work in accordance with the local code prevailing and local interpretations thereof. Any such additional work shall be performed at no additional cost to the Owner.

C. Materials and components shall be UL listed and labeled by Underwriters Laboratories, Inc. for the intended use under the latest appropriate testing standard.

D. The Contractor shall obtain all permits required to commence work. Upon completion of the Work, the Contractor shall obtain and deliver to the Owner's Representative a Certificate of Inspection and Approval from the State Board of Fire Underwriters, the City of Greenville, Texas, and other authorities having jurisdiction. The Contractor shall pay required permit fees.

1.6 ASSOCIATIONS AND STANDARDS

A. Associations and Standards:

ADA Standards: Americans with Disabilities Act.
ANSI: American National Standards Institute, 1430 Broadway; New York, NY 10018.
ASTM: American Society for Testing and Materials, 1916 Race Street; Philadelphia, PA 19103.
BICSI: (RCDD5 Standards), 8610 Hidden River Parkway, Tampa, FL 33637.

IEEE: Institute of Electrical and Electronics Engineers, 345 East 47th Street; New York, NY 10017.
ICEA: Insulated Cable Engineers Association, P.O. Box P, South Yarmouth, MA 02664.
NEC: National Electrical Code; NFPA No. 70.
NECA: National Electrical Contractors Association, Inc., 7315 Wisconsin Ave., Washington, DC 20014.
NEMA: National Electrical Manufacturers Association, 155 East 44th Street; New York, NY 10017.
NESC: National Electrical Safety Code, ANSI Standard C2.
NFPA: National Fire Protection Association, 60 Batterymarch Street; Boston, MA 02110.
OSHA: Occupational Safety and Health Administration, US Department of Labor; Washington, DC 20402.
TAS: Texas Accessibility Standards (TAS) Article 9102.
UL: Underwriters Laboratories, Inc., 333 Pfigsten Road; Northbrook, IL 60062.

B. Nothing in the Contract Documents shall be construed to permit work not conforming to these codes.

C. When two or more codes or standards are applicable to the same work, then the stricter code or standard shall govern.

D. The date of the code or standard is that in effect on the date of issue stated on the contract documents, except when a particular publication date is specified.

E. The Contractor shall comply with all State, Federal, NFPA, local codes and ordinances that may alter any part of the plans or specifications. The Contractor shall bear all costs for correcting any deficiencies due to non-compliance.

F. Where local codes and ordinances are not in writing or on record but local precedence have been set, the Owner shall pay for any additional resulting cost.

1.7 DEFINITIONS

A. Approval: It is understood that approval must be obtained from the Architect in writing before proceeding with the proposed work. Approval by the Architect of any changes, submitted by the Contractor, will be considered as general only to aid the Contractor in expediting his work.

B. The Builder: The primary contractor engaged to oversee the construction project. They may be technically described as a Construction Manager, General Contractor, Managing Construction Contractor, et cetera.

C. The Contractor: The Contractor engaged to execute the work included a particular section only, although he may be technically described as a Subcontractor to the Builder. If the Contractor, engaged to execute said work, employs Sub-Contractors to perform various portions of the work included under a particular Section, they shall be held responsible for the execution of this work, in full conformity with Contract Document requirements. The Contractor shall cooperate at all times and shall be responsible for the satisfactory cooperation of his Subcontractors with the other Contractors on the job so that all of the various sections and phases of work may be properly coordinated without unnecessary delays or damage.

D. The Electrical Contractor: The Electrical Contractor shall be engaged to execute the work included Division 26 only.

E. PDF file or .pdf: The filename extension associated with “Portable Document Format” files, which are multi-platform computer files in the ISO 32000-1:2008 open standard format developed and licensed by Adobe Systems. These files are a digital electronic representation of text, documents, images, and technical drawings in a font and color-accurate fixed-layout format that is platform and display resolution independent. PDF files can be electronically transmitted, viewed, or printed with various free PDF reader application programs, and may allow markups/comments with various PDF editing application programs.

F. Provide: Defined as requiring both the furnishing and installation of the item or facility indicated, complete in all respects and ready for operation unless otherwise specifically noted.

1.8 SCHEDULE OF VALUES, APPLICATION FOR PAYMENT

A. The Contractor shall in accordance with the General Provisions of the Contract, including General and Supplementary Conditions, and Division 1, complete a Schedule of Values and Applications for Payment. When a portion of this work separately funded, including donations or E-Rate, the contractor shall accommodate this in the Schedule of Values and Applications for Payment. For E-Rate eligible portions of this work, the contractor will be required to participate in the E-Rate program, comply with all E-Rate regulations, and provide billing as needed. The contractor shall coordinate with the Owner to file Form 471 or later edition and/or other forms as may be required.

1.9 WARRANTY

A. The Contractor shall warranty his work against defective materials and workmanship for a period of one year from date of acceptance of the job.

B. Neither the final payment nor any provisions in Contract Documents shall relieve the Contractor of the responsibility for faulty materials or workmanship.

C. He shall remedy any defects due thereto, and pay for any damage to other work resulting there from, which shall appear within a period of one year from date of substantial completion.

D. The Owner shall give notice of observed defects with reasonable promptness.

E. This Warranty shall not be construed to include the normal maintenance of the various components of the system covered by these specifications.

1.10 SITE VISIT

A. Before submitting a proposal, each proposed contractor shall examine all plans and specifications relating to the work, shall visit the site of the project, and become fully informed of the extent and character of the work required, including all required utilities.

B. No consideration will be granted for any alleged misunderstanding of the materials to be furnished or the amount of work to be done, it being fully understood that the tender of a proposal carries with it the agreement to all items and conditions referred

to herein, or indicated on the accompanying plans or required by nature of the site of which may be fairly implied as essential to the execution and completion of any and all parts of the work.

1.11 SUBMITTALS

A. Submittal procedures shall be per Division 1 - General Requirements.

B. Provide a complete submittal for each section as specified.

C. Submit complete submittal package within 30 calendar days after award of this work for approval. Equipment is not to be ordered without approval. Partial submittals are not acceptable for review. Each submittal shall include a dated transmittal.

D. A submittal may be electronically transmitted in PDF file format (preferred) or paper copies may be provided in quantities indicated in Division 1. Paper copies shall be organized including index tabs in a 3-ring black binder of sufficient size.

E. Each Product data submittal shall include:
   1. A cover sheet with the name and location of the project, the name, address, and telephone number of the Contractor, and the name, address, and telephone number of the submitting sub-contractor. Include on or after the cover sheet sufficient space for review stamps.
   2. An indication of any deviations from Contract Document requirements, including variations and limitations. Show any revisions to equipment layout required by use of selected equipment.
   3. A product data index and complete equipment list including for each product submitted for approval the manufactures name and part number, including options and selections.
   4. Cut-sheets or catalog data illustrating the physical appearance, size, function, compatibility, standards compliance, and other relevant characteristics of each product on the equipment list. Indicate by prominent notation (an arrow, circle, or other means) on each sheet the exact product and options being submitted.
   5. Submit design data, when the scope of work requires, including calculations, schematics, risers, sequences, or other data.
   6. When the contract requires extended product warranties, submit a sample of warranty language.
   7. Any resubmittal shall include a complete revised equipment list and any product data that is revised.

F. Submit shop or coordination drawings, when specified or the required for the scope of work, which include information that will allow to the Contractor to coordinate interdisciplinary work and when necessary guide the manufacturer or fabricator in producing the product. Shop or coordination drawings shall be specifically prepared to illustrate the submitted portion of work, this may require diagrams, schedules, details, and accurate to scale equipment and device layouts prepared using a CAD or BIM engineering drawing program.

G. The Engineer`s review of submittals is only for confirmation of adherence to design of project and does not relieve the Contractor of final responsibility for furnishing all materials required for a complete working system and in complying with the Contract Documents in all respects.

1.12 PROJECT RECORD DOCUMENTS

A. Upon submitting his request for final payment, he shall turn over to the Architect, for subsequent transmittal to the Owner revised plans showing "as installed" work.

B. In addition to the above, the Contractor shall accumulate during the jobs progress the following data in PDF file format (preferred) or paper copies to be turned over to the Architect for checking and subsequent delivery to the Owner:
   1. All warranties, guarantees, and manufacturer`s directions on equipment and material covered by the Contract.
   2. PDF file or paper copies of all Shop Drawing prints and CAD or BIM engineering drawing program files.
   3. Any software programs, data/programming files, passwords, special interface cables, or keys that may be needed to maintain or access equipment.
   4. Set of operating instructions. Operating instructions shall also include recommended maintenance and seasonal changeover procedures.
   5. Any and all other data and/or plans required during construction.
   6. Repair parts lists of all major items and equipment including name, address, and telephone number of local supplier or agent.
   7. The first page, or pages, shall have the names, addresses, and telephone numbers of the following:
   8. Builder and all Contractors.
   9. Major Equipment Suppliers
   10. Submit communication systems warranties.

1.13 TRAINING

A. Upon completion of the work and at a time designated by the Architect, provide formal training sessions for the Owner`s operating personnel to include location, operation, and maintenance of all Electronic Safety and Security systems equipment and systems.

B. See other sections for time requirements.

1.14 PLANS AND SPECIFICATIONS

A. The intent of the project drawings is to establish the types of systems and functions, but not to set forth each item essential to the functioning of the system.

B. Electrical drawings are generally diagrammatic and show approximate location and extent of work.

C. Install the work complete including minor details necessary to perform the function indicated. Provide Electronic Safety and Security systems (including all hook-ups) complete in every respect and ready to operate.

D. If clarification is needed, consult the Architect.

E. Review pertinent drawings and adjust the work to conditions shown. Where discrepancies occur between drawings, specifications, and actual field conditions, immediately notify the Architect for his interpretation.

F. The Architect reserves the right to make any reasonable change in the location of any part of this work without additional cost to the Owner.

1.15 PRODUCT SUBSTITUTIONS

A. Descriptions and details, acceptable manufacturers` names listed, and specific manufacturer and model number items indicated in the plans and specifications shall establish a standard of quality, function, and design. Manufacturers and model numbers listed "no exceptions" shall not be substituted without specific notice in an addendum. Otherwise, where a specific manufacturer`s product is indicated, products of other manufacturers listed as acceptable may be submitted for approval based on the substitute product being, in the opinion of the Engineer, of equivalent or better quality than that of the product specified.

B. Proposed contractors wishing to propose systems which differ in manufacturer, features, functions, or operating characteristics from those outlined in these specifications must do so in writing to the specifying authority at least ten (10) days prior to the proposal opening.

C. For manufacturers equipment or models other than that specified, the proposed contractor shall supply proof that such substitute equipment equals or exceeds the features, functions, performance, and quality of the specified equipment. Proposals must include detailed information showing all deviations from the system as specified and include relevant technical and cost data. This shall include a complete description of the proposed substitution, drawings, catalog cuts, performance data, test data, or any other data or information necessary for evaluation.

D. The Engineer will consider all such submittals and the Architect will issue an addendum listing items that the Engineer considers acceptable. Only such items as specified or approved as acceptable will be installed on this project.

E. Substitute products for which the proposed contractor does not obtain prior approval will not be considered acceptable for this project. Final approval of the alternate system shall be based on the decision of the Owner and Architect. Prior approval to make a proposal for this project does not automatically ensure the system will be an acceptable equivalent.

F. The Contractors' proposal represents that the contract proposal price is based solely upon the materials, equipment, and labor described in the Contract Proposal Documents (including addenda, if any) and that he contemplates no substitutions or extras.

G. The manufacturer of the proposed substitute unit shall provide samples for evaluation, when required, at no charge and non-returnable.

H. Requests for substitution are understood to mean that the Contractor:
   1. Has personally investigated the proposed substitution and determined that it is equivalent or superior in all respects to that specified.
   2. Will provide the same guarantee for the substitution that he would for that specified.
   3. Will, at no cost to the Owner, replace the substitute item with the specified product if the substitute item fails to perform satisfactorily.
   4. After Award of the Contract, substitutions will be considered only under one or more of the following circumstances:
   5. The substitution is required for compliance with subsequent interpretations of code or insurance requirements.

6. The specified product is unavailable through no fault of the Contractor.
7. The manufacturer refuses to warranty the specified products as required.
8. Subsequent information indicates that the specified product is unable to perform properly or to fit in the designated space.
9. In the Engineer`s sole judgment, the substitution would be in the Owner`s best interest.
10. Revisions to the electrical system caused by substitutions shall be under the supervision of the Architect, at a standard hourly rate charged by the Engineer. Charges from the Architect, Engineer and Electrical Contractor shall be paid by the Contractor originating the changes.

1.16 FUTURE USE CABLING

A. When cabling is installed for future use, it shall be identified with a tag of sufficient durability to withstand the environment involved.

B. Locations and Existing Conditions:
   1. Location and condition of any existing equipment or services, when shown, have been obtained from substantially reliable sources, are shown as a general guide only, without guarantees as to accuracy.
   2. The Contractor will examine the site, verify all requirements, service points, and availability of all services required to complete this project. No consideration will be granted for any alleged misunderstanding of the materials and labor to be provided as necessitated by nature of the site including those items that may be fairly implied as essential to the execution and completion of any and all parts of this project.

1.17 EXISTING ELECTRONIC SAFETY AND SECURITY SYSTEMS

A. The electronic safety and security contractor shall be responsible for selective demolition and renovations of the existing electronic safety and security systems, including demolition of any devices and cabling previously abandoned. Demolition shall include:
   1. Disconnection and removal of all electronic safety and security devices not to remain in service in walls, floors, and ceilings.
   2. Identification and verification of abandoned wiring and equipment. All disconnected or abandoned devices that are visible shall be removed, i.e. non-functional fire pulls, bells, speakers, signals, et cetera. Remove abandoned wiring to the source of the supply everywhere possible.
   3. Removal of exposed abandoned conduit and supports including brackets, stems, hangers, and other accessories located on walls and above accessible finished ceilings. Cut abandoned conduit flush with walls, floors, etc., and patch surfaces.
   4. Provide a blank cover for abandoned device backboxes that are impractical to remove from masonry construction without unnecessary damage.
   5. Confirm with Owner/Architect regarding the handling and disposal/reuse of removed material, equipment, devices, et cetera.
   6. Off-site disposal in a legal manner of all materials not requested to be turned over to the Owner. Comply with government regulations pertaining to environmental protection, and disposal of materials and equipment. Do not burn any materials on the site.
   7. Repair of any finishes or adjacent construction damaged during modification, extension, and demolition work.

1.18 EXAMINATION

A. Verify field conditions including existing systems, equipment models, configurations, circuiting arrangements, cabling, and devices. Adjust all circuiting, cabling, and materials to be provided as required by job conditions.

B. Project drawings are based on casual field observation and existing record documents when available, report any significant discrepancies to the Engineer before disturbing existing systems.

C. The Contractor accepts the existing conditions when beginning demolition.

1.19 IMPLEMENTATION

A. Verify phasing in regard to systems and coordinate before energizing any system.

B. When required during phases of construction to maintain existing systems in service in particular areas, provide temporary wiring and connections as necessary to accommodate construction.

1.20 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment in areas of renovation that are to remain or be reused.

1.21 OPERATION OF NEW EQUIPMENT PRIOR TO PROJECT COMPLETION

A. When the phasing of a project requires that electronic safety and security systems are operable in certain areas and the Owner needs to operate the equipment the contractor shall make such provisions. The warranty period shall commence on new equipment when it is operated for the beneficial use of the Owner. Regardless of whether or not the equipment has or has not been operated, the Contractor shall properly clean the equipment, properly adjust, and complete all punch list items before final acceptance by the Owner. In these cases, the date of acceptance and the start of the warranty may be different dates.

1.22 PROTECTION OF EQUIPMENT AND MATERIALS

A. The Contractor shall take such precautions as may be necessary to protect his apparatus from damage.

B. This shall include the creation of all required temporary shelters to protect any apparatus above the floor of the construction and the covering of apparatus in the completed building with tarpaulins or other protective covering.

C. Failure to comply with the above to the satisfaction of the Owner`s inspector will be sufficient cause for the rejection of the equipment in question and its complete replacement by the Contractor.

1.23 FINAL OBSERVATION

A. It shall be the duty of the Contractor to make a careful observation trip of the entire project, assuring themselves that the work on the project is ready for final acceptance before calling upon the Architect to make a final observation.

B. To avoid delay of final acceptance of the work, the Contractor shall have all necessary bonds, warranties, receipts, affidavits, et cetera, called for in the various articles of these specifications, prepared and signed in advance, together with a letter of transmittal, listing each paper included, and shall deliver the same to the Architect at or before the time of said final observation. The Contractor is cautioned to check over each bond, receipt, et cetera, before preparing for submission to verify that the terms check with the requirements of the specifications.

C. The following and other provision of Division 1 General Conditions will be required at time of final completion:
   1. Final clean up completed.
   2. All systems are fully operational, all material and devices installed.
   3. As built (as installed) drawings and operations manuals.

1.24 PROHIBITED MATERIALS

A. No new asbestos, lead, or materials containing these substances shall be permitted in this project. The Contractor shall consult the Architect concerning these materials if their presence is suspected. All work in or around existing asbestos or lead materials is at the sole risk of the Contractor and his personnel.

1.25 CUTTING AND PATCHING

A. Notify the Builder sufficiently ahead of construction of any floors, walls, ceiling, roof, et cetera, of any openings that will be required for his work.

B. The Contractor shall see that all sleeves required for his work are set at proper times to avoid delay of the job.

C. All necessary cutting of walls, floors, partitions, ceilings, et cetera, as required for the proper installation of the work under this Contract shall be done at the Subcontractor or at the Subcontractor`s expense in a neat and workmanlike manner, and as approved by the Architect.

D. Patching of openings and/or alterations shall be provided by the Electronic Safety and Security Subcontractor or at the Subcontractor`s expense in an approved manner.

E. No joists, beams, girders, or columns shall be cut by any Contractor without first obtaining written permission of the Architect.

F. All openings in firewalls and floors shall be completely sealed after installation for a completely airtight installation. Sealing material shall be non-combustible and UL approved. The installed sealing assembly shall not cause the fire rating of the penetrated structure to be decreased.

G. All openings in exterior walls shall be sealed watertight.

H. Seal voids around conduits penetrating fire-rated assemblies and partitions using fire stopping materials and methods in accordance with NFPA and local codes.

1.26 MANUFACTURERS` INSTRUCTIONS

A. All equipment and devices shall be installed in accordance with the drawings and specifications, manufacturer`s instructions, and applicable codes.

B. Where specifications call for installation of a product to be in accordance with manufacturer`s instructions and/or where manufacturer`s instructions are required for installation of a product, it shall be the contractor`s responsibility to obtain the necessary applicable manufacturer`s instructions and install the product in accordance with the manufacturer`s instructions.

C. It shall be the Contractor`s responsibility to install all equipment, materials, and devices shown on the plans and as called out in these specifications even if manufacturer`s instructions are absolutely unattainable.

1.27 INSTALLATION

A. Cooperation with trades of adjacent, related or affected materials or operations, and or trades performing continuations of this work under subsequent contracts are considered a part of this work. In order to effect timely and accurate placing of work and to bring together, in the proper and correct sequence, the work of such trades, including work provided under a Division 1 allowance.

B. The Electronic Safety and Security Contractor shall coordinate installation of the Electronic Safety and Security systems with the Builder, Electrical, Mechanical, and Plumbing Contractors to ensure a complete working system for the Owner.

C. Where required for accessibility all conduit and boxes for all Electronic Safety and Security systems shall be provided by the Electrical contractor as specified, including systems in Division 28, any and all allowances shall be included. Normally low voltage wiring shall run open and supported in accessible attic space. All low voltage wiring in exposed areas such as gyms, stages, shops, and field houses shall be enclosed in conduit. Coordinate with, and verify with Division 26 to provide required conduit and boxes at locations and heights as required.

D. Conduit, innerduct, track, or raceway shall conceal and protect wiring in exposed areas, within walls, through in- accessible areas, floors, chases, under slab, crawlspaces, or underground.

E. All conduit, duct, track, and raceway runs shall be spaced apart to allow for maintenance, such as the installation of couplings, without disturbing adjacent pathways.

F. All work must be performed by workers skilled in their trade. The installation must be complete whether the work is concealed or exposed.

G. Provide stainless screw/bolt hardware wherever stainless devices are used and in potentially wet areas.

H. Coordinate the actual locations of devices and outlets and equipment with building features and mechanical equipment as indicated on architectural, structural, and mechanical drawings. Review with the Architect any proposed changes in outlet or equipment location. Relocation of devices, before installation, of up to 3 feet from the position indicated, may be directed without additional cost. Remove and relocate outlets placed in an unsuitable location when so requested by the Architect.

PART 2 – PRODUCTS

2.1 NOT APPLICABLE

PART 3 – EXECUTION

3.1 NOT APPLICABLE

END OF SECTION

SECTION 28 13 27

BUILDING ACCESS CONTROL SYSTEM

PART 1 - GENERAL

1.1 WORK INCLUDES

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1, apply to this Section.

B. Provide all required devices to revise and expand the existing Building Access Control System that shall serve the areas as indicated in the specifications and on the project drawings.

C. Provide all equipment, materials, labor, software, licensing, supervision, and services necessary for or incidental to the installation of a card reader operated door and gate access control system, as shown or indicated, on the drawings and as specified.

D. This access control system shall provide for controlled entry doors to be released when a valid credential card is presented to the credential card reader. This system shall monitor for unauthorized entry attempts, control access to the building, and log entry information. The system shall in no way impede free emergency exit from the building. Exit from the building shall not require special effort or knowledge.

E. It shall be the responsibility of this Contractor to obtain all required approvals and certifications from authorities having jurisdiction.

F. It shall be the responsibility of the Electrical Contractor to provide and install all conduit systems, standard electrical boxes, and operating power for the building access systems as outlined on the project drawings. This Contractor shall coordinate all system requirements with and provide special back boxes to the Electrical Contractor prior to installation of conduit.

G. The electrical contractor shall provide 120-volt power as required to the security system through separate dedicated branch circuits, maximum 20 amperes each. Each such circuit shall be labeled at the power distribution panel as ACCESS CONTROL. The location of all circuit breakers serving the system shall be posted in the control unit cabinets. Each cabinet shall be grounded securely to the building grounding system.

H. Provide all testing, documentation, training, and warranty service as outlined in these specifications.

I. NOTE: All electric door locks shall be configured for fail-safe un-delayed egress operation and fail-secure to prevent unauthorized entry on loss of power.

1.2 RELATED SECTIONS

A. Section 26 05 34 - Provisions For Communication, Security & Safety Systems.

B. Section 27 10 30 - Data and Telephone Cable Plant.

C. Section 27 51 40 - Intercom Communication System

D. Section 28 05 00 - General Electronic Safety and Security System Requirements.

E. Section 28 21 23 - Video Surveillance System

1.3 CODES AND REGULATIONS

A. Perform all work in strict accordance with the requirements and recommendations stated in the codes and standards except when requirements are exceeded by the contract documents.

B. The equipment, materials, and installation shall confirm to the latest version of all applicable codes, standards and regulations of authorities having jurisdiction including the following:
NFPA 70, National Electrical Code
NFPA 72, National Fire Alarm and Signaling Code
Americans with Disabilities Act
Texas Accessibility Standards
International Building Codes (IBC)
Local and State Building Codes
All requirements of the local Authority Having Jurisdiction (AHJ)

1.4 SUBMITTALS

A. Submittal procedures: See Section 28 05 00.

B. Submit a complete submittal package within 30 calendar days after award of this work for approval. Equipment is not to be ordered without approval. Partial submittals are not acceptable for review. Each submittal shall include a dated transmittal.

C. Submittal may be electronically transmitted in PDF file format (preferred) or paper copies may be provided in quantities indicated in Division 1. Paper copies shall be organized including index tabs in a 3-ring black binder of sufficient size.

D. Quality Assurance Submittal:
a. Letter from manufacturer stating that the Contractor is an Authorized Factory Distributor for the area where the project is located.
b. The Contractor and Manufacturer shall supply sufficient information to indicate that the proposed system is based on the latest hardware, software technology available.
c. Current copy of the Contractors Electronic Access Control Device Security Company license issued by the Texas Department of Public Safety.
d. Calculations for device circuit current drop and battery backup calculations.

E. Product Data Submittal including special boxes, cable, and other material as requested by the Architect including:
1. A cover sheet with the name and location of the project, the name, address, and telephone number of the Contractor, and the name, address, and telephone number of the submitting sub-contractor. Include on or after the cover sheet sufficient space for review stamps.
2. An indication of any deviations from Contract Document requirements, including variations and limitations. Show any revisions to equipment layout required by use of selected equipment.

3. A product data index and complete equipment list including for each product submitted for approval the manufactures name and part number, including options and selections.
4. Cut-sheets or catalog data illustrating the physical appearance, size, function, compatibility, standards compliance, and other relevant characteristics of each product on the equipment list. Indicate by prominent notation (an arrow, circle, or other means) on each sheet the exact product and options being submitted.
5. Submit design data, when the scope of work requires, including calculations, schematics, risers, sequences, or other data.
6. Any resubmittal shall include a complete revised equipment list and any product data that is revised.

F. Submit shop drawings locating all components of the system, indicating circuit routing, cable type, and gauge. Shop or coordination drawings shall include information that will allow to the Contractor to coordinate interdisciplinary work and when necessary guide the manufacturer or fabricator in producing the product. Shop or coordination drawings shall be specifically prepared to illustrate the submitted portion of work, this may require diagrams, schedules, details, and accurate to scale equipment and device layouts prepared using a CAD or BIM engineering drawing program.

1.5 QUALIFICATIONS OF A PROPOSED CONTRACTOR

A. Proposed contractors who do not currently possess the necessary qualifications, trained and experienced personnel, financial capacity, and meet the other requirements herein described will be disqualified.

B. The Contractor shall be currently licensed under the Texas Department of Public Safety as an Electronic Access Control Installer Company to sell, install, and service private security systems.

C. The proposed contractor, as a business entity, shall be an authorized distributor and designated representative of the security panel manufacturer, with full warranty privileges, and shall have been actively engaged in the business of selling, installing, and servicing commercial building alarm systems for a period of at least 5 years.

D. Recently formed companies are acceptable only if specific pre-approval is requested, and granted by the Architect/Engineer, based on experience of key personnel, current and completed projects, and all licensing requirements are met 10 working days prior to the contract proposal date.

E. All employees working on the project must be registered alarm system installers. The Contractor shall employ factory trained technicians capable of supporting the maintenance of the system. No contract employees are allowed unless they have been to the factory service school within the last 18 months. A certificate of this training shall be provided with the Contractors submittal.

F. The contractor shall employ full time local technicians and installers. The manufacturer shall maintain a full-time factory employed service staff for product support and service.

G. The proposed Contractor shall have an office within 150-miles of the job site, staffed with trained technicians who are qualified and licensed to supervise the installation, to be responsible that the system is installed as submitted, to conduct system start up

and perform a 100 percent operational audit of all installed devices, to instruct the Owners representatives in the proper operation of the system, and to provide service throughout the warranty period. The contractor shall be capable of dispatching technicians to repair a system within six hours of a service request.

H. The proposed contractor shall be fully experienced in the design and installation of the type of security system herein specified and shall furnish with the contract proposal an itemized list of the installations of the type specified herein. The list shall include the name of the project, date of completion, the amount of the contract, the name, and telephone number of a qualified person to contact for reference. This list must contain at least two (2) projects within a 150-mile radius of the project to allow the owner to visit the job site for review of the system installation and service. Each reference project listed must utilize equipment by the same manufacturer as the proposed system.

I. The Contractor shall employ factory-trained technicians capable of supporting the maintenance of the system. No contract employees are allowed unless they have been to the factory service school within the last 18 months. A certificate of this training shall be provided with the contractors' submittal.

J. The Proposed Contractor shall not have any grievances or complaints of record regarding workmanship, code compliance, or service response. A Proposed Contractor that has any prior finding(s) of a code or license violation or has any litigation in process concerning the installation of a communication system is unacceptable.

K. The ability of a proposed Contractor to obtain plans and provide a performance bond shall not be regarded as the sole qualification of the Contractors' competency and responsibility to meet the requirements and obligations of the contract.

L. The Builder shall be satisfied that a proposed Contractor meets all the requirements expressed herein before including the Contractor's proposal in the project.

M. The Owner may investigate, as they deem necessary to determine the ability of the proposed Contractor to perform the work. The proposed Contractor shall furnish to the Owner with any information or data requested for this purpose.

N. The Owner reserves the right to reject any contract proposal if the evidence submitted, or their investigation, fails to indicate that the Contractor is qualified to fulfill of any part of the contract or to complete the work contemplated therein.

O. The Owner reserves the right to reject the proposal of any Contractor who has previously failed to perform properly, or complete on time, contracts of a similar nature.

PART 2 – PRODUCTS

2.1 GENERAL

A. The system provided shall be fully compatible and integrated with the Owners existing system hardware, software, credentials, and credential database.

B. Provide complete and satisfactorily operating Access Control System as described herein, using materials and equipment of types, sizes, ratings, and performances as

indicated. Use materials and equipment that comply with referenced standards and manufacturers' standard design and construction, in accordance with published product information. Coordinate the features of all materials and equipment so they form a functional system, with components and interconnections matched for optimum performance of specified functions.

C. The system and all components shall be tested and found suitable for the specified purpose as part of a commercial building security system by a nationally recognized approvals agency acceptable to the AHJ.

D. The control units, power supplies, batteries, subassemblies, software, firmware, and all cable, devices control units, power supplies, batteries, subassemblies, software, firmware, cable, and all accessories provided shall be listed and labeled by Underwriters Laboratories, Inc. for commercial security system use under the latest appropriate testing standard.

E. All date keeping hardware, firmware, and software provided shall be fully compliant with the calendar year designated in four-digit date format. Any time equations must function normally, leap year, and daylight savings time must be supported.

F. Only equipment devices have been shown on the contract drawings. Specific wiring between equipment has not been shown.

G. The system shall include but not be limited to all control units, power supplies, batteries, subassemblies, card sensors, software, firmware, and all cable, door release equipment, and all accessories required to provide a complete operating system.

H. All equipment and components shall be installed in strict compliance with manufacturers' recommendations and the requirements of the components UL listing. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, electrical requirements, cable types, and physical equipment sizes, etc., before beginning system installation. Refer to the manufacturers' riser / connection diagrams for all specific system installation/termination/wiring data.

I. All equipment and components shall be new, and the manufacturer's current model. All like devices shall be of the same manufacturer and model number.

J. All equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place (e.g., detectors shall not be supported solely by suspended ceilings). Fasteners and supports shall be adequate to support the required load.

2.2 RELATED WORK - NETWORK CONNECTIVITY

A. The system shall be utilizing the customer's existing Ethernet system backbone for all security devices communications.

B. No Ethernet cabling, network RJ-45 jacks, or patch cords are included in the scope of this Specification Section.

C. The Owner will provide this Contractor with a terminated network drop at security devices, and the required TCP/IP configuration settings: static IP address, domain, gateway, and subnet mask.

D. This contractor will program and test all access control system devices for connection to the network.

E. This contractor will provide complete programming of all device parameters in accordance with the Owners requirements.

F. For each building access control system intelligent door controller (network controller) panel requiring an Ethernet network connection, the Division 27 contractor shall provide a dedicated data drop located above the ceiling at the panel location. The building access control system contractor shall provide and install a conduit pathway from the top of the panel up to the ceiling space with plastic snap in bushings at each conduit end or transition used for this connection. The Division 27 contractor shall provide the patch cable, and the building access control system contractor shall route and connect the patch cable between the faceplate jack above the ceiling and the panel Ethernet network connection jack.

2.3 ACCEPTABLE BUILDING ACCESS CONTROL SYSTEM MANUFACTURER

A. Descriptions and details, acceptable manufacturers' names listed, specific manufacturers' model numbers indicated in the project plans and specifications, and other pertinent information herein are intended to establish minimum standards of quality, compatibility, functions, features, and performance of the equipment to be furnished. Manufacturers and model numbers listed "no exceptions" shall not be substituted without specific notice in an addendum. Otherwise, where a specific manufacturer's product is indicated, products of other manufacturers listed as acceptable may be submitted for approval based on the substitute product being, in the opinion of the Engineer, of equivalent or better quality than that of the product specified.

B. Proposed contractors wishing to propose any product substitution must do so in writing to the specifying authority at least ten (10) days prior to the proposal opening.

C. For manufacturers equipment or models other than that specified, the proposed contractor shall supply proof that such substitute equipment equals or exceeds the features, functions, performance, and quality of the specified equipment. Proposals must include detailed information showing all deviations from the system as specified.

D. Substitute products for which the proposed contractor does not obtain prior approval will not be considered acceptable for this project. Final approval of alternate products shall be based on the decision of the Owner and Architect. Prior approval to make a proposal for this project does not automatically ensure products will be an acceptable equivalent.

E. It is the responsibility of the Contractor to provide all features and functions as outlined in these specifications. The functions and features specified are vital to the operation of this facility; therefore, inclusion in the list of acceptable manufacturers does not release the contractor from strict compliance with the requirements of this specification

F. The manufacturers model numbers, functions, and features described in this specification section are those of the **Lenel•S2 Security** building access control system, this shall constitute the quality, compatibility, features, and performance of the equipment to be furnished, no exceptions. Any other proposed manufactures

devices or software must be pre-approved.

G. The access control system hardware shall be Mercury Security controllers located in a central location as shown on the contract drawings.

2.4 BUILDING ACCESS CONTROL SYSTEM INSTALLATION REQUIREMENTS

A. Contractors shall provide all material, labor, tools, and equipment required to perform the work described and make complete, safe, and functional systems.

B. Contractors shall pay for and acquire all permits and inspections required by controlling authority.

C. All work shall be installed in accordance with state, local, and national codes.

D. Contractors shall warrant his workmanship and materials for a period of one year from the date of acceptance upon completion of the project.

E. All work shall be done by mechanics skilled in the particular trade involved, under responsible supervision.

F. No surface mounted raceway or conduit will be accepted on any new construction job.

G. Seal all wall and floor penetrations with approved sealant.

H. Access control system cabling can share conduit with intrusion alarm system cabling.

I. All cabling must be suspended up off the ceiling grid.

J. Contractor must provide the Owner with all security equipment MAC addresses and network drop information.

K. The access control contractor shall provide and install all required parts and local cabling to get the system online and operational; this includes power supplies required to operate the electrified exit devices.

L. Where 110 Volt electrical receptacles as needed to accommodate system transformers, they shall be provided by the electrical contractor at exact locations coordinated with the access control contractor.

M. Where 110 Volt electrical receptacles as needed to accommodate door release hardware/ electrified exit devices, they shall be provided by the electrical contractor in an accessible location at 12” above the finished ceiling and within 20 feet of door location.

N. Data drops shall be provided by the cabling contractor for security equipment. See Section 27 10 30 - Data-Telephone Cable Plant.

O. Exterior card reader locations shall be prepared including a recessed single-gang weatherproof metal back box located approximately 44’’ centered from the ground and 12’’ off the opened door edge to the side, with a ½” secured rigid or flex conduit with pull string to an accessible interior location concealed above the finished ceiling.

P. Controlled door frames shall be prepared as detailed on the plans including a ½” secured rigid or flex conduit with pull string to an accessible interior location concealed above the finished ceiling.

Q. Continuous hinges with built in power transfers (concealed ribbon wire) are not acceptable.

R. Mag-locks are not acceptable.

2.5 ACCESS CONTROL SYSTEM LAYOUT PLANS

A. The Contractor shall provide a mock-up of the layout plan documents prior to mounting.

B. Provide mounted inside each Access Control System Panel/Enclosure cover, or adjacent to the panel location, a laminated layout plan including the following information:
1. In the upper left corner of the layout provide the name of the installing company, phone number and Texas Security License number.
2. In the upper right corner of the page provide the Name of the campus and the MDF or IDF room I.D./location.
3. Under the room I.D. list:
   a. IP address of the panel
   b. Subnet mask.
   c. Gateway IP address
4. Place the service contract information (contact or department and phone number or just phone number will be acceptable).
5. Beneath the common information, provide a line diagram indicating each module location and the name of the device attached to each input on each card.

2.6 DOOR CONTROLLER MODULES

A. Provide as required Mercury Security Corporation open platform controllers. These shall be configured to automatically receive policy and schedule updates for all identities and hardware configurations as distributed by the Lenel•S2 Security access control system. The controllers shall ensure security is enforced at the controlled doors, even when upstream network communications are temporally interrupted.

B. All system programming shall be maintained in non-volatile memory such that program information is maintained even if all external AC and battery power is removed.

C. Provide as required Power-over-Ethernet and/or RS-485 serial interface controllers and door modules that include a door/reader interface module all in one unit and support standard reader technologies, including Wiegand, clock and data, magnetic stripe, keypads, LCD, and biometrics.

D. Each module shall be housed in a wall enclosure and connected, internally or adjacently, to a 12 VDC battery backed up power supply.

E. Intelligent door controllers (Network Controllers) – intelligent control modules shall include an Ethernet port for communication with the server network and an RS-485 serial output interface for communication with a group of door reader interface sub-modules, wireless lock wireless hub, door, and cabinet devices, and also a group of door reader interface sub-modules may communicate with an assigned control module directly through the Ethernet network.

F. Door reader interface sub-modules (Interface Modules) - interface sub-modules shall include card reader ports, input monitor points, and control relay outputs. The door controllers shall be auto-addressable, directly managed by an assigned intelligent host controller, and shall be capable of elaborate processes and procedures without host intervention.

G. Input and Output Modules are required to provide programmed and integrated events and functions with other systems. Input and output module function:
   1. Input Modules: input modules shall have an RS-485 serial interface providing the ability to monitor high concentrations of system auxiliary inputs. Each shall be capable of supporting 16 general purpose input circuits which can be individually set for normally-open or normally-closed operations and can be declared supervised and non-supervised. Individually configurable parameters can be set for sensitivity ranges, timing parameters, and end-of-line resistance values.
   2. Output Modules: output modules shall have an RS-485 serial interface providing the ability to control high concentrations of system auxiliary outputs. Each shall provide 16 general purpose outputs as Form 'C' relay contacts, each with individually configurable parameters, which may be set for timing and for fail-safe vs. fail secure modes. Each relay output can be configured to control outboard devices and can be activated by the condition of selected system devices locally or regionally without host intervention.

H. Refer to the access control system schedule on the drawings for module part numbers.

2.7 MODULE ENCLOSURES AND POWER SUPPLY/BATTERY BACKUPS

A. Provide as required to house all modules, enclosures that shall be 19-gauge high grade steel with textured black finish enclosures for indoor use, suitable for surface wall mounting, and shall include battery backup power supplies where required. Each enclosure shall include a removable back plate for module mounting, a keyed lock, and tamper switch. Access power enclosures shall include a single AC power connection (for power supply), a pre-wired LSP power section. Each tamper switch shall be wired to a module input circuit for monitoring by the System.

B. Provide UL 294 listed power limited source, filtered and electronically regulated 12 VDC output power supplies with short circuit/thermal overload protection, and automatic switch over to stand-by battery backup when AC fails. Each power supply shall include a built-in charger and sealed type battery.

C. Power supply/chargers and batteries shall provide operating and emergency power to the system. Provide sufficient battery capacity for operation without AC power for all control modules, card readers, and electric unlocking/locking devices for a minimum of 4-hours (design calculations required). Include a 20% safety factor in battery calculations to ensure adequate performance for the service life of batteries.

D. Refer to the access control system schedule on the drawings for enclosure part numbers.

2.8 PROXIMITY CARD READERS

A. Controlled access door location as indicated on plans, elevators and security grills, shall be provided with an entry card reader or a door hardware integrated card reader

to allow access to authorized individuals as scheduled.

B. Each proximity card reader shall mount on a standard single-gang electrical wall box or on the surface of an interior or exterior wall.

C. Where the proximity card reader is integrated into the Schlage NDE wireless integrated locksets, access control contractor shall coordinate installation with the Division 08 hardware contractor and verify the specified door hardware and the sequence of operations is appropriate for the security application for each controlled opening.

D. Outdoor weatherproof back boxes shall be flush mounted and connected to a ½" threaded rigid pipe conduit and sealed. The reader casing shall be grounded to prevent electrostatic discharge from interfering with the operation of the reader.

E. Threaded conduit is required for outdoor applications and dielectric grease shall be used to coat field connections.

F. Refer to the access control system schedule on the drawings for reader part number.

2.9 DOOR LOCK AND RELEASE HARDWARE INTERFACE

A. This contractor, the Owner, and the Div. 08 supplier shall carefully coordinate this hardware and clearly identify who supplies and installs each component and cabling type.

B. Install all wiring and control devices necessary to enable limited access to the indicated points of entry. Each controlled access door shall be fitted with a door switch (above), control relay, and an electric latch or strike. Each controlled door shall be setup to allow entry as permitted by the building access system, to prevent unauthorized entry, and to allow free exit from the building without special knowledge or effort. Magnetic force holding or 'mag' locks are prohibited by this specification.

C. NOTE: All electric door locks shall be configured for fail-safe un-delayed free egress operation and fail-secure to prevent unauthorized entry on loss of power.

D. Verify exact hardware requirements with Division 08 and Door Hardware Schedules including door and frame preparation details.

E. Only when the door hardware does not include an integrated Request-to-Exit Switch, provide a request-to-exit sensor (see below).

2.10 DOOR HARDWARE AUXILIARY POWER SUPPLY

A. Door Lock Hardware Power Supply Provide:
   1. Altronix model AL600ULACM Power Supply/Charger with Multi-Output Access Power Controllers.
      a. Eight (8) independently controlled 12VDC or 24VDC fail-safe and/or fail-secure outputs with a total of six (6) amp continuous supply current.
      b. Built in charger for sealed lead acid or gel type batteries, provide minimum four hours back up power with a 20% safety factor to ensure adequate performance for the service life of batteries.
      c. Enclosure dimensions/weight, 15.5"Hx12"Wx4.5"D/10.3lbs.

2.11 DOOR SWITCHES (ACCESS SYSTEM DOOR CONTACTS)

A. Provide door switches where indicated on floor plans with conduit run to a nearby, accessible, junction box located above ceiling.

B. Door frame flush mount: Provide recessed magnetic contact door switch - dual contact DPDT switch to support both access and security system connections with wire leads.

C. Doors surface mount, heavy duty armored: Provide magnetic contact door switches, heavy duty for overhead doors

D. Refer to the access control system schedule on the drawings for door switch part number.

2.12 REQUEST-TO-EXIT SWITCH OR SENSOR

A. Provide where required request-to-exit devices. The system shall not be programmed to unlock a door automatically from a request to exit signal, as this presents a security breach. The request to exit signal shall be used only to indicate a normal exit status, as opposed to a forced entry. Exit shall be made with the normal door hardware and shall not be impeded or assisted by the electronic system. Exit shall not be affected if the power is off and the battery backup exhausted.

B. When no request-to-exit switch is provided integrated into the door hardware (see above), provide at the exit side of each controlled door a request-to-exit passive infrared detector with x-y targeting and digital signal processing.

C. Refer to the access control system schedule on the drawings for request-to-exit device part number.

2.13 PROPPED OPEN DOOR ALERT

A. Controlled door locations shall include an alert to indicate a propped open or held open too long alert. The alert is a strobe/light device in the main building reception area. All additional controlled doors (doors with door position switches) shall activate the alert device. Program the access control system to supervise all doors with door position switches and to activate the light when a door position switch indicates a propped open door.

2.14 ACCESS CONTROL SYSTEM SEQUENCE OF OPERATION

A. Scheduled automatic door unlocking/locking of specific entry doors shall be programmed to require verification before being enacted. A credential card from a select group at the local facility (including the principal/vice principals, etc. as requested) must be presented at the facility within a two-hour period prior to the scheduled unlocking event. This is to prevent the entrance doors from be unlocked when no one is present to supervise the students, such as due to a snow day or other unscheduled occurrence. If a scheduled unlocking event is delayed, and a credential card from the select group is presented within two hours after the unlocking event was scheduled, the unlocking shall be enacted immediately.

B. This access control system shall provide for controlled access through entry doors and into restricted areas when a valid credential card is presented to the credential card reader located adjacent to the door, only if the users group access rights and

time schedules allow for access. This system shall monitor for unauthorized entry attempts, control access to the building, and log entry information. The system shall in no way impede free emergency exit from the building. Exit from the building shall not require special effort or knowledge. Controlled door locks shall fail secure from outside entry on loss of power and backup power.

C. Door Forced and/or Door Held Open alarms shall have the capacity to be locally annunciated via Auxiliary Output relays on the individual controllers. This annunciation shall be controlled as follows. A direct one-to-one relationship shall be able to be programmed between the Door Forced and/or Door Held Open alarm and the auxiliary output. When either condition exists, the auxiliary output is energized. When either condition is cleared, the auxiliary output is de-energized.

D. The system shall provide the capability for individual controlled door locations as noted on plans to include a local sounder. Unless otherwise required, the local sounder shall annunciate when a door is held open, left ajar, or propped open for over one minute. If the door remains held open for over three minutes, a system Door Held Open Alarm alert shall pop-up and generate an entry in the log file for later review, the alert shall be automatically silenced and cleared once the door is closed.

E. Controlled doors using a retractable latch strike shall, on a valid credential card read, activate the output to retract the door latch and immediately allow the exit door to be entered by standard pull lever operation; the door may then be opened without retracting the latch bolt. When the door closes, the latch bolt shall ride over the strike lip. The installation shall include dual switch monitoring, the strike shall have two SPDT contacts; one switch shall monitor the tripper, which is depressed when the latch bolt is inserted into the strike pocket. The second switch shall monitor the condition of the strike lip, indicating open or closed and locked conditions.

F. Controlled doors with frame or mullion retractable strike, on a valid credential card read, activate the output to retract the door strike and immediately allow the exit door to be entered by standard pull lever operation; the door may then be opened without retracting the latch bolt. When the door closes the beveled latch, bolt shall ride over the lip and fall into the electric strike pocket. The installation shall include dual switch monitoring, the strike shall have two SPDT contacts; one switch shall monitor the tripper, which is depressed when the latch bolt is inserted into the strike pocket. The second switch shall monitor the condition of the strike lip, indicating open or closed and locked conditions.

G. Controlled doors with a crash bar shall include electric latch retraction and a request-to-exit switch, the access control system shall, on a valid credential card read, activate the output to retract the latch bolt and immediately allow the door to be entered by standard pull handle operation.

H. Where required, the system shall interface with electric door openers utilized for ADA access. This interface shall interconnect to door control interface to mechanically open the door when a valid credential card is read, and the exterior door button is pressed. The exterior button shall also open the door when the door is scheduled to be unlocked without a credential card read. The interior door open button shall always be functional, allowing full egress, regardless of the status of the access control system; the interior button shall also be interfaced to the request to exit function.

I. The request-to-exit switch or sensor shall provide a means for the system to monitor the status of the controlled door and detect a forced entry condition. The request-to-

exit signal shall be used only to indicate a normal exit status, as opposed to a forced entry. Exit shall be made with the normal door hardware and shall not be impeded or assisted by the electronic system. Exit shall not be affected if the power is off and the battery backup exhausted.

J. The access system door contact switch shall provide a means for the system to monitor the open/closed status of the controlled door and detect if the door is held open or left ajar after a valid credential card read.

2.15 CABLING (PLENUM RATED)

A. All exposed wiring shall be NEC type CMP, plenum cable.

B. All exterior cabling shall be in rigid metallic conduit. All connectors must be fastened, tied, and crimped for maximum reliability.

C. Avoid if at all possible, junctions or splicing - all junctions in cable shall be made by proper splicing techniques in a junction box.

D. All cabling is to be concealed where construction permits.

E. This contractor shall provide and install new and unused ASTM bare stranded copper conductor wire per ANSI/NEMA codes. Follow the manufacturer's instructions. All wire shall the type recommended by the manufacturer for security system applications.

F. All cable shall have a machine printed label located within 2” from every terminal block and within 6” from all other connections utilizing self-laminating flexible vinyl film labels.

G. Wire gauge shall be selected per circuit based on cable length and current requirements.

LOW VOLTAGE CABLE TYPES

Conductors	Min. AWG	Description
1-Pair Twisted	24	Overall Shield
4-Pair UTP	23	Category 6
1-Pair Twisted	22	Overall Shield
2-Pair Twisted	22	Overall Shield
3-Pair Twisted	22	Overall Shield
4-Pair Twisted	22	Overall Shield
5-Pair Twisted	22	Overall Shield
6-Pair Twisted	22	Overall Shield
1-Pair Twisted	24	Overall Shield
6-Wire	18	Overall Shield
Multi-Conductor	22	Overall Shield
2-Pair Twisted	18	Unshielded
1-Pair Twisted	18	Unshielded
1-Pair Twisted	16	Unshielded
1-Pair Twisted	14	Unshielded
1-Pair Twisted	12	Unshielded

* Belden 82841 or equivalent up to 4,000’ per RS-485 serial circuit.

2.16 CABLE TIES (PLENUM RATED)

A. HALAR Fluoropolymer plenum rated cable ties shall be furnished and installed to attach wire bundles to supports and for appropriate wire management as required.
   1. HALAR wire tie, 4.0”, miniature - Panduit PLT1M-C702 or equivalent.
   2. HALAR wire tie, 7.4”, standard - Panduit PLT2S-C702 or equivalent.
   3. HALAR wire tie, 11.6”, standard - Panduit PLT3S-C702 or equivalent.

2.17 SURGE AND AMPERAGE PROTECTION

A. Electrical surge protection shall be provided for all service entrance connections and on each copper pair that connects one building to another (i.e. any other portion of a building complex not under one continuous roof) at both exit points to prevent damage to equipment.

B. Security system circuit surge protectors shall be mounted in a standard grounded metallic electric box. Shall be Ditek, 12345-A Starky Road, Largo, Florida 34643 model numbers as follow, multiple pair units are available, or equivalent:
   1. 2-wire protector for 12 Volt circuits.
   2. 2 wire protector for 5 Volt circuits.
   3. 8-pair protector for RS-485 circuits.

2.18 CABLE ROUTING, INSTALLATION, AND SUPPORT

A. System wiring and equipment installation shall be in accordance with good engineering practices as established by the NFPA. Wiring shall meet all state and local electrical code requirements.

B. Cable pathways, conduit, and cable support systems shall be complete with bushings, de-burred, cleaned, and secure prior to installation of cable.

C. Before energizing the system check all cables for correct connections and test for short circuits, ground faults, continuity, and insulation.

D. In all exposed areas such as gymnasiums, shops, field houses, janitors’ closets, or mechanical / electrical rooms all access system cable shall be fully enclosed in conduit.

E. Access system cables shall be run in conduit stubs from wall boxes to accessible areas above finished ceilings. Conduit shall be required only within walls and concealed spaces to provide access. Provide bushings to protect the cable from damage for conduit ends, box openings, and passage through metal studs.

F. Access system cables shall be run in bundles above accessible ceilings and supported from building structure by j-hooks, conduit or cable tray. Cabling shall be loosely bundled with cable ties randomly spaced at 30 to 48 inches on center, cable ties shall not be tight enough to deform cabling and shall not be used to support the cabling.

G. Do not attach any supports to joist bridging or other lightweight members. The support system shall provide a protective pathway to eliminate stress that could damage the cabling.

H. Mount all equipment firmly in place such that vibration or jarring will not interfere with system operation. Route cable in a professional, neat, and orderly installation.

I. The cable shall not be crushed, deformed, skinned, crimped, twisted, or formed into tight radius bends that could compromise the integrity of the cabling.

J. Access system cable must not be fastened to electrical conduits, mechanical ductwork / piping, sprinkler pipes, or routed to obstruct access to hatches, doors, utility access panels, or service work areas. Do not route cables through fire doors, ventilation shafts, grates, or parallel for more than four-feet with line voltage electrical conductors. Access system cables shall not be run loose on ceiling grid or ceiling tiles.

K. Support shall be provided by mounting appropriate fasteners that may be loaded with multiple cables. If the weight load is carried by the support rod or wire, the support assembly may attach to the ceiling grid for lateral stabilization. The required support wires for the ceiling grid or light fixtures shall not be utilized. Any fastener attached to the ceiling grid shall not interfere with inserting or removing ceiling tiles. The cable pathway of supports must be positioned at least 12 inches above the ceiling grid.

L. All cable shall have a label on both ends utilizing self-laminating, flexible vinyl film, non-smear, machine printed labels.

M. Each cable run shall include a three-foot service loop with wire tie located in the ceiling above the control unit panel. This is to allow for future re-termination or repair.

N. Provide for adequate ventilation to all equipment housings and take precautions to prevent electromagnetic or electrostatic hum.

O. All conduit, ducts, track, and raceways shall be supported from the structure at industry standard intervals for the size specified, utilizing proper anchoring devices. Cable fill may not exceed the manufacturers' instructions for each type of support.

P. All conduit, duct, track, and raceway runs shall be spaced apart to allow for maintenance, such as the installation of couplings, without disturbing adjacent pathways.

Q. Each cable run shall be free of splices. No terminations, splices, or equipment will be installed in or above ceilings.

R. All cabling will be placed with regard to the environment, EMI/RFI interference, and its effect on communication signal transmission.

S. Do not route any communication cable within two feet of any light fixture, HVAC unit, service access area, electric panel, or any device containing a motor or transformer.

T. Access system cable will not be installed in the same conduit, duct, or track with line voltage electrical cable.

U. Maximum cable pulling tension shall not exceed 25 pounds force (110 N) or the manufactures recommendation, whichever is less.

V. Any pulling compounds utilized must be approved by the cable manufacturer and shall not degrade the strength or electrical characteristics of the cable.

2.19 TERMINATION PRACTICES

A. Strip back only as much cable jacket as required to terminate.

B. Do not "loop" over wiring terminals, the cable could come loose, and the condition not be detected as an open circuit or disconnected device.

C. Preserve wire twists as closely as possible to point of termination (0.5" maximum) to keep signal impairment to a minimum.

D. Avoid twisting cable jacket during installation.

2.20 BUSHINGS

A. Provide a plastic snap in bushing at each box opening, passage through a metal stud, and at the end of all open conduit stubs or sleeves prior to cable installation to protect the cabling from damage:
   1. Box openings - Thomas & Betts Knockout Bushing Series 3210, or equivalent.
   2. Metal stud passage - Thomas & Betts Twist It Bushing Catalog Number SB1216-SC, or equivalent.
   3. Conduit ends - Thomas & Betts Anti-Short Bushing Series 390 or Tite-Bite Combination Coupling Series 442, or equivalent.

2.21 CEILING MOUNTED DEVICE BOX HANGERS

A. All ceiling mounted devices including: smoke detectors, heat detectors, remote power/status LEDs, ceiling mounted strobes and horn/strobes, et cetera, when mounted in a drop ceiling shall be supported by an electrical box hanger (Caddy #512 or #512A for deep boxes - 24" span), or equivalent. Box hangers shall be attached to the ceiling grid only for lateral stabilization, separate support wires shall be provided. The required support wires for the ceiling grid or light fixtures shall not be utilized. The backbox shall be flush and level with the bottom of the ceiling tile and the hole neatly cut for a finished appearance when the device is installed.

B. Device and box hanger assemblies shall not be supported solely by suspended ceilings. Fasteners and supports shall be adequate to support the required load.

2.22 J-HOOKS

A. Attachments for cabling support shall be spaced at approximately 48 to 60 inches on center. Each cable bundle shall be routed with enough slack to prevent damage to cables but not allowed to sag more than 12 inches mid-span between attachments. Attachments shall be sized as follows:
   1. Single cables or bundles up to four cables may be supported directly by the building structure.
   2. 2" bridle ring, Caddy #4BRT32 or equivalent
   3. 3/4" J-Hook, Caddy #CAT12 or equivalent
   4. 1-5/16" J-Hook, Caddy #CAT21 or equivalent
   5. 2" J-Hook, Caddy #CAT32 or equivalent
   6. Split bundles greater than 2" dia. or provide cable tray.

B. Do not mix different signal strength cables on the same J-Hook (i.e. access system with telephone/data cable). Multiple J-Hooks can be placed on the same attachment point, up to the rated weight load of the attachment device.

2.23 COMMUNICATIONS CIRCUIT SURGE PROTECTION

A. Provide surge protection shall be provided for all exterior devices, communications service or antenna entrance connections, and for each circuit that connects one building to another (i.e. any other portion of a building complex not under one continuous roof) at both entry/exit points to prevent damage to equipment.

B. Each surge protector shall be mounted in a standard grounded metallic electric box or equipment backboard with a separate ground wire ran directly to the ground bus bar or equipment panel ground stud, do not daisy chain ground wires.

C. Surge protectors for low voltage communications signal and control circuits with a data rate from 200kbps to 2Mbps, nominal voltage as listed below AC or DC. Each module shall protect up to two pairs using hybrid design multi-stage SAD technology, shall be Ditek 2MHLP series field replaceable modules with MB Series mounting bases for one to five modules, or equivalent, model numbers as follows:
   1. 70 to 75 Volt circuit, 4 wire protector with base DTK-2MHLP75BWB.
   2. 48 to 50 Volt circuit, 4 wire protector with base DTK-2MHLP48BWB.
   3. 36 Volt circuit, 4 wire protector with base DTK-2MHLP36BWB.
   4. 24 Volt circuit, 4 wire protector with base DTK-2MHLP24BWB.
   5. 12 Volt circuit, 4 wire protector with base DTK-2MHLP12BWB.
   6. 0 to 6 Volt circuits, 4 wire protector with base DTK-2MHLP5BWB.

D. Surge protectors for low voltage communications high data rate voice, data and signaling data and loop circuits, or serial communication, nominal voltage as listed below AC or DC. Each module shall provide Line-Ground (All) protection modes, maximum surge current: 2,000 Amps per pair (6V-50V) or 9,000 Amps per pair (75V-130V), and maximum continuous current: 5 Amps to 0.15 Amps, shall be Ditek LVLP series or equivalent, model numbers as follows:
   1. 115 to 130-Volt circuit, 2-pair protector, 10-12 AWG, DTK-2LVLAWGRUV.
   2. 95-Volt circuit, 2-pair protector, 10-12 AWG, DTK-2LVLAWGSGR.
   3. 75-Volt circuit, 2-pair protector, 10-12 AWG, DTK-2LVLAWGSPK.
   4. 48 to 50-Volt circuit, 2-pair protector, 16-22 AWG, DTK-2LVLPOPX.
   5. 24 to 30-Volt circuit, 2-pair protector, 16-22 AWG, DTK-2LVLPLV.
   6. 12 to 14-Volt circuit, 2-pair protector, 16-22 AWG, DTK-2LVLPX
   7. 0 to 6-Volt circuit, 2-pair protector, 16-22 AWG, DTK-2LVLPD.
   8. 0 to 6-Volt circuit, 8-pair protector (RS-485, RS-232), 16-22 AWG, DTK-8LVLPLVD.

E. Surge protectors for access control devices, types and nominal voltage as listed below. Each module shall provide Line-Ground (All) protection modes, maximum surge current: 2,000 Amps per pair power and 500 Amps per pair data, and maximum continuous current of 3 Amps, shall be Ditek model numbers as follows or equivalent:
   1. Wiegand credential reader surge protection 3-pair, 12 to 14-Volt terminal strip, Ditek DTK-3LVLPX.
   2. Credential reader surge protection, 4-pair reader and 1-pair each: 12-Volt power, 24-Volt power, 5-Volt data, and 1-Volt signal, Ditek DTK-4LVLPCR.
   3. Entry intercom system with data circuit surge protection 1-pair 12/24-Volt power supply, 2-pair 130-Volt voice line, and 1-pair 0 to 6-Volt data circuit, Ditek DTK-4LVTEP.
   4. Entry intercom system with door release surge protection 1-pair 12/24-Volt power supply, 2-pair 130-Volt voice line, and 1-pair 24-Volt release solenoid

circuit, Ditek DTK-4LVXR.

F. Surge protectors for Ethernet network runs rated up to Category 6A and operating at up to 10-Gigabit data rates. Each module shall protect up all four pairs using hybrid design multi-stage SAD technology which shall automatically reset to protect against multiple surges, Ethernet surge protectors shall be Ditek DTK-CAT6A series as follows:
   1. DTK-110RJC6APOE with 110 to RJ-45 connections with PoE.
   2. DTK-110C6APOE with 110 to 110 connections with PoE.
   3. DTK-110RJC6A with 110 to RJ-45 connections without PoE.
   4. DTK-110C6A with 110 to 110 connections without PoE.

G. Surge protectors for analog copper pair PSTN telephone service POTS/Trunk/C.O. line alarm Digital Communicator service lines shall be Ditek DTK-2MHTPWB, or equivalent, 2-pair/lines, maximum ring-up voltage 110V, includes base. In addition, At Telco service connection demarcation point locations servicing an alarm Digital Communicator, provide per line a Suttle Solutions Part # 635B-48, or equivalent, RJ31X surface mount jack with 8-conductor screw terminal board input and factory wired DATA and VOICE labeled, non-keyed RJ-45 output ports, with line seizure port shorting bar (1&4, 5&8) for alarm reporting device service.

H. Surge protectors for coaxial cable shall be suitable for analog and digital signals up to 2 Ghz, and shall feature 75 Ω nominal impedance, Center Pin - Shield, Shield - Ground protection modes, 20,000A surge current rating, a service voltage of 50VDC, and a clamping Voltage of 75VDC. Note: Insertion loss per surge protection module is 0.5dB, include signal attenuation from these devices in signal strength calculations. Surge protectors shall be Ditek VSP series, or equivalent, as follows:
   1. Type 'F' connectors Ditek DTK-VSPA or Ditek DTK-VSPA2 (dual).
   2. BNC connectors Ditek DTK-VSPBNCA or DTK-VSPBNCA2 (dual).
   3. BNC connectors and 24-volt power connections Ditek DTK-PVP27B.
   4. PTZ camera surge protection; BNC video, power and data Ditek DTK-DP4P.
   5. HD-SDI video Ditek DTK-iBNCHD.
   6. Type 'N' antenna connector Ditek DTK-VSPN.

2.24 FIRE STOPPING, DRAFT/NOISE STOPPING, PENETRATIONS, AND CORING

A. UL Listed fire stopping methods that match the fire rating of the wall or floor being penetrated are to be used at all fire barrier penetrations. Seal the interior of the conduit sleeve around the cables and around the outside of the sleeve on each side of the penetration with fire-stop caulk or putty, install according to the manufacturers' instructions.

B. All penetrations through fire rated walls or floors shall feature a suitable length of metal conduit. Hole diameter shall not exceed ½" larger than the conduit or sleeve to be installed. The hole shall be neatly cut, not oversize or irregular. Do not share wall/floor penetrations with ductwork, piping, line voltage electrical conduits, etc.

C. All gypsum board or plaster penetrations shall tool cut using an appropriate hole saw / mandrel or manufactured assembly.

D. Draft/Noise Stopping - All penetrations through non-rated walls shall include draft/noise stopping to minimize the transfer of air and sound between enclosed areas. This shall include but not limited to:

1. Neatly cutting all non-rated wall penetrations with a 1" maximum clearance. All gypsum board or plaster penetrations shall be tool cut using an appropriate hole saw / mandrel or manufactured assembly. The hole shall be neatly cut and not oversize or irregular. Do not share wall penetrations with other types of ductwork, piping, line voltage electrical conduits, communications cabling, etc.
2. Provide and install non-combustible mineral wool, fiberglass, cellulose insulation, caulk, and/or sealant as required. Seal the interior of conduit sleeves around the cables and around the outside of the sleeve on each side of the penetration with caulk or putty, install materials according to the manufacturers' instructions.

E. The Contractor shall make every effort to coordinate with the building Architect, Engineer, Builder, and Electrical Contractor to have sleeves placed in new construction so that later coring or drilling of building structural members will not be required. The Contractor must consult with the building Architect, Engineer, and Builder prior to drilling, coring, or sawing of any wall, floor, etc. All penetrations shall be made at approved, appropriate, locations.

F. Upon approval, the Contractor shall be required to supply all labor, equipment, tools, and materials to create any additional penetrations, and shall provide the sleeve, temporary and final fire stopping. Special care shall be taken not to stress, overheat, or penetrate any building support member. Coring shall be made with equipment appropriate for the dry penetration of concrete and block materials. Under no circumstances shall penetrations be made utilizing a chisel or percussion type equipment. Concrete, block, or plaster cores shall be made by dry saw methods only.

PART 3 - EXECUTION

3.1 SEQUENCE OF OPERATION

A. Scheduled automatic door unlocking/locking of specific entry doors shall be programmed to require verification before being enacted. A credential card from a select group at the local facility (including the manager/assistant manager, etc. as requested) must be presented at the facility within a two-hour period prior to the scheduled unlocking event. This is to prevent the entrance doors from be unlocked when no one is present to supervise and unlocked building, such as due to an unavoidable delay or other unscheduled occurrence. If a scheduled unlocking event is delayed, and a credential card from the select group is presented within two hours after the unlocking event was scheduled, the unlocking shall be enacted immediately.

B. This access control system shall provide for controlled access through entry doors and into restricted areas when a valid credential card is presented to the credential card reader located adjacent to the door, only if the users group access rights and time schedules allow for access. This system shall monitor for unauthorized entry attempts, control access to the building, and log entry information. The system shall in no way impede free emergency exit from the building. Exit from the building shall not require special effort or knowledge. Controlled door locks shall fail secure from outside entry on loss of power and backup power.

C. Door Forced and/or Door Held Open alarms shall have the capacity to be locally annunciated via Auxiliary Output relays on the individual controllers. This annunciation shall be controlled as follows. A direct one-to-one relationship shall be able to be programmed between the Door Forced and/or Door Held Open alarm and the auxiliary output. When either condition exists, the auxiliary output is energized.

When either condition is cleared, the auxiliary output is de-energized.

D. Controlled doors using a retractable latch strike shall, on a valid credential card read, activate the output to retract the door latch and immediately allow the exit door to be entered by standard pull lever operation; the door may then be opened without retracting the latch bolt. When the door closes, the latch bolt shall ride over the strike lip. The installation shall include dual switch monitoring, the strike shall have two SPDT contacts; one switch shall monitor the tripper, which is depressed when the latch bolt is inserted into the strike pocket. The second switch shall monitor the condition of the strike lip, indicating open or closed and locked conditions.

E. Controlled doors with frame or mullion retractable strike, on a valid credential card read, activate the output to retract the door strike and immediately allow the exit door to be entered by standard pull lever operation; the door may then be opened without retracting the latch bolt. When the door closes the beveled latch bolt shall ride over the lip and fall into the electric strike pocket. The installation shall include dual switch monitoring, the strike shall have two SPDT contacts; one switch shall monitor the tripper, which is depressed when the latch bolt is inserted into the strike pocket. The second switch shall monitor the condition of the strike lip, indicating open or closed and locked conditions.

F. Controlled doors with a crash bar shall include electric latch retraction and a request-to-exit switch, the access control system shall, on a valid credential card read, activate the output to retract the latch bolt and immediately allow the door to be entered by standard pull handle operation.

G. Where required, the system shall interface with electric door openers utilized for ADA access. This interface shall interconnect to door control interface to mechanically open the door when a valid credential card is read, and the exterior door button is pressed. The exterior button shall also open the door when the door is scheduled to be unlocked without a credential card read. The interior door open button shall always be functional, allowing full egress, regardless of the status of the access control system; the interior button shall also be interfaced to the request to exit function.

H. The request-to-exit switch or sensor shall provide a means for the system to monitor the status of the controlled door and detect a forced entry condition. The request-to-exit signal shall be used only to indicate a normal exit status, as opposed to a forced entry. Exit shall be made with the normal door hardware and shall not be impeded or assisted by the electronic system. Exit shall not be affected if the power is off and the battery backup exhausted.

I. The access system door contact switch shall provide a means for the system to monitor the open/closed status of the controlled door and detect if the door is held open or left ajar after a valid credential card read.

3.2 TESTING, WARRANTY SERVICE

A. A factory trained representative of the manufacturer shall supervise the final connections and testing of the system and it shall be subject to the final acceptance of the Architect/Engineer and Owner.

B. This contractor will thoroughly test all components of the systems and devices proposed herein to assure equipment specifications are met. This contractor will start up, test, and debug systems to ensure that all aspects of the system are working,

documented, and reporting properly.

C. This Contractor shall make a thorough inspection and test of the complete installed security system including all components and controls to ensure the following:
   1. Complete and functional system.
   2. Installed in accordance with manufacturer's instructions.
   3. Verify proper operation and processing of signals.

D. The installation will be verified through use of testing procedures designed to test all specific functions and requirements of your system under various operating conditions.

E. This Contractor shall provide a warranty of the installed system against defects in material or workmanship for a period of one (1) year from the date of substantial completion. Any equipment or wiring shown to be defective shall be replaced, repaired, or adjusted free of charge. All labor and materials shall be provided at no expense to the Owner. All equipment will carry a one-year warranty or manufacturer's warranty whichever is greater.

3.3 DRAWINGS, MANUALS, AND TRAINING

A. Upon completion of the installation, and prior to final inspection, the Building Access Control Contractor shall furnish four (4) hard copies and one (1) electronic CAD and PDF copy on CD-R of as-built drawings. In addition, the Building Access Control contractor shall furnish four (4) hard copies and one (1) electronic PDF copy on CD-R of a complete operating and maintenance manuals listing the manufacturer's name(s), including technical data sheets. Manuals shall include wiring diagrams to indicate internal wiring for each device and the interconnections between the items of equipment. Provide the Owner a copy of the panel control software including the licensed program, site specific data file, and passwords that the Owner may require to maintain the system. Provide a clear and concise description of operation that gives, in detail, the information required to properly operate the equipment and system. Provide a parts list with manufacturer and model number for commonly replaced parts. Include complete instructions for the inspection, testing, and maintenance of the system. Include copies of all programming sheets used to configure the system. As-built drawings and operating and maintenance manuals may be electronically transmitted in PDF file format (preferred) or paper copies may be provided in quantities indicated in Division 1. Paper copies shall be organized including index tabs in a 3-ring black binder of sufficient size.

B. Provide the Owner a copy of the panel control software including the licensed program, site specific data file, and passwords that the Owner may require to maintain the system.

C. Formal on-site training sessions shall be conducted by this Contractor. It shall be the responsibility of this Contractor to coordinate time and location of training sessions with the Owner. The training sessions are to be recorded and the recordings are to be made available to the Owner on portable media.

END OF SECTION

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SECTION 28 46 21

FIRE DETECTION AND ALARM SYSTEM

PART 1 GENERAL

1.1 WORK INCLUDED

A. General provisions of the Contract, including General and Supplementary Conditions and Division 1, apply to this Section.

B. This specification provides requirements for the expansion of the building fire detection and alarm system. The specification reflects the intent of the design and installation.

C. Renovation and expansion of the existing fire alarm system to serve the additional areas as indicated on the drawings.

D. The existing signaling line circuits (SLC), initiation device circuits (IDC), and notification appliance circuits (NAC) shall be rearranged, reconfigured and/or optimized to provide a fully code compliant building fire detection and alarm system.

E. Equipment specified herein is designed to provide specific functional and operational characteristics. It is the responsibility of the Contractor to provide all features and functions as outlined in these specifications.

F. Furnish and install all equipment, accessories, materials, tools, scaffolding, man lifts, labor and transportation in accordance with these specifications to provide a complete and operating fire alarm system.

G. It is the intent of these specifications to provide complete installations although every item necessary may not be specificially mentioned or shown.

H. This project shall include preparation of construction plans locating the fire alarm system devices and having the plans reviewed by the Engineer, Owner, and local AHJ for permitting.

I. It shall be the responsibility of this Contractor to obtain all required approvals, permits, and certifications from Authorities Having Jurisdiction (AHJ).

J. The system devices shall be provided in accordance with Part 2 - Product Requirements, Function, and Performance.

K. Provide installation, testing, documentation, training, and warranty service documentation in accordance with Part 3 - Project Execution and Installation.

L. The Division 26 Electrical Contractor shall provide:
   1. Dedicated 120VAC power to the fire alarm control units maximum 20 amps each. Each electrical disconnect device shall be labeled "FIRE ALARM". An access key to the disconnect device shall be stored in the fire alarm control panel. Secure disconnect in the "ON" position with a lockout clip, Space Age Electronics model Elock or equivalent.

2. Provide and install all conduit and standard electrical boxes for the fire alarm system as specified herein. The fire alarm contractor shall coordinate all conduit and box requirements and locations with, and provide special back boxes to, the electrical contractor prior to installation.
3. Fire alarm cabing in all open ceiling areas shall be enclosed in conduit.
4. Provide required conduit for accessibility to attic or plenum space.
5. Installation of special back boxes supplied by Division 28 contractors.
6. Provide equipment mounting boards as indicated on the drawings.
7. Provide utility services conduit as outlined on the drawings.
8. Coordination of requirements of Division 28 with the Builder.

M. Fire safety control devices and equipment installed by others:
1. Include any function that is designed to make the building occupants safer from the impact of fire and smoke during evacuation. For each controlled device, the contractor providing the device shall wire it internally for fail-safe shut-down and provide a labeled 3` coil of cable outside the unit to allow the fire alarm contractor to make final connection to the controlling relay. These may include but are not limited to:
   a. Fire/smoke curtains, shutters and doors.
   b. Air handler shutdown.
   c. Fire/smoke damper control.
   d. Elevator fire service functions and cab recall.
   e. Automatic door unlocking.
2. Each Fire Safety Control Function circuit controlled device shall be configured such that when the fire alarm system safety control circuit is re-energized, by the fire alarm control panel, the device shall return to normal operation (e.g. re-start or be ready to re-start) without a need for manual or environmental control system intervention. Line voltage, 120 VAC fire safety control function circuits shall be wired by a qualified electrical contractor and shall be standard non-supervised line voltage circuits in conduits.

1.2 WORK NOT INCLUDED

A. Contractors shall make no agreement that obligates the Owner to pay any company providing communications, monitoring, or other services.

B. Contractors shall not make selection, purchase, or installation of interconnect instruments and/or equipment to be used on this project.

1.3 RELATED SECTIONS

A. Section 26 00 00 - Electrical.

1.4 PRESCRIPTIVE CODES, STANDARDS, AND REGULATIONS

A. Perform all work in strict accordance with the requirements and recommendations stated in the codes and standards except when requirements are exceeded by the contract documents.

B. In addition to requirements outlined in other sections of the specifications these codes and standards are imposed as applicable to the work in each instance.

C. The equipment, materials, and installation shall confirm to the latest version of all applicable codes, standards and regulations including the following:

NFPA 1 - Uniform Fire Code
NFPA 13 - Standard for the Installation of Sprinkler Systems
NFPA 70 - (NEC) National Electrical Code, Articles 250, 300, 725, 760, and 800.
NFPA 72 - National Fire Alarm and Signaling Code
NFPA 90A - Installation of Air Conditioning and Ventilation Systems
NFPA 101 - Code for Safety to Life from Fire in Buildings and Structures
NESC - National Electrical Safety Code, ANSI Standard C2
NEiS - National Electrical Installation Standards
NEMA - National Electrical Manufacturers Association
ICC (IECC) - 60268-16:2011(E) Sound system equipment – Part 16: Objective rating of speech intelligibility by speech transmission index
IEEE - Institute of Electrical and Electronics Engineers
ISO 7240-24:2016 - Fire detection and fire alarm systems - Part 24: Sound-system loudspeakers
ANSI 117 - American National Standard for Accessible and Useable Buildings and Facilities
ASME A17.1 - Safety Code for Elevators and Escalators
ASTM - American Society for Testing and Materials
BICSI - RCDD5 Standards
ADA Standards - Americans with Disabilities Act
OSHA - Safety and Health Regulations for Construction
TAS - Texas Accessibility Standards
Texas Insurance Code - Chapter 6002 - Fire Detection and Alarm Device Installation and 28 TAC §§ 34.600 The Fire Alarm Rules
ICC (IBC) - International Building Code
ICC (IFC) - International Fire Code
UL - Underwriters Laboratories, Inc.
Local and State Building Codes and Ordinances.
All requirements of the Authority Having Jurisdiction (AHJ)

D. Nothing in the Contract Documents shall be construed to permit work not conforming to these codes and standards.

E. When two or more codes or standards are applicable to the same work, then the stricter code or standard shall govern.

F. The date of the code or standard is that in effect on the date of issue stated on the contract docuements, except when a particular publication date is specified.

G. The Contractor shall comply with all State, Federal, NFPA, local codes and ordinances that may alter any part of the plans or specifications. The Contractor shall bear all costs for correcting any deficiencies due to non-compliance.

H. Where local codes and ordinances are not in writing or on record but local precedence have been set, the Owner shall pay for any additional resulting cost.

1.5 PLANS AND SPECIFICATIONS

A. The intent of the project drawings is to establish the types of systems and functions, but not to set forth each item essential to the functioning of the system.

B. Electrical drawings are generally diagrammatic and show approximate location and extent of work.

C. Install the work complete including minor details necessary to perform the function indicated. Provide Electronic Safety and Security systems (including all hook-ups) complete in every respect and ready to operate.

D. If clarification is needed, consult the Architect/Engineer.

E. Review pertinent drawings and adjust the work to conditions shown. Where discrepancies occur between drawings, specifications, and actual field conditions, immediately notify the Architect/Engineer for his interpretation.

F. The Architect/Engineer reserves the right to make any reasonable change in the location of any part of this work without additional cost to the Owner.

1.6 SITE VISIT

A. Before submitting a proposal, each proposed contractor shall examine all plans and specifications relating to the work, shall visit the site of the project, and become fully informed of the extent and character of the work required, including all required utilities.

B. No consideration will be granted for any alleged misunderstanding of the materials to be furnished or the amount of work to be done, it being fully understood that the tender of a proposal carries with it the agreement to all items and conditions referred to herein, or indicated on the accompanying plans or required by nature of the site of which may be fairly implied as essential to the execution and completion of any and all parts of the work.

1.7 SUBMITTALS

A. Submit a complete submittal package within 30 calendar days after award of this work for approval. Equipment is not to be ordered without approval. Partial submittals are not acceptable for review. Each submittal shall include a dated transmittal.

B. Submittal may be electronically transmitted in PDF file format (preferred) or paper copies may be provided in quantities indicated in Division 1. Paper copies shall be organized including index tabs in a 3-ring black binder of sufficient size.

C. For each submittal provide a cover sheet with the name and location of the project, the name, address and telephone number of the Contractor, and the name, address and telephone number of the submitting sub-contractor. Include on or after the cover sheet sufficient space for review stamps.

D. Product Data Submittal to include:
   1. Letter from the fire alarm control panel manufacturer stating that the contractor is a Factory Authorized Distributor for the area where the project is located.
   2. Current copy of the contractors Alarm Certificate of Registration (ACR) for sales, service, and installation of fire alarm systems issued by the Texas State Fire Marshal’s Office.
   3. Copy of the commercial (non-residential) Alarm Planning Superintendent`s License (APS) responsible for the design of the system submitted.
   4. An indication of any deviations from Contract Document requirements, including variations and limitations. Show any revisions to equipment layout required by use of selected equipment.

5. A product data index and complete equipment list including for each product submitted for approval the manufactures name and part number, including options and selections.
6. Cut-sheets or catalog data illustrating the physical appearance, size, function, compatibility, standards compliance, and other relevant characteristics of each product on the equipment list. Include special boxes, cable and other material as requested by the Architect.
7. Indicate by prominent notation (an arrow, circle, or other means) on each sheet the exact product and options being submitted.
8. Submit design data, when the scope of work requires, including schematics, risers, sequences, or other data.
9. If not included in the Shop Drawings, calculations for notification device circuit current drop, conductor size, and battery backup for each unit.
10. Any resubmittal shall include a complete revised equipment list and any product data that is revised.

E. Shop Drawings Submittal to include:
1. A cover page that includes project name and address, index of drawings, scope of work description, code editions designed under, local AHJ information, a sequence of operation input/output matrix, bill of material, device and cable legends, typical device connections and installation height details, schedules and location map.
2. Resubmittal of shop drawings shall include a revision notation and clouded changes.
3. Produce accurate to scale (min. 1/8” = 1’) drawings showing equipment and device layouts prepared using a CAD or BIM engineering drawing program. When CAD background files are not available for existing buildings the Contractor shall inspect the site and collect information to create a floor plan. Walls shall be double line showing the thickness, single line diagrams are not acceptable.
4. Every room shall have a name and number identifying the use of the space with ceiling heights notated for each space or group of spaces throughout the design.
5. Indicate and/or notate door swings, glass walls, half walls, floor to ceiling windows, skylights, and other openings, projections, ceiling features, elevation changes, et cetera that affect the placement of alarm devices.
6. Show fire-rated walls, fire/smoke rated doors, fire rated shutters, fire rated rolling doors.
7. Locate and label all components of the system, label and indicate circuit routing, cable type, and gauge. The fire alarm panel location and all device locations shall be clearly identified by symbols matching the symbol legend. The labeling of circuits and devices shall correspond with the riser diagram.
8. Riser diagrams showing all components of the system. Show control panels, power supply panels, amplifiers, annunciators, network interfaces, all initiation and notification devices. Partial or typical riser diagrams are not acceptable.
9. If not included in the Product Data Submittal, include calculations for notification device circuit current drop, conductor size, and battery backup for all panels.
10. When multiple buildings make up the system, provide a block diagram of the project site showing all buildings to be covered by the fire alarm system and detailing the route and type of Signaling Line Circuit (SLC) connection between buildings. Note building entry points, conduit type and size, and routing pathway (underground or over canopy installation). Provide a separation in the outgoing and return conductors for all building connections as required for Class A circuits

per NFPA 72, 12.3.8.

11. Shop or coordination drawings shall include information that will allow the Contractor to coordinate interdisciplinary work and when necessary guide the manufacturer or fabricator in producing the product.
12. Any resubmittal shall include clouded changes and revision notation.

1.8 QUALIFICATIONS OF A PROPOSED CONTRACTOR

A. Proposed contractors who do not currently possess the necessary qualifications, trained and experienced personnel, financial capacity, required current licenses, and meet the other requirements herein described will be disqualified.

B. The contractor shall be licensed by the State of Texas Fire Marshal to sell, install, and service commercial fire alarm systems in accordance with the Texas Insurance Code.

C. The contractor shall not have any grievances or complaints of record regarding workmanship, code compliance, or service response with either the Owner or the State Fire Marshal's Office.

D. The Contractor shall have a full-time employee who is a state licensed Fire Alarm System Planning Superintendent. They shall be responsible for the design of the system submitted and shall sign all submittal drawings.

E. All work associated with the installation of the fire alarm system shall be under the direct supervision of a state licensed Fire Alarm Technician.

F. The proposed contractor, as a business entity, shall be an authorized and designated representative of the fire alarm panel equipment manufacturer, with full warranty privileges, and shall have been actively engaged in the business of selling, installing, and servicing commercial building fire alarm systems for a period of at least five (5) years.

G. The Contractor shall employ factory-trained technicians capable of supporting the maintenance of the system. A certificate of this training shall be provided with the contractors' submittal.

H. The proposed Contractor shall have an office within 150-miles of the job site and shall be capable of dispatching technicians to repair a system within six hours of a service request.

I. The proposed contractor shall be fully experienced in the design and installation of the type of Fire Alarm System herein specified and shall furnish with the contract proposal an itemized list of the installations of at least two (2) projects of the type specified herein. Each reference project listed must utilize a fire alarm control panel by the same manufacturer as the proposed system.

J. The ability of a proposed Contractor to obtain these specifications and provide a performance bond shall not be regarded as the sole qualification of the Contractors' competency and responsibility to meet the requirements and obligations of the contract.

K. The Builder shall be satisfied that a proposed Contractor meets all the requirements expressed herein before including the Contractor's proposal in the project.

L. The Owner may investigate, as they deem necessary, to determine the ability of the proposed Contractor to perform the work. The proposed Contractor shall furnish to the Owner with any information or data requested for this purpose.

M. The Owner reserves the right to reject the proposal of any Contractor who is unqualified, has previously failed to perform properly, or complete on time, contracts of a similar nature.

PART 2 PRODUCT REQUIREMENTS, FUNCTION AND PERFORMANCE

2.1 GENERAL

A. Type: Complete 24 VDC, closed circuit, electrically supervised, analog addressable, intelligent reporting, microprocessor-controlled fire detection and alarm system .

B. The system shall meet all requirements for a protected premises and supervising station fire alarm system per NFPA 72.

C. All equipment and components shall be new and the manufacturer`s current model. All like devices shall be of the same manufacturer and model number.

D. The system and all components shall be tested and found suitable for the specified purpose as part of a protected premises protective signaling (fire alarm) system by a nationally recognized approvals agency acceptable to the local AHJ.

E. All date keeping hardware, firmware, and software provided shall be fully compliant with the calendar year designated in four-digit date format. Any time equations must function normally, leap year, and daylight savings time must be supported.

F. All equipment and components shall be installed in strict compliance with manufacturers` recommendations and the requirements of the components UL listing.

G. The control units, power supplies, batteries, subassemblies, software, firmware, all cable types, detection, notification, control devices, and all accessories required to provide a complete operating system shall be listed and labeled by Underwriters Laboratories, Inc. for fire alarm system use under the latest appropriate testing standard including but not limited to the following:

UL 38 - Manually Actuated Signaling Boxes for Use with Fire Protective Signaling Systems
UL 50 - Enclosures for Electrical Equipment
UL 193 - Alarm Valves for Fire-Protection Service
UL 217 - Single and Multiple Station Smoke Detectors
UL 228 - Door Closers-Holders, With or Without Integral Smoke Detectors
UL 268 - Smoke Detectors for Fire Protective Signaling Systems
UL 268A - Smoke Detectors for Duct Application
UL 346 - Waterflow Indicators for Fire Protective Signaling Systems
UL 444 - Communications Cables
UL 464 - Audible Signal Appliances
UL 497B - Protectors for Data Communications and Fire Alarm Circuits
UL 521 - Heat Detectors for Fire Protective Signaling Systems
UL 539 - Single and Multiple Station Heat Detectors
UL 793 - Automatically Operated Roof Vents for Smoke and Heat
UL 864 - Control Units for Fire Protective Signaling Systems, Ninth Edition

UL 910 - Test for Cable Flame-Propagation and Smoke-Density Values for Electrical and Optical Fiber Cables Used in Spaces Transporting Environmental Air
UL 1424 - Cables for Power-Limited Fire Alarm Circuits
UL 1479 - Fire Tests of Through-Penetration Firestops
UL 1480 - Speakers for Fire Protective Signaling Systems
UL 1481 - Power Supplies for Fire Protective Signaling Systems
UL 1581 - Electrical Wires, Cables, and Flexible Cords
UL 1635 - Digital Alarm Communicator System Units
UL 1638 - Visual Signaling Appliances - Private Mode Emergency and General Utility Signaling
UL 1711 - Amplifiers for Fire Protective Signaling Systems
UL 1971 - Signaling Devices for the Hearing Impaired
UL 2043 - Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces
UL 2572 - Control and Communication Units for Mass Notification Systems

H. Consult the manufacturer`s installation manuals for all wiring diagrams, schematics, electrical requirements, cable types, and physical equipment sizes, et cetera, before beginning system installation. Refer to the manufacturers` riser and connection diagrams for all specific system installation, termination, and wiring data.

I. The contractor shall be responsible for sizing, verifying and supplying proper power supply(s) necessary to operate the system and audible/visual signals.

J. Provide stainless steel screw/bolt hardware wherever stainless devices are used and in potentially wet areas.

K. All equipment shall be attached to walls and ceiling/floor assemblies utilizing a structured cabling system and shall be held firmly in place (e.g., detectors shall not be supported solely by suspended ceilings). Fasteners and supports shall be adequate to support the required load.

2.2 ACCEPTABLE MANUFACTURES

A. Descriptions and details, acceptable manufacturers` names listed, and specific manufacturer and model number items indicated in this specification shall establish a standard of quality, function, and design.

B. Expand existing fire alarm control panels to serve the additional areas of the portables as shown on the drawings for each facility.
1. Travis Elementary School - Silent Knight.
2. LP Waters Elementary - Farenhyt IFP-1000.
3. Greenville Middle School - Farenhyt IFP-1000.

2.3 CIRCUIT TYPES

A. General: All low voltage fire alarm circuits shall be power limited, electrically or electronically supervised, and of the correct cable type and gauge. Low voltage fire alarm cables of various types are to be permitted within the same raceway or conduit. Cable must be separated from any open conductors of power, or Class 1 circuits, and shall not be placed in any conduit, junction box, or raceway containing these conductors, as per NEC Article 760. T-taps in any electrically supervised circuit are prohibited by this specification. All junction boxes and conduit ends shall be marked

red for all low voltage fire alarm circuits.

B. All fire alarm systems shall be installed in such a manner that the failure of any single alarm-actuating or alarm-indicating device will not interfere with the normal operation of any other such devices. All circuit types shall comply with NFPA 72 Chapter 12.
   1. Signaling Line Circuit (SLC): SLC circuits shall be wired Class A redundant path. Class A separation of outgoing and return cable routing shall be observed per NFPA 72, Chapter 12.
   2. Audio/Visual Notification Appliance Circuit (NAC): These circuits shall be wired Class B with electrical supervision and end of line devices.
   3. Initiating Device Circuits (IDC): Initiating device circuits shall be arranged to serve like categories (beam detectors, heat detectors, tamper switches). Mixed category circuitry shall not be permitted in a single IDC. A two-wire IDC shall contain only devices that require point-contact to operate. A four-wire IDC shall include an additional supervised circuit to supply 24 VDC operating power to devices that require it. These circuits shall be wired Class B with electrical supervision and end of line devices for circuits less than 10 feet in length, otherwise, the circuit shall be Class A redundant path. Class A separation of outgoing and return cable routing shall be observed per NFPA 72, Chapter 12.
   4. Low voltage, 24 VDC, device power circuits provide power to fire alarm system devices that are not powered by the SLC or the IDC circuit. These circuits have backup power and are supervised by an end of line relay and monitor module combination. These types of circuits are required to remotely power devices such as detector sounder bases, stand-alone CO detectors, etc.
   5. Low voltage, 24 VDC, fire safety control function circuits shall in all cases feature Class D "fail safe" operation and shall not have power backup. These circuits shall be controlled by a fire alarm system activated addressable control relay located within three feet of the device controlled and on activation, or loss of power, the connected device shall actuate to its fire safety condition (i.e. HVAC blower control circuits shall open).
   6. Line voltage, 120 VAC, fire safety control function circuits shall in all cases feature Class D "fail safe" operation and shall not have power backup. These circuits shall be controlled by a fire alarm system activated addressable control relay and auxiliary relay pair located within three feet of the device controlled and on activation, or loss of power, the connected devices shall actuate to their fire safety condition (i.e. fire door holders shall release, smoke dampers and fire/smoke dampers shall close). Line voltage fire safety control function circuits shall be wired by the Electrical Contractor and shall be standard non-supervised line voltage circuits in conduit, utilizing the type of conductors specified in Division 26 for light and power circuits.

2.4 FIRE ALARM CONTROL PANEL

A. Provide additional fire detection and alarm capability from existing fire alarm control panels at each site.

2.5 FIRE ALARM FLOOR PLAN MAP

A. Provide adjacent to the fire alarm control panel an updated view of all building areas covered by the fire alarm system meeting the following requirements:
   1. Framed and secured to the wall and plan covered with clear acrylic panel, SpaceAge Electronics Inc. model SSU52003 Display Frame or equivalent.
   2. Size plan to clearly show all required information.

3. Orient building to place the entry nearest to control panel at the bottom of plan.
4. "YOU ARE HERE" indicator with arrow.
5. Logical alarm zones.
6. Room names and numbers. (Verify with Owner)
7. Show each initiating device with symbol and identification number programmed in the panel. Do not show audio/visual devices.
8. Symbol legend.
9. True north arrow.
10. Scale indicator.

2.6 SYSTEM RECORD DOCUMENT CABINET

A. Provide, in accordance with NFPA 72, an adequately sized record documentation cabinet located at the system control unit or at an on-premises location approved by the AHJ and identified at the system control unit. Printed and/or electronic documentation shall include an owner's manual, published instructions, a design narrative and layout, record drawings, site specific software, passwords, and a record of installed software and firmware version numbers. The record documentation cabinet shall be 18-gauge minimum cold rolled steel with a red powder coat finish, a stainless steel-piano hinge, and keyed door lock. The cover shall be permanently screened with 1" high lettering stating "SYSTEM RECORD DOCUMENTS" in white letters. The interior shall accommodate as required standard 8.5" x 11" manuals and loose document records, a permanently mounted digital flash drive with USB-B connector, a business card holder, and key ring hooks. The cabinet shall be a Space Age Electronics, Inc. Part # SSU00689 System Record Document Cabinet or equivalent.

2.7 POWER SUPPLY PANELS

A. Provide as required additional power supplies for notification appliance circuits or as a remote power supply. Match new equipment to each fire alarm system expansion.

B. The primary locations shall be in IDF/MDF rooms, electrical rooms, wiring closets, custodial closets, or storage rooms. An area smoke detector shall be located at each fire alarm power supply location.

C. An area smoke detector shall be located at the power supply panel locations.

D. Each power supply shall individually report a trouble condition including battery charging failure, battery failure, NAC loss, AC power loss (delay acceptable), power brownout, or ground fault detection.

E. A trouble condition on a power supply shall not interfere with normal operation the rest of the system.

F. In the event of a trouble condition, each power supply shall provide location annotated individual point supervisory incident reporting to the main fire alarm control panel. This may be accomplished using one addressable module per power supply or via power supplies with multiplexed system bus communication or an integrated addressable interface.

G. Provide sufficient battery capacity for operation without AC power for twenty-four hours of normal supervision and five minutes of alarm operation at the end of this period; include a 20% safety factor in battery calculations to ensure adequate

performance for the service life of batteries.

H. Each power supply shall be labeled in a visible area with its device hardware address utilizing self-laminating, flexible vinyl film, non-smear, machine printed labels.

I. Conduit shall enter the power supply backbox only where conduit entry is specified by the manufacturer.

2.8 EMERGENCY ALARM STROBES AND HORN/STROBES

A. Provide as indicated below and as required per NFPA, federal, state and local code and ADA standards, notification appliances to include strobes, horns and horn/strobes that alert the building occupants to an emergency.

B. NFPA 72 prescribes the use of both ceiling and wall mounted audible/visual notification appliances. For this project, the preferred use is ceiling mounted devices in areas with a finished ceiling. Provide wall mounted devices in areas where the ceiling type or height prevents mounting and servicing of devices on the ceiling.

C. Notification appliance circuits serving employee work areas shall be initially installed with a minimum of 20% spare capacity for visible notification appliances to facilitate future additional device installation to accommodate hearing-impaired employees.

D. Audible signals shall be designed to provide at least 15 dB above ambient sound levels measured at 5 feet above the floor in the occupied area. Sound levels shall not exceed 110 dbA at the minimum hearing distance from the audible appliance.

E. Strobe intensity (candela output) and audible decibel level shall be sized for the room size and area of coverage per ADA and NFPA/ANSI and local codes and standards.

F. All interior strobe flashing shall be synchronized. Provide synchronization control such that all strobe circuits are synchronous, for all notification appliance circuits. Note that signal appliances that can synchronize on a single circuit, but not across all circuits are not acceptable.

G. Signal housings and grilles shall be white in color, imprinted `FIRE` and the strobe lens shall be clear.

H. Each device shall include IN and OUT wiring terminals, each designed to accept two #12 to #18 AWG wires at each terminal, with standard reverse polarity DC NAC circuit supervision.

I. Provide where indicated on plans or as required protective polycarbonate or wire Device Guards. Minimum of 1/8” thick clear polycarbonate or 10-gauge welded steel wire constriction with a corrosion resistant finish. To be Space Age Electronics, Inc. models: SSU03503 HSG Wall Mount Device Guard, SSU03504 FDG Flush Wall Mount Device Guard, or SSU03500 Ceiling Mount Device Guard as required or equivalent.

J. Provide notification appliances as follows:
   1. Match each portable notification appliances to the existing fire alarm system notification appliances.

2.9 MANUAL PULL STATIONS

A. Provide manual fire alarm pull stations as shown on the drawings. Manual fire alarm pull stations shall be matched to each fire detection and alarm system that is being expanded, or equivalent.

B. Manual stations shall be double action and provide a visible indication they have been operated. Manual stations shall require a key to be returned to normal condition, key alike to FACP. It is the responsibility of the Fire Alarm Contractor to ensure that the pull stations provided allow key reset with the station protector frame/spacer in place.

C. Provide a tamper proof clear Lexan shield with horn station protector over each pull station. The protector shall be a Stopper II Manual Station Protector with horn as manufactured by Safety Technology International, Inc. Waterford, Michigan, part number STI 1100 flush mount or STI 1130 for surface mount backboxes as required. For potentially wet areas, provide a similar cover with weather gasket, part number STI 1150 flush mount or STI 1155 for surface mount backboxes.

D. Each manual station shall be labeled in a visible area with its device hardware address utilizing self-laminating, flexible vinyl film, non-smear, machine printed labels.

2.10 SMOKE DETECTORS

A. Furnish and install analog spot type photoelectric smoke detectors as as shown on the drawings. Analog spot type photoelectric smoke detectors shall be matched to each fire detection and alarm system that is being expanded, or equivalent.

B. Except for temporary testing, smoke detectors shall not be installed until the building is ready for occupancy and cleaned as dust free as possible.

C. Each detector head shall be labeled in a visible area with its device hardware address utilizing self-laminating, flexible vinyl film, non-smear, machine printed labels.

2.11 CARBON MONOXIDE ALARMS

A. Provide as indicated on plans CO Alarm units listed and rated for commercial occupancies to be connected to an alarm control panel (system-connected). CO Alarm units shall be UL Listed and installed in accordance with IBC/IFC and NFPA requirements.

B. CO Alarm units shall be installed as Single-Station Carbon Monoxide Alarms (non-tandem operation) and they shall be zoned on a Class A (Style D) four-wire IDC circuit (six-wire interface (4+2) total between CO Alarm Units including power circuit). Zoned as indicated on the plans, provide at least one zone per floor.

C. Each zone of CO Alarm units shall be supervised for Alarm and Trouble conditions through interconnection with an addressable monitor module, which in turn is supervised through an SLC loop on the main control panel. Each CO Alarm unit shall be operate as a stand-alone detection and notification subsystem and the function of each shall not be impaired by any alarm or trouble condition on the other CO Alarm units in the same zone.

D. All system connected CO Alarm units function as a single system providing zone notification at the control panel for reporting of CO Alarm or CO Trouble conditions.

CO Trouble includes integral supervision for loss of power.

E. If a dangerous level of Carbon Monoxide gas is detected by a CO Alarm unit, the red LED alarm light will come on and stay on, the temporal-four pattern audible alarm will sound, and the Alarm relay will be activated. The CO Alarm unit will automatically reset when CO is no longer detected. If the test/hush button in pushed during an alarm, it will silence the integral sounder for five minutes, the red LED alarm light will stay on, and if CO is still present after five minutes, the detector will once again sound the audible alarm.

F. If there is a problem identified within a CO Alarm unit, on loss of power, or if the end of unit life indicator expires, the Trouble relay will be activated, in addition to the various LED blink rates will indicate the exact trouble.

G. The status of each zone of CO Alarm units shall be descriptively annunciated at the main control panel by zone and shall be distinct from fire alarm status conditions. CO Alarm signals must take precedence over a CO Trouble signals. CO zone status signals shall be indicated visually (alphanumeric display description and/or indicator lights) and audibly (sounder) at the control panel and distinctly transmitted to the supervising station, in addition to each CO Alarm unit shall include a test/hush button, multicolored LED status indicator, and a built-in 85 dB Code-4/TC4 (temporal-four pattern) audible alarm.

H. Each zone of CO Alarm units, as indicated on the plans, shall be a complete functional interconnected system of devices that includes supervised interface circuits to the main control panel. These circuits shall be arranged to monitor and annunciate the status of the CO Alarms and to initiate the appropriate response to those conditions. The power circuit shall be monitored via the CO Trouble relay when it indicates loss of power. The power source must be a regulated, filtered, power-limited, non-resettable, output from a system main or auxiliary control unit, providing 24 VAC operating power with primary (AC Main) and secondary (Battery Backup) capacity sufficient for operation without AC power for twenty-four hours of normal supervision and two hours of emergency operation at the end of this period.

I. Each CO Alarm unit shall be labeled in a visible area with its device zone identification utilizing self-laminating, flexible vinyl film, non-smear, machine printed labels.

J. Manufactures/Models:
   1. Provide as required - System Sensor CO1224TR or ESL model 260-CO Carbon Monoxide Detector Alarm units.
   2. Provide one (1) per zone - Addressable Monitor Module to supervise an IDC zone interface for 4-wire type conventional initiating devices, Class A (Style D).
   3. Provide as required IDC four-conductor wiring, shall be NEC type FPLP Plenum rated, 16 AWG or 14 AWG, solid four conductor signaling cable. Equivalent by Atlas, Belden, BSCC, or Remee.
   4. Provide as required power circuit two-conductor wiring, shall be NEC type FPLP Plenum rated, 16 AWG or 14 AWG, solid two conductor signaling cable. Equivalent by Atlas, Belden, BSCC, or Remee.

2.12 MONITOR MODULE

A. Addressable Monitor Modules shall be provided where an interface is required to supervise wiring and monitor contact alarm devices. Monitor modules shall be

matched to each fire detection and alarm system that is being expanded, or equivalent.

B. Mini-monitor modules concealed in an electrical box with a blank cover are not acceptable.

C. Each monitor module shall be labeled in a visible area with its device hardware address utilizing self-laminating, flexible vinyl film, non-smear, machine printed labels.

2.13 CONTROL MODULE

A. Addressable Signal Control Modules shall be matched to each fire detection and alarm system that is being expanded, or equivalent.

B. Each control module shall be labeled in a visible area with its device hardware address utilizing self-laminating, flexible vinyl film, non-smear, machine printed labels.

2.14 CONTROL RELAY

A. Addressable Control Relays shall be provided where required to provide a control interface for fire alarm system functions and shall be matched to each fire detection and alarm system that is being expanded, or equivalent.

B. Addressable Control Relays shall be located within three feet of the controlled device or unit and the relay output (load) wiring shall be configured a fail-safe Fire Safety Control Function circuit.

C. Each Fire Safety Control Function circuit-controlled device shall be configured such that when the fire alarm system safety control function circuit is re-energized, by the fire alarm control panel, the device shall return to normal operation (e.g. re-start or be ready to re-start) without a need for manual or environmental control system intervention.

D. Addressable Control Relays shall be used to directly control only pilot duty loads, those not exceeding 0.5 amps, up to 120 volts, and without transient voltage spikes. For all applications exceeding these parameters also provide with an Auxiliary Relay to handle the load.

E. Each control relay shall be labeled in a visible area with its device hardware address utilizing self-laminating, flexible vinyl film, non-smear, machine printed labels.

2.15 AUXILIARY RELAY

A. Provide a hardwired Auxiliary Relay paired with the addressable Control Relay for all fire safety control function applications in which the load exceeds 0.5 amps, 120 volts, or with high transient voltage spikes.

B. Each relay shall be mounted in a surface mount red metal enclosure with conduit knockouts. Relays shall be UL recognized and rated for ten million mechanical operations.

C. Auxiliary relays shall be labeled in a visible area with its device function utilizing self-laminating, flexible vinyl film, non-smear, machine printed labels.

D. Single pole standard duty Auxiliary Relays shall be operated by a multi-voltage coil (24 VDC, 24 VAC, 120 VAC, or 230 VAC), feature SPDT dry Form C contacts rated

10 Amps @ 120 VAC, and a status LED to indicate that the relay is energized. Provide Air Products & Controls model MR-101/C/R, multi-voltage coil, control relay with red metal enclosure or approved equivalent.

E. Double pole standard duty Auxiliary Relays shall be operated by a multi-voltage coil (24 VDC, 24 VAC, 120 VAC, or 230 VAC), feature DPDT dry Form C contacts rated 10 Amps @ 120 VAC, and a status LED to indicate that the relay is energized. Provide Air Products & Controls model MR-201/C/R, multi-voltage coil, control relay with red metal enclosure or approved equivalent.

F. Double pole heavy duty Auxiliary Relays shall be operated by a 24 VDC or a 120 VAC coil and feature DPDT dry Form C contacts rated at 30A @ 240VAC; 20A @ 277VAC; 2HP @ 240VAC / 1.5HP @ 120VAC. Provide Air Products & Controls model MR-199X-13/C/R (24VDC coil) or MR-199X-14/C/R (120 VAC coil) as required, heavy duty relay with red metal enclosure or approved equivalent.

2.16 DUCT MOUNTED SMOKE DETECTORS

A. Refer to mechanical system drawings and schedules and site visit observation for air handler sizes to determine the locations and quantities of addressable duct smoke detectors and addressable modules required to monitor and/or control HVAC units, dampers, smoke control systems, etc.

B. It shall be the sole responsibility of the fire alarm system contractor to furnish and install all of the fire alarm system devices that are required by the code and the AHJ for the mechanical systems.

C. The duct smoke detector shall be matched to each fire detection and alarm system that is being expanded, or equivalent.

D. Duct mounted smoke detector housings and sample tubes shall be furnished by the Fire Alarm Contractor and mounted by the Mechanical Contractor. Coordinate with the mechanical contractor.

E. When smoke is detected by a duct mounted smoke detector it shall activate a supervisory fire alarm condition at the fire alarm control panel.

F. Install duct smoke detector in the supply or return duct of units supplying greater than 2000 cfm per local AHJ requirements. Install duct smoke detectors in the supply and return duct of units supplying greater than 15,000 cfm.

G. Each HVAC unit for which a duct mounted smoke detector is installed shall also have a blower shutdown relay.

H. The activation of any duct mounted smoke detector shall actuate all related fire safety control functions: air handler shut down relays, smoke fire damper motors, fire door release devices, et cetera.

I. Each duct mounted detector housing shall be labeled in a visible area with its device hardware address utilizing self-laminating, flexible vinyl film, non-smear, machine printed labels.

J. Each detector shall be provided with a remote power/status LED and remote testing function. The remote LED indicator shall be located in the nearest corridor ceiling unless otherwise directed.

K. The status LED shall flash under normal conditions, indicating that the detector is operational and in regular communication with the control panel. The LED shall be placed into steady illumination when a supervisory fire alarm condition has been detected.

L. Each remote LED faceplate shall have a self-laminating, flexible vinyl film, non-smear, machine printed label indicating the HVAC unit number, type, and device identification number as programmed in panel.

2.17 HVAC UNIT BLOWER SHUT-DOWN AND SMOKE DAMPER OR FIRE/SMOKE DAMPER OPERATION

A. Refer to the mechanical system drawings, schedules and site visit observation to determine the locations and quantities of addressable modules required to control HVAC blowers, dampers, smoke control systems, etc.

B. It shall be the sole responsibility of the fire alarm system contractor to furnish and install all of the fire alarm system devices that are required by the code and the AHJ for the mechanical systems.

C. The contractor providing the device shall wire it internally for fail-safe shut-down and provide a labeled 3` coil of cable outside the unit to allow the fire alarm contractor to make final connection to the dry contacts on the controlling relay.

D. Provide an addressable control relay to control air handler shutdown of each unit without smoke dampers or fire/smoke dampers located in that unit’s duct system as indicated on the project mechanical plans.

E. Provide an addressable control relay, a double pole auxiliary relay, and a line voltage 120 VAC, fire safety control function circuit to control air handler shutdown of each unit with smoke dampers or fire/smoke dampers located in that unit’s duct system as indicated on the project mechanical plans.

F. Units with at least one supply grille serving a major path of egress (corridors, open concept classroom groups) shall have a shut-down control relay, even if unit is less than 2,000 CFM capacity. The shut-down will be activated on general alarm, which shall include any alarm from the smoke detectors in the corridor.

G. Duct detector supervisory alarm condition shutdown function shall be limited to a single unit or group of units as required. A shutdown of all the facility’s units on a single duct detector supervisory alarm shall be prohibited.

2.18 BUILDING LIGHTING CONTROL SYSTEM

A. Provide a fire alarm addressable control relay, located at the FACP, configured to activate on general alarm building illumination per NFPA 101 Section 7.8 Illumination of Means of Egress. The lighting control system contractor shall provide all associated hardware and wiring from this single fire alarm output to the lighting control system.

2.19 CABLING

A. The fire alarm contractor shall provide and install new and unused ASTM bare solid or stranded copper conductor cable per ANSI/NEMA, NEC and NFPA codes. Follow the manufacturer`s instructions. All cable shall be UL listed for fire protective, power

limited applications. All cable exposed in plenum attic spaces shall comply with UL 910, UL 1424, and UL 1581 vertical tray flame test.

B. Cabling shall be in accordance with local, state, and national codes (e.g., NEC Article 760) and as recommended by the manufacturer of the fire alarm system. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 18 AWG (1.02 mm) for initiating device circuits and signaling line circuits, and 14 AWG (1.63 mm) for notification appliance circuits.

C. Cable not installed in conduit shall have a fire resistance rating suitable for the installation as indicated in NFPA 70 (e.g., FPLP).

D. Signaling Line Circuit (SLC): Use shielded, or unshielded cabling as recommended by the FACP manufacturer. When recommended, shielded cable should be utilized to minimize electrical noise interference with data transmission. Shield drain wire to be grounded at one end only.

E. Between Building Signaling Line Circuit (SLC) or Network Node Circuits: Cabling between buildings shall be enclosed in conduit, including underground and over canopy installations. Cable installed in conduit between buildings shall be rated for direct burial. Use shielded or unshielded cabling as recommended by the FACP manufacturer.

F. Notification Appliance Circuit (NAC): All audible/visual signaling circuits shall be NEC type FPLP as required. Equivalent by West Penn, Atlas, Belden, BSCC, or Remee.

G. Initiating Device Circuits (IDC): All conventional contact alarm circuits and low voltage control circuits shall be NEC type FPLP as required. Equivalent by West Penn, Atlas, Belden, BSCC, or Remee.

H. Remote, supervised, 24 volt fire alarm device power: Two-conductor unshielded wiring, shall be NEC type FPLP, 16 AWG, 14 AWG, or 12 AWG, solid two conductor signaling cable. Equivalent by West Penn, Atlas, Belden, BSCC, or Remee.

2.20 CABLE ROUTING, INSTALLATION

A. The system cable, support and raceway installation shall be in accordance with good engineering practices and as established by the NFPA, the NEC and the Texas Insurance Code. Wiring shall meet all state and local electrical code requirements.

B. All cable shall have a label on both ends utilizing self-laminating, flexible vinyl film, non-smear, machine printed labels.

C. Fire alarm cables shall be run in bundles above accessible ceilings and supported from building structure building structure by j-hooks, conduit or cable tray.

D. No terminations or splices shall be installed in or above ceilings.

E. Fire alarm cables shall not be run loose on ceiling grid or ceiling tiles.

F. Each cable run shall include a three-foot service loop with wire tie located in the ceiling above the control unit panel. This is to allow for future re-termination or repair.

G. All cabling shall be placed with regard to the environment, EMI/RFI interference, and its effect on fire alarm signal transmission.

H. Do not route any fire alarm cable within two feet of any light fixture, HVAC unit, service access area, electric panel, or any device containing a motor or transformer.

I. Fire alarm cable must not be fastened to electrical conduits, mechanical ductwork/piping, sprinkler pipes.

J. Plenum rated Velcro hook cable ties shall be furnished and installed to attach wire bundles to supports and for appropriate wire management as required. Tie wraps made of hard plastic or metal will not be allowed.

K. Cabling shall be loosely bundled with cable ties randomly spaced at 30 to 48 inches on center, cable ties shall not be tight enough to deform cabling and shall not be used to support the cabling.

L. Attachments for cabling support shall be spaced at approximately 48 to 60 inches on center. The cable bundle shall not be allowed to sag more than 12 inches mid-span between attachments. Provide J-hoods as follows:
   1. Bundles up to 1/2" diameter - 3/4" J-Hook
   2. Bundles up to 1" diameter - 1-1/2" J-Hook
   3. Bundles up to 1-1/2" diameter - 2" J-Hook
   4. Bundles greater than 1-1/2" diameter - provide cable tray.

M. Do not mix different signal cables on the same J-Hook (i.e. fire alarm with telephone/data cable).

N. Cable shall not be installed in the same conduit or surface track raceway with line voltage electrical cable without a metallic barrier meeting NEC requirements.

O. Cable bends shall not be tighter that the manufacturers' suggested bend radius.

P. The cable shall not be crushed, deformed, skinned, crimped, twisted, or formed into tight radius bends that could compromise the integrity of the cabling.

Q. Maximum cable pulling tension should not exceed 25 pound-force (110 N) or the manufactures recommendation, whichever is less.

R. Any pulling compounds utilized must be approved by the cable manufacturer and shall not degrade the strength or electrical characteristics of the cable.

S. The cable pathway supports of ceiling installed devices must be positioned at least 12 inches above the ceiling grid. The required support wires for the ceiling grid or light fixtures shall not be utilized for support attachment.

T. Cable routing must not obstruct hatches, doors, utility access panels, fire doors, ventilation shafts, grates, service work areas or parallel for more than four-feet with line voltage electrical conductors.

2.21 FIRE ALARM SYSTEM CONTROL UNIT POWER

A. Line voltage for each fire alarm system control unit shall be provided as follows:
   1. Through individual dedicated branch circuits.
   2. Each fire alarm control unit cabinet shall be grounded securely to the building grounding system.
   3. Each branch circuit shall not be supplied through ground-fault circuit interrupters or arc-fault circuit interrupters.

4. Circuit breakers shall be labeled in red as FIRE ALARM.
5. Secure the “ON” breaker handle with a lockout clip that is red and clearly labeled “FIRE ALARM”
   a. Provide Space Age Electronics “ELOCK” or equivalent.
6. A breaker panel key shall be stored within the locked cabinet of each fire alarm control unit served by the breaker panel.
7. The location of the circuit breaker panel serving each fire alarm control unit shall be posted in the fire alarm control unit cabinet.

2.22 CONDUIT, SURFACE TRACK RACEWAY, ROUTING, INSTALLATION

A. Conduit and surface track raceway and support installation shall be in accordance with good engineering practices and as established by the NFPA, the NEC and the Texas Insurance Code. Conduit installation shall meet all state and local electrical code requirements.

B. It shall be the responsibility of the fire alarm electrical contractor to provide and install all conduit systems and standard electrical boxes for the fire alarm system.

C. The fire alarm contractor shall coordinate all requirements with, and provide special back boxes to, the electrical contractor prior to installation of conduit.

D. In all exposed and open ceiling areas such as gymnasiums, shops, field houses, janitors’ closets, elevator hoist ways, and mechanical / electrical rooms all fire alarm cable shall be fully enclosed in conduit.

E. Definitions:
   1. Electrical metallic tubing (EMT) for indoor applications. Compression fittings for EMT shall be used. Set screw fittings are not acceptable.
   2. Rigid metallic tubing (RMT) for outdoor applications. Threaded fittings for shall be used for RMT conduit.
   3. Flexible metallic conduit (FMC) for indoor applications. FMC is approved for short protected cable connections to the device. Support FMC per NEC.
   4. Surface track raceway shall be Wiremold® or equivalent. Surface track raceway shall be utilized for indoor finished surfaces where concealed cable is impracticable or impossible. Back boxes of the same manufacturer and color shall be installed.
   5. Polyvinyl chloride (PVC) for underground installations. Follow burial depth, protection and conduit fill per NEC.

F. Conduit and surface track raceway shall be complete with bushings, de-burred, cleaned, and secure prior to installation of cable.

G. Conduit and surface track raceway bends shall not be tighter that the manufacturers’ suggested bend radius.

H. All conduit and surface track raceway shall be supported from the structure at industry standard intervals for the size specified, utilizing proper anchoring devices. Cable fill may not exceed the standard set forth by the NEC.

I. All conduit and surface track raceway runs shall be spaced apart to allow for maintenance without disturbing adjacent pathways.

J. Conduit and surface track raceway shall not obstruct hatches, doors, utility access panels, fire doors, ventilation shafts, grates or service work areas.

K. Conduit stubs from wall boxes to accessible areas above finished ceilings shall be provided for wall mounted devices. Provide bushings to protect the cable from damage from metal openings as follows:
   1. Box openings - Thomas & Betts Series 3210 or equivalent.
   2. Conduit ends - Thomas & Betts Series 390 or equivalent.

2.23 CEILING MOUNTED DEVICE BOX HANGERS

A. All ceiling mounted devices including smoke detectors, heat detectors, remote power/status LEDs, ceiling mounted strobes and horn/strobes, et cetera, when mounted in a drop ceiling shall be supported by an electrical box hanger (Caddy #512 or #512A for deep boxes - 24" span), or equivalent. Box hangers shall be attached to the ceiling grid only for lateral stabilization, separate support wires shall be provided. The required support wires for the ceiling grid or light fixtures shall not be utilized. The backbox shall be flush and level with the bottom of the ceiling tile and the hole neatly cut for a finished appearance when the device is installed.

B. Device and box hanger assemblies shall not be supported solely by suspended ceilings. Fasteners and supports shall be adequate to support the required load.

2.24 SURGE PROTECTION

A. Each incoming 120VAC power circuit shall be provided with an electrical surge protection module. Provide one for each fire alarm control unit, this shall include every fire alarm control panel, digital communicator, signal power expander and any other 120VAC powered fire alarm control units. Each power circuit surge protector module shall be Ditek DTK-120SRD or equivalent.

B. Surge protection shall be provided for all exterior devices, communications service or antenna entrance connections, and for each circuit that connects one building to another (i.e. any other portion of a building complex not under one continuous roof) at both entry/exit points to prevent damage to equipment. Each surge protector shall be UL listed and mounted in a standard grounded metallic electric box or equipment backboard with a separate ground wire ran directly to the ground bus bar or equipment panel ground stud, do not daisy chain ground wires.

2.25 CUTTING AND PATCHING

A. Notify the Builder sufficiently ahead of construction of any floors, walls, ceiling, roof, et cetera, of any openings that will be required for his work.

B. The Contractor shall see that all sleeves required for his work are set at proper times to avoid delay of the job.

C. All necessary cutting of walls, floors, partitions, ceilings, et cetera, as required for the proper installation of the work under this Contract shall be done at the Subcontractor or at the Subcontractor's expense in a neat and workmanlike manner, and as approved by the Architect/Engineer.

D. Patching of openings and/or alterations shall be provided by the Electronic Safety and Security Subcontractor or at the Subcontractor's expense in an approved manner.

E. No joists, beams, girders, or columns shall be cut by any Contractor without first obtaining written permission of the Architect/Engineer.

F. All openings in firewalls and floors shall be completely sealed after installation for a completely airtight installation. Sealing material shall be non-combustible and UL approved. The installed sealing assembly shall not cause the fire rating of the penetrated structure to be decreased.

G. All openings in exterior walls shall be sealed watertight.

H. Seal voids around conduits penetrating fire-rated assemblies and partitions using fire stopping materials and methods in accordance with NFPA and local codes.

2.26 FIRE STOPPING, DRAFT/NOISE STOPPING, PENETRATIONS, CORING

A. UL Listed fire stopping methods that match the fire rating of the wall or floor being penetrated are to be used at all fire barrier penetrations. Seal the interior of the conduit sleeve around the cables and around the outside of the sleeve on each side of the penetration with fire-stop caulk or putty, install according to the manufacturers' instructions.

B. All penetrations through fire rated walls or floors shall feature a suitable length of metal conduit. Hole diameter shall not exceed ½" larger than the conduit or sleeve to be installed. The hole shall be neatly cut, not oversize or irregular. Do not share wall/floor penetrations with ductwork, piping, line voltage electrical conduits, et cetera.

C. Penetrations through non-rated walls shall include draft/noise stopping to minimize the transfer of air and sound between enclosed areas. Provide the penetration as in the rated wall instructions and install non-combustible mineral, wool, fiberglass, cellulose insulation, caulk, and/or sealant as required.

D. Sleeves placed for new construction shall be coordinated with the building Architect, Engineer, Builder and Electrical Contractor so that later coring or drilling of building structural members will not be required. The Contractor must consult with the building Architect, Engineer, and Builder to place sleeves at approved, appropriate locations.

E. Any concrete coring required this Contractor shall supply all labor, equipment, tools, materials and pay for the X-ray and concrete coring contractor to create any additional penetrations. Approval shall be required by the Architect/Engineer before coring can take place. Under no circumstances shall penetrations be made without approval. Care shall be taken not to stress, overheat, or penetrate any building support member. Utilizing a chisel or percussion type equipment is forbidden.

PART 3 PROJECT EXECUTION AND INSTALLATION

3.1 INSTALLATION

A. Cooperation with trades of adjacent, related or affected materials or operations, and or trades performing continuations of this work under subsequent contracts are considered a part of this work. In order to effect timely and accurate placing of work and to bring together, in the proper and correct sequence, the work of such trades, including work provided under a Division 1 allowance.

B. The Electronic Safety and Security Contractor shall coordinate installation of the electronic safety and security systems with the Builder, Electrical, Mechanical, and Plumbing Contractors to insure a complete working system for the Owner.

C. Where required for accessibility all conduit and boxes shall be provided by the Electrical Contractor as specified, including systems in Division 28, any and all allowances shall be included. Normally low voltage wiring shall run open and supported in accessible attic space. All low voltage wiring in exposed areas such as gyms, stages, shops, and field houses shall be enclosed in conduit. Coordinate with, and verify with Division 26 to provide required conduit and boxes at locations and heights as required.

D. Conduit, innerduct, track, or raceway shall conceal and protect wiring in exposed areas, within walls, through in- accessible areas, floors, chases, under slab, crawlspaces, or underground.

E. All conduit, duct, track, and raceway runs shall be spaced apart to allow for maintenance, such as the installation of couplings, without disturbing adjacent pathways.

F. All work must be performed by workers skilled in their trade. The installation must be complete whether the work is concealed or exposed.

G. Coordinate the actual locations of devices and outlets and equipment with building features and mechanical equipment as indicated on architectural, structural, and mechanical drawings. Review with the Architect any proposed changes in outlet or equipment location. Relocation of devices, before installation, of up to 3 feet from the position indicated, may be directed without additional cost. Remove and relocate outlets placed in an unsuitable location when so requested by the Architect.

3.2 EXAMINATION

A. Verify field conditions including existing systems, equipment models, configurations, circuiting arrangements, cabling, and devices. Adjust all circuiting, cabling, and materials to be provided as required by job conditions.

B. Project drawings are based on casual field observation and existing record documents when available, report any significant discrepancies to the Engineer before disturbing existing systems.

C. The Contractor accepts the existing conditions when beginning the project.

3.3 IMPLEMENTATION

A. Verify phasing in regard to systems and coordinate before energizing any system.

B. When required during phases of construction to maintain existing systems in service in particular areas, provide temporary wiring and connections as necessary to accommodate construction.

3.4 OPERATION PRIOR TO COMPLETION

A. When the phasing of a project requires that fire alarm systems are operable in certain areas and the Owner needs to operate the equipment, such provisions shall be made by the contractor. The warranty period shall commence when the equipment is operated for the beneficial use of the Owner. Regardless of whether or not the equipment has or has not been operated, the Contractor shall properly clean the equipment, properly adjust, and complete all punch list items before final acceptance by the Owner. The date of acceptance and the start of the warranty may not be the

same date.

3.5 PROTECTION OF EQUIPMENT AND MATERIALS

A. The Contractor shall take such precautions as may be necessary to protect his apparatus from damage.

B. This shall include the creation of all required temporary shelters to protect any apparatus above the floor of the construction and the covering of apparatus in the completed building with tarpaulins or other protective covering.

C. Failure to comply with the above to the satisfaction of the Owner's inspector will be sufficient cause for the rejection of the equipment in question and its complete replacement by the Contractor.

3.6 SIGNAL TYPES (SYSTEM STATUS)

A. General: The Fire Alarm Control Panel shall indicate various conditions or signals depending on system inputs. In all instances, a more severe signal shall override all less severe signals. All events are to be recorded with time and date in an electronic event history log maintained by the fire alarm control panel. The following is a short description of conditions that the Fire Alarm Control Panel is required to indicate in order of severity.
   1. WATERFLOW FIRE ALARM: A waterflow signal is a special alarm condition that is only applicable when an automatic building sprinkler or similar system is monitored. It indicates that at least one sprinkler head is open, so in addition to a fire, the premises are subject to water damage. This signal is transmitted on a special channel on the digital communicator. This is a fire alarm condition and all actions listed under fire alarm shall take place.
   2. FIRE ALARM: This alarm signal is indicative of fire. Such a signal indicates an emergency requiring immediate action. All premises audible and visual notification appliances shall operate and the protected premises evacuated. A local audible alert shall sound, the alarm LED illuminate, and descriptive message appear on the LCD display at the panel and any remote annunciators until the panel is reset. The digital communicator transmits a fire alarm signal.
   3. SUPERVISORY ALARM: A supervisory signal indicates the need for action concerning a duct mounted smoke detector, or the maintenance of related systems. An audible alert shall sound, the supervisory LED illuminate, and descriptive message appear on the LCD display at the panel and any remote annunciators until silenced. The digital communicator transmits a supervisory signal.
   4. TROUBLE: A trouble signal indicates a fault in a monitored circuit or component of the fire alarm system. This could be a short, open, or ground in a supervised circuit. It could also indicate a device or battery failure. A local audible alert shall sound, the trouble LED illuminate, and descriptive message appear on the LCD display at the panel and any remote annunciators until silenced. The digital communicator transmits a trouble signal.
   5. MAINTENANCE ALERT: A maintenance alert is an early warning of a condition before a device becomes inoperable. This is often a smoke detector that needs cleaning or other normal maintenance item. The maintenance alert shall display on the panel and any remote annunciator LCD display until acknowledged. No audible alert shall sound and no signal transmitted, in order that this condition not be confused with a supervisory or trouble condition.

6. NORMAL: All systems and supervised circuits functioning normally.

3.7 SEQUENCE OF OPERATION

A. Alarm Condition: When a fire alarm condition is indicated by any manual pull station, heat detector, area smoke detector shall cause the following actions or effects to take place:
   1. At the panel and any remote annunciators, a system alarm LED shall flash and a local sounding device shall activate.
   2. The 80-character LCD display shall indicate all pertinent information associated with the alarm condition and its location.
   3. The digital communicator shall activate and transmit a GENERAL ALARM signal to the monitoring company.
   4. All audible and visual signal devices shall activate and operate until silenced manually, or until automatically silenced, by the control panel. Any subsequent alarm from another device shall automatically reactivate all audible and visual signal devices.
   5. Fire safety control functions related to providing free egress from the facility shall be activated on general alarm, including the automatic opening of any controlled motorized security grills and automatic unlocking for egress of any controlled non-fire rated security doors or gates.
   6. Fire safety control functions conditional on the detection of an alarm condition in one or more designated adjacent area smoke detectors shall be activated independently on a one-for-one basis, these functions may include air handler shutdown of units without a duct mounted smoke detector, electromagnetic door hold back release, release of overhead coiling or hinged fire or smoke rated doors or shutters (those designed to close in order to control the spread of fire or smoke), high volume low speed (HVLS) fan shut down, and any other conditional operations such as elevator recall.
   7. Each Fire Safety Control Function circuit controlled device shall be configured such that when the fire alarm system safety control function circuit is re-energized, by the fire alarm control panel, the device shall return to normal operation (e.g. be ready to re-start) without a need for manual or environmental control system intervention.
   8. The FACP event history storage equipment shall log the information associated each new fire alarm control panel condition, along with time and date of occurrence.

B. When a dangerous accumulation of Carbon Monoxide gas is detected on any CO detection unit zone the following actions or effects shall take place:
   1. At the individual initiating CO detection unit, the red LED alarm light will come on and stay on, the temporal-four pattern audible sounder base alarm will sound.
   2. At the panel and any remote annunciators, a system alarm LED shall flash and a local sounding device shall activate.
   3. The 80-character LCD display shall indicate Carbon Monoxide Alarm, the zone number, and its location.
   4. The digital communicator shall activate and transmit a Carbon Monoxide Alarm, the zone number, and its location to the monitoring company.
   5. The FACP event history storage equipment shall log the information associated each new fire alarm control panel condition, along with time and date of occurrence.

C. The detection of any system internal or external trouble condition or the actuation of any supervisory alarm condition, as applicable, including any duct mounted smoke detector shall automatically cause the following actions to take place:
   1. At the panel and any remote annunciators, a system supervisory alarm LED or trouble LED shall flash as appropriate and a local sounding device shall activate. Audible supervisory or trouble alerts that have been silenced shall automatically resound every twenty-four hours or less until repairs are made.
   2. The 80-character LCD display shall indicate all pertinent information associated with the trouble or supervisory condition and its location; however, unacknowledged alarm messages shall have priority over trouble messages.
   3. The digital communicator shall activate and transmit a SUPERVISORY or TROUBLE signal to the monitoring company.
   4. Conditional activation on supervisory alarm of any automatic programs assigned to the supervisory alarm point shall be executed and the associated indicating devices and relays shall be activated. When duct mounted smoke detectors indicate a supervisory alarm provide instantaneous activation of related fire safety control functions including any electromagnetic door hold back and release devices and any air handler shut down relays and smoke fire damper motors.
   5. Detection of a supervisory alarm in a duct mounted smoke detector shall initiate shutdown of the associated air handler and closing of any smoke dampers or fire/smoke dampers located in that unit’s duct system, on a conditional one-for-one basis.

3.8 BASIC SETUP AND TESTING

A. The completed system is to be tested for compliance with the specifications.

B. The System Contractor shall make a thorough inspection of the complete installation to ensure the following:
   1. Complete and functional system.
   2. Installed in accordance with manufacturer`s instructions.

C. Prior to the testing, ensure that the system is free of short circuits, grounds, or instability of any form.

D. The testing work shall be performed after installation has been completed, but prior to any use of the system.

3.9 SYSTEM RECORD OF COMPLETION, INSPECTION AND TESTING, WARRANTY, SERVICE

A. A factory-trained representative of the manufacturer shall supervise the final connections and testing of the system and it shall be subject to the final acceptance of the Architect, Engineer, and local authorities. Testing shall be per NFPA 72, Chapter 7 Documentation. Provide applicable forms for each Record of Completion, Inspection and Testing and other documents from NFPA 72, Chapter 7. Testing shall include, but not be limited to, the following:
   1. Before energizing the system check all cables for correct connections and test for short circuits, ground faults, continuity, and insulation.
   2. Close each sprinkler system valve with a tamper switch, when applicable, and verify proper supervisory alarm at the FACP.

3. Verify alarm activation of waterflow switches by operation of the test port valve on each riser (when applicable).
4. Open each initiating device circuit and verify that the trouble signal actuates.
5. Open and short each signaling line circuit and verify that the trouble signal actuates.
6. Open and short each notification appliance circuit and verify that trouble signal actuates.
7. Individually ground each circuit and verify response of trouble signals.
8. Check for presence of strobe signal and audibility of tone at all alarm notification devices.
9. Check installation, supervision, and operation of all area detectors using the walk test.
10. Check installation, configuration, and operation of all duct mounted smoke detectors. Verify that there is adequate airflow through the sample tubes and housing to activate the detector when smoke is present in the duct.
11. Each of the alarm conditions that the system is required to detect should be introduced on the system. Verify the proper receipt and the proper processing of the signal at the FACP and the correct activation of the control points.
12. Verify proper operation of all fire safety control functions including when applicable fire door hold open/release, coiling fire door release, air handler shutdown, smoke damper or fire/smoke damper control, high volume low speed (HVLS) fan shut down, and the automatic opening of any controlled motorized security grills and automatic unlocking for egress of any controlled non-fire rated security doors or gates.
13. Check operation of elevator recall and shunt-trip when applicable.
14. Ensure that all dust covers are removed from smoke and heat detectors at substantial completion.

B. The Fire Alarm Contractor shall be ultimately responsible for safe and complete operation of the system. Any issues affecting proper operation of the system relating to the Electrical, Mechanical, Fire Protection, Fire Suppression or other contractors shall be resolved by the Fire Alarm Contractor, at no additional cost to, and without requesting intervention by the Owner.

C. The Fire Alarm Contractor shall provide a complete, dated, installation certificate meeting state requirements for each installation including a System Record of Completion and an Emergency Communications Systems Supplementary Record of Completion. A Fire Alarm Installation Record sticker listing the; installation firm`s name, address, and telephone number; signature of Licensee and license number; Fire Alarm Planning Superintendents name and license number; and the installation date, meeting state requirements shall be attached to the main fire alarm control panel. The Fire Alarm Contractor shall submit a copy of the installation certificate, final testing forms with final results and speech intelligibility testing results to the Architect at the time of substantial completion.

D. The contractor shall provide a labor warranty of the installed system against defects in material or workmanship for a period of one (1) year from the date of substantial completion. Provide the equipment manufacturer’s warranty information with the operating and maintenance (O&M) manual.

E. Equipment or cabling shown to be defective shall be replaced, repaired, or adjusted free of charge. All equipment will carry a one-year warranty or manufacturer’s warranty whichever is greater. All labor and materials shall be provided at no expense

to the Owner.

F. Immediately prior to the end of the warranty period, the system shall be inspected and certified for the following year at no additional cost to the Owner.

3.10 AS-BUILT DRAWINGS, MANUALS, TRAINING

A. As-built drawings and operating and maintenance (O&M) manuals may be electronically transmitted in PDF file format (preferred) or paper copies may be provided in quantities indicated in Division 1. Paper copies shall be organized including index tabs in a 3-ring black binder of sufficient size.

B. Upon completion of the installation, and prior to final inspection, the fire alarm Contractor shall furnish as-built drawings.

C. In addition, the fire alarm contractor shall furnish complete operating and maintenance manuals listing the manufacturer`s name(s), including technical data sheets. Manuals shall include wiring diagrams to indicate internal wiring for each device and the interconnections between the items of equipment. Provide a clear and concise description of operation that gives, in detail, the information required to properly operate the equipment and system. Provide a parts list with manufacturer and model number for commonly replaced parts. Include complete instructions for the inspection, testing, and maintenance of the system.

D. Provide fire alarm testing frequency information to the owner in the O&M manual per NFPA 72, Section 14.4.4.

E. Provide the Owner a copy of the panel control software including the licensed program, site specific data file, and passwords that the Owner may require to maintain the system.

F. The fire alarm contractor shall conduct formal on-site training sessions. It shall be the responsibility of the Contractor to coordinate time and location of training sessions with the Owner. Provide documented general instruction as follows:
   1. Provide instruction to the maintenance personnel to include the location, inspection, maintenance, testing, and operation of all system components. Provide a minimum of four (4) hours-two 2-hour sessions separated by a minimum of two weeks.
   2. Provide instruction to designated personnel on the functions and operation of the FIRE DETECTION AND ALARM SYSTEM including capabilities, limitations, monitoring, and the meaning of status messages. State the proper procedure for fire drills, routine maintenance, and request for service. Provide a minimum of four (4) hours-two 2-hour sessions separated by a minimum of two weeks.

END OF SECTION

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SECTION 31 05 13

SOILS FOR EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Subsoil materials.
   2. Topsoil materials.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:
   1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:
   1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
   2. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).
   3. ASTM D2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Samples: Submit appropriate quantity, in air-tight containers, sample of each type of fill to testing laboratory.

C. Materials Source: Submit name of imported materials source.

D. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

A. Furnish each subsoil or topsoil material from single source throughout the Work.

B. Perform Work in accordance with appropriate city and state agency requirements.

PART 2 - PRODUCTS

2.1 SUBSOIL MATERIALS

A. Use of onsite excavated soils.
   1. If the geotechnical report indicates that onsite excavated soils may meet any of the subsoil types contained herein, they shall be used in preference of imported subsoils.
   2. Onsite excavated soils that are to be used for any Subsoil type shall conform to the same standards and testing requirements stated below.
   3. It shall be the contractor's responsibility that onsite soils are properly segregated, stockpiled, and verified as adequate in quantity for the intended purpose.

B. Subsoil Type S1:
   1. Select Fill: These soils are typically used in structural embankment areas.
   2. Excavated and re-used material or imported borrow.
   3. Graded.
   4. Free of lumps larger than 3 inches, rocks larger than 2 inches, and debris.
   5. Conforming to the requirements of the geotechnical report. If no geotechnical report the fill materials to be used beneath areas to be paved may consist of any native soil and should be compacted to a minimum density of 95% ASTM D698 (standard proctor) at a moisture content within the range of optimum +/-3% except for fat clay soils which should be placed at above optimum moisture contents. Lime treatment of the finished subgrade can be omitted where the top 18" of finished subgrade in fill areas consists of a select material with the following properties: a PI ranging from 8 to 18, a liquid limit ≤35 and a percentage passing the #200 sieve < 40%.

C. Subsoil Type S2:
   1. General Fill: These soils are typically used in non-structural embankment areas, 10' outside of buildings or 2' outside of other structures.
   2. Excavated and re-used material or imported borrow.
   3. Graded.
   4. Free of lumps larger than 3 inches, rocks larger than 2 inches, and debris.
   5. Conforming to the requirements of the geotechnical report. If no geotechnical report the fill materials to be used shall be approved by the engineer.

D. Subsoil Type S3:
   1. Native Soils for Utilities
   2. Excavated and re-used material or imported borrow.
   3. Graded.
   4. Free of lumps larger than 3 inches, rocks larger than 2 inches, and debris.
   5. Conforming to the requirements of the geotechnical report. If no geotechnical report the fill materials to be used shall be approved by the engineer.
   6. TOPSOIL MATERIALS

E. Topsoil Type S4:
   1. Excavated and reused material.
   2. Graded.
   3. Free of roots, rocks larger than 1/2 inch, subsoil, debris, large weeds and foreign matter.

F. Topsoil Type S5:
   1. Imported borrow.
   2. Friable loam.
   3. Reasonably free of roots, rocks larger than 1/2 inch, subsoil, debris, large weeds, and foreign matter.
   4. Acidity range (pH) of 5.5 to 8.5.

2.2 SOURCE QUALITY CONTROL

A. Section 01 40 00.10 - Civil Quality Requirements: Testing and Inspection Services Testing and analysis of soil material.

B. Testing and Analysis of Subsoil Material: Perform in accordance with ASTM D698.

C. When tests indicate materials do not meet specified requirements, change material and retest.

D. Furnish materials of each type from same source throughout the Work.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Excavate subsoil and topsoil from areas designated. Strip topsoil to full depth of topsoil in designated areas.

B. Stockpile excavated material meeting requirements for subsoil materials and topsoil materials.

C. Remove excess excavated materials not intended for reuse, from site.

D. Remove excavated materials not meeting requirements for subsoil materials and topsoil materials from site.

3.2 STOCKPILING

A. Stockpile materials on site at locations indicated by Owner.

B. Stockpile in sufficient quantities to meet Project schedule and requirements.

C. Separate differing materials with dividers or stockpile apart to prevent mixing.

D. Prevent intermixing of soil types or contamination.

E. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.

F. Stockpile unsuitable materials on impervious material and cover to prevent erosion and leaching, until disposed of.

3.3 STOCKPILE CLEANUP

A. Remove stockpile, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

B. Leave unused materials in neat, compact stockpile, if allowed.

C. When borrow area is indicated, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

END OF SECTION

SECTION 31 05 16

AGGREGATES FOR EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Coarse aggregate materials.
2. Fine aggregate materials.
3. Document: Geotechnical report; bore hole locations and findings of subsurface materials.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:
1. AASHTO M147 - Standard Specification for Materials for Aggregate and Soil-Aggregate Subbase, Base and Surface Courses.
2. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:
1. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
3. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).
4. ASTM D2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).
5. ASTM D4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Samples: Submit, in moisture-tight containers to testing laboratory.

C. Materials Source: Submit name of imported materials suppliers.

D. Manufacturer's Certificate: Certify materials meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

A. Furnish each aggregate material from single source throughout the Work.

B. Perform Work in accordance with appropriate city and state agency requirements.

C. Maintain one copy of document on site.

PART 2 - PRODUCTS

2.1 COARSE AGGREGATE MATERIALS

A. Roadway Sub-base and Base Aggregates: Conforming to TxDOT Standard Specification Item 421 and local standards. Aggregates approved for project use are as follows:
   1. Grade 1, Grade 2 or Grade 3, as shown on the plans.
   2. Type A, Type B, Type C, or Type D material types may be used.
   3. If not listed on plans or specifications, use Type A Grade 2 road base.

B. Foundation and Drainage Aggregates: Conforming to TxDOT and local standards. Aggregates approved for project use are as follows:
   1. Grade 2 or Grade 3, as shown on the plans.

2.2 FINE AGGREGATE MATERIALS

A. Pipe Bedding: Conforming to ASTM D2321 and ASTM D2774. Bedding and haunching types as follows:
   1. Class IA (open graded manufactured) and Class IB (dense graded manufactured).
   2. Class II Clean Coarse Grained Soils (GW, GP, SW, and SP).
   3. Class III Coarse Grained Soils with Fines (GM, GC, SM, and SC).

B. Surface Treatment Cover Stone: Conforming to TxDOT and local standards. Fine Aggregates approved are as follows:
   1. Grade 1, Grade 2 or Grade 3S as shown on the plans.
   2. Type A, Type C, Type D, Type L, Type PA, Type PC, Type PD, or Type PL material types may be used.
   3. If not listed on plans or specifications, use Type 2 or 3S cover stone.

2.3 SOURCE QUALITY CONTROL

A. Section 01 40 00.10 - Civil Quality Requirements: Testing and inspection services.

B. Coarse Aggregate Material - Testing and Analysis: Perform in accordance with ASTM D698, ASTM D4318, ASTM C136.

C. Fine Aggregate Material - Testing and Analysis: Perform in accordance with ASTM D698, ASTM D4318, ASTM C136.

D. When tests indicate materials do not meet specified requirements, change material and retest.

PART 3 - EXECUTION FOR EARTHWORK

3.1 EXCAVATION

A. Excavate aggregate materials from on-site locations designated by Architect/Engineer.

B. Stockpile excavated material meeting requirements for coarse aggregate materials and fine aggregate materials.

C. Remove excess excavated materials not intended for reuse, from site.

D. Remove excavated materials not meeting requirements for coarse aggregate materials and fine aggregate materials from site.

3.2 STOCKPILING

A. Stockpile materials on site at locations designated by Architect/Engineer.

B. Stockpile in sufficient quantities to meet Project schedule and requirements.

C. Separate different aggregate materials with dividers or stockpile individually to prevent mixing.

D. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.

E. Stockpile unsuitable materials on impervious material and cover to prevent erosion and leaching, until disposed of.

3.3 STOCKPILE CLEANUP

A. Remove stockpile, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

B. Leave unused materials in neat, compact stockpile, if allowed.

C. When borrow area is indicated, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

PART 4 - EXECUTION FOR BASE COURSES

4.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify compacted substrate is dry and ready to support paving and imposed loads.
   1. Proof roll substrate with loaded dump truck or pneumatic roller in minimum two perpendicular passes to identify soft spots.
   2. Remove soft substrate and replace with compacted fill.

C. Verify substrate has been inspected, gradients and elevations are correct.

4.2 PREPARATION

A. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting.

B. Do not place fill on soft, muddy, or frozen surfaces.

4.3 AGGREGATE PLACEMENT

A. When required, install geotextile fabric over subgrade in accordance with manufacturer's instructions.
   1. Lap ends and edges a minimum of 6 inches.
   2. Anchor fabric to subgrade when required to prevent displacement until aggregate is installed.

B. Spread aggregate over prepared substrate to total compacted thickness as indicated on Drawings.

C. Roller compact aggregate to 95% maximum density ASTM D698, or as indicated on Drawings.

D. Level and contour surfaces to elevations, profiles, and gradients indicated.

E. Maintain optimum moisture content of fill materials to attain specified compaction density.

F. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

4.4 TOLERANCES

A. Section 01 40 00.10 - Civil Quality Requirements: Tolerances.

B. Maximum Variation From Thickness: ¼ inch.

C. Maximum Variation From Elevation: ¼ inch in 16 feet.

4.5 FIELD QUALITY CONTROL

A. Section 01 40 00.10 - Civil Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Compaction testing will be performed in accordance with ASTM D698.

C. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.

D. Frequency of Tests: One test for every 1,500 square yards compacted aggregate.

4.6 COMPACTION

A. Compact materials to 98 percent of maximum density as determined from test strip, in accordance with ASTM D2940.

PART 5 - EXECUTION FOR SURFACE COURSES

5.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify compacted substrate is ready to support paving and imposed loads.
   1. Flexible base shall be compacted, swept and seal coated.
   2. Asphalt surfaces shall be swept and primed.

C. Aggregate shall be clean and dry.

5.2 AGGREGATE PLACEMENT

A. Place and spread using proper equipment and volume of material.

B. Place in accordance with TxDOT Standard Specification Item 316 and local standards.

END OF SECTION

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SECTION 31 10 00

SITE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Removing surface debris.
   2. Removing designated paving, curbs, and structures.
   3. Removing designated trees, shrubs, and other plant life.
   4. Removing abandoned utilities.
   5. Disposal

1.2 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data for herbicide. Indicate compliance with applicable codes for environmental protection.

1.3 QUALITY ASSURANCE

A. Conform to applicable code for environmental requirements, disposal of debris, burning debris on site, and use of herbicides.

B. Perform Work in accordance with appropriate city and state agency requirements.

C. Maintain one copy of each document on site.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Herbicide: Type, approved by authority having jurisdiction.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify existing plant life designated to remain is tagged, identified and protected.

C. Identify waste and/or salvage areas for placing removed materials.

3.2 PREPARATION

A. Call Local Utility Line Information service not less than three workdays before performing Work.
   1. Request underground utilities to be located and marked within and surrounding construction areas.

B. Install erosion and sedimentation controls.

C. Install traffic controls.

D. Coordinate with adjoining property owners.

3.3 PROTECTION

A. Locate, identify, and protect utilities indicated to remain, from damage.

B. Protect trees, plant growth, and features designated to remain, as final landscaping.

C. Protect bench marks, survey control points, and existing structures from damage or displacement.

D. Protect erosion and sedimentation controls.

3.4 TREE PROTECTION

A. Erect and maintain temporary fencing around tree protection zones before starting site clearing. Remove fence when construction complete.
   1. Do not store construction materials, debris or excavated material in tree protection zones.
   2. Do not permit vehicles, equipment or foot traffic within tree protection zone.
   3. Maintain fenced area free of weeds and trash.

B. Do not excavate within tree protection zones, unless otherwise indicated in plans.

C. Where new construction is required in tree protection zones, hand clear and excavate to minimize damage to root systems.
   1. Use small tools and cleanly cut roots.
   2. Cover exposed roots with burlap and water regularly.
   3. Temporarily support and protect roots from damage until they are permanently redirected and covered with topsoil.
   4. Coat cut faces of roots more than 1 1/2 inches in diameter with an emulsified asphalt or other approved coating formulated for use on damaged plant tissues.
   5. Backfill with soil as soon as possible.

D. Repair or replace trees and vegetation indicated to remain that are damaged by construction.

3.5 CLEARING

A. Clear areas required for access to site and execution of Work.

B. Remove trees and shrubs as indicated. Remove stumps, root ball, root system, and surface rock.

C. Clear undergrowth and deadwood, without disturbing subsoil.

3.6 REMOVAL

A. Remove debris, rock, and extracted plant life from site.

B. Remove paving, curbs, and structures.

C. Neatly saw cut edges at right angle to surface paving, curb and structures to remain as indicated on plans. Replace any paving, curb and structures for items damaged during project.

D. Remove abandoned utilities. Indicate removal termination point for underground utilities on Record Documents.

E. Continuously clean-up and remove waste materials from site. Do not allow materials to accumulate on site.

F. Do not bury materials on site. Leave site in clean condition.

G. Burning is not allowed without authorization by local authorities and proper permitting by the contractor.

H. Unless otherwise shown on the plans, accept ownership and properly dispose of removal items in accordance with federal, state, and local regulations.

END OF SECTION

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SECTION 31 22 13

ROUGH GRADING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Excavating topsoil.
2. Excavating subsoil.
3. Cutting, grading, filling, rough contouring, and compacting.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:
1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:
1. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
3. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
4. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).
5. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
6. ASTM D2419 - Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
7. ASTM D2434 - Standard Test Method for Permeability of Granular Soils (Constant Head).
8. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
9. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Samples: Submit appropriate quantity, in air-tight containers, sample of each type of fill to testing laboratory.

C. Materials Source: Submit name of imported materials suppliers.

D. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Accurately record actual locations of utilities remaining by horizontal dimensions, elevations or inverts, and slope gradients.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with ASTM C136, ASTM D2419, and ASTM D2434.

B. Perform Work in accordance with appropriate city and state agency requirements.

C. Maintain one copy of each document on site.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Topsoil: as specified in Section 31 05 13.

B. Subsoil Fill: as specified in Section 31 05 13.

C. Structural Fill: Soil materials as specified in Section 31 05 13 and Aggregate materials as specified in Section 31 05 16.

D. Granular Fill: Materials as specified in Section 31 05 13 and Section 31 05 16.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements.

B. Verify site conditions are as indicated on the Drawings.

C. Verify survey bench mark and intended elevations for the Work are as indicated on Drawings.

3.2 PREPARATION

A. Call Local Utility Line Information service not less than three workdays before performing Work.
   1. Request underground utilities to be located and marked within and surrounding construction areas.

B. Identify required lines, levels, contours, and datum.

C. Notify utility company to remove and relocate utilities.

D. Protect utilities indicated to remain from damage.

E. Protect plant life, lawns, and other features remaining as portion of final landscaping.

F. Protect bench marks, survey control point, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

3.3 TOPSOIL EXCAVATION

A. Excavate topsoil from areas to be further excavated, re-landscaped, or re-graded, marked areas, or as shown on plans, without mixing with foreign materials for use in finish grading.

B. Do not excavate wet topsoil.

C. Stockpile in area designated on site to depth not exceeding 8 feet and protect from erosion. Stockpile material on impervious material.

D. Remove excess topsoil not intended for reuse, from site.

3.4 SUBSOIL EXCAVATION

A. Excavate subsoil from areas to be further excavated, re-landscaped, or regarded, marked areas or as shown on plans.

B. Do not excavate wet subsoil or excavate and process wet material to obtain optimum moisture content.

C. When excavating through roots, perform Work by hand and cut roots with sharp axe.

D. Remove excess subsoil not intended for reuse, from site.

E. Remove excavated materials not meeting requirements for subsoil materials from site.

F. Stockpile subsoil in area designated on site to depth not exceeding 8 feet and protect from erosion.

G. Benching Slopes: Horizontally bench existing slopes greater than 4H:1V to key placed fill material to slope to provide firm bearing.

H. Stability: Replace damaged or displaced subsoil as specified for fill.

3.5 FILLING

A. Fill areas to contours and elevations with unfrozen materials.

B. Place fill material in continuous layers and compact.

C. Place material in continuous layers as follows:
   1. Subsoil Fill: Maximum 6 inches compacted depth.
   2. Structural Fill: Maximum 6 inches compacted depth.
   3. Granular Fill: Maximum 6 inches compacted depth.

D. Maintain optimum moisture content of fill materials to attain required compaction density.

E. Slope grade away from building minimum 2 percent slope for minimum distance of 10 ft, unless noted otherwise.

F. Make grade changes gradual. Blend slope into level areas.

G. Repair or replace items indicated to remain damaged by excavation or filling.

H. Install Work in accordance with appropriate city and state agency requirements.

3.6 TOLERANCES

A. Section 01 40 00.10 - Civil Quality Requirements: Tolerances.

B. Top Surface of Subgrade:
   1. Structures: Plus or minus 1/2 inch average from required elevation.
   2. Pavement: Plus or minus 1/2 inch average from required elevation.
   3. Other: Plus or minus 1/10 of a foot.

C. The variance shall not affect the required thickness of concrete or subsequent structures above subsoil.

D. The application of the tolerances will not relieve contractor from other requirements related to paving or structures above subsoils and accessibility requirements.

3.7 FIELD QUALITY CONTROL

A. Section 01 40 00.10 - Civil Quality Requirements and 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Perform laboratory material tests in accordance with ASTM D1557, ASTM D698, and AASHTO T180.

C. Perform in place compaction tests in accordance with the following:
   1. Density Tests: ASTM D1556, ASTM D2167, or ASTM D2922.
   2. Moisture Tests: ASTM D3017.

D. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.

E. Frequency of Tests: 1 per every 1500 Square Yards.

END OF SECTION

SECTION 31 23 16

EXCAVATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Soil densification.
2. Excavating for building foundations.
3. Excavating for paving, roads, and parking areas.
4. Excavating for slabs-on-grade.
5. Excavating for site structures.
6. Excavating for landscaping.

1.2 REFERENCES

A. Local utility standards when working within 24 inches of utility lines.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with appropriate city and state agency requirements.

B. Excavation Protection Plan shall be in accordance with OSHA.

C. Maintain one copy of each document on site.

PART 2 - EXECUTION

2.1 PREPARATION

A. Call Local Utility Line Information service not less than three workdays before performing Work.
1. Request underground utilities to be located and marked within and surrounding construction areas.

B. Identify required lines, levels, contours, and datum.

C. Notify utility company to remove and relocate utilities.

D. Protect utilities indicated to remain from damage.

E. Protect plant life, trees, lawns, and other features remaining as portion of final landscaping.

F. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

2.2 SOIL DENSIFICATION

A. Conforming to the requirements of the geotechnical report. If no geotechnical report is performed, the subsoil materials should be proof rolled and compacted to a minimum density of 95% ASTM D698 (standard proctor).

PART 3 - EXECUTION

3.1 EXCAVATION

A. Perform and protect all work in accordance with OSHA regulations.

B. Protect adjacent structures which may be damaged by excavation work.

C. Excavate subsoil to accommodate building foundations, slabs-on-grade, paving and site structures, and construction operations.

D. Excavate to working elevation as noted on plans.

E. Compact disturbed load bearing soil in direct contact with foundations to original bearing capacity.

F. Slope banks with machine to angle of repose or less until shored.

G. Do not interfere with 45 degree bearing splay of foundations.

H. Grade top perimeter of excavation to prevent surface water from draining into excavation.

I. Trim excavation. Remove loose matter.

J. Remove lumped subsoil, boulders, and rock.

K. Notify Architect/Engineer of unexpected subsurface conditions.

L. Correct areas over excavated with structural fill Type S1 specified in Section 31 05 13, as directed by Architect/Engineer.

M. Remove excess and unsuitable material from site.

N. Overexcavate in accordance with geotechnical report. If no geotechnical report is available, contact Architect/Engineer for instruction.

O. Stockpile subsoil in area designated on site to depth not exceeding 8 feet and protect from erosion.

P. Repair or replace items indicated to remain damaged by excavation.

3.2 FIELD QUALITY CONTROL

A. Section 01 40 00.10 - Civil Quality Requirements, 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Perform inspection of excavation and controlled fill operations in accordance with appropriate city and state agency requirements.

C. Request visual inspection of bearing surfaces before installing subsequent work.

3.3 PROTECTION

A. Prevent displacement or loose soil from falling into excavation; maintain soil stability.

B. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.

C. Protect structures, utilities and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth operations.

END OF SECTION

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SECTION 31 23 17

TRENCHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Excavating trenches for utilities from 5 feet outside building to utility service.
2. Compacted fill from top of utility bedding to subgrade elevations.
3. Backfilling and compaction.

B. Related Sections:
1. Geotechnical report; bore hole locations and findings of subsurface materials.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:
1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:
1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
2. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
3. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).
4. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
5. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
6. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

1.3 DEFINITIONS

A. Utility: Any buried pipe, duct, conduit, or cable.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data for geotextile fabric indicating fabric and construction.

C. Samples: Submit appropriate quantity, in air-tight containers, sample of each type of fill to testing laboratory.

D. Materials Source: Submit name of imported fill materials suppliers.

E. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with appropriate city and state agency requirements.

B. Maintain one copy of each document on site.

1.6 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.7 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify Work associated with lower elevation utilities is complete before placing higher elevation utilities.

PART 2 - PRODUCTS

2.1 FILL MATERIALS

A. Subsoil Fill: Type S1, S2, or S3 as specified in Section 31 05 13.

B. Structural Fill: Type S1 as specified in Section 31 05 13.

C. Granular Fill: Pipe Bedding as specified in Section 31 05 16.

D. Concrete: Lean concrete or Class A Concrete.

PART 3 - EXECUTION

3.1 LINES AND GRADES

A. Lay pipes to lines and grades indicated on Drawings.
   1. Architect/Engineer reserves right to make changes in lines, grades, and depths of utilities when changes are required for Project conditions.

B. Use laser-beam instrument with qualified operator to establish lines and grades.

3.2 PREPARATION

A. Call Local Utility Line Information service not less than three workdays before performing Work.
   1. Request underground utilities to be located and marked within and surrounding construction areas.

B. Identify required lines, levels, contours, and datum locations.

C. Protect plant life, trees, lawns, and other features remaining as portion of final landscaping.

D. Protect bench marks, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

E. Maintain and protect above and below grade utilities indicated to remain.

F. Establish temporary traffic control and detours when trenching is performed in public right-of-way. Relocate controls and reroute traffic as required during progress of Work.

3.3 TRENCHING

A. Follow all OSHA and industry safety regulations for trench work.

B. Excavate subsoil required for utilities to utility service.

C. Remove lumped subsoil, boulders, and rock.

D. Perform excavation within 24 inches of existing utility service in accordance with utility’s requirements.

E. Do not advance open trench more than 200 feet ahead of installed pipe.

F. Cut trenches to width indicated on Drawings. Remove water or materials that interfere with Work.

G. Excavate trenches to depth indicated on Drawings. Provide uniform and continuous bearing and support for bedding material and pipe utilities.

H. Do not interfere with 45 degree bearing splay of foundations.

I. When Project conditions permit, slope side walls of excavation starting 2 feet above top of pipe. When side walls cannot be sloped, provide sheeting and shoring to protect excavation as specified in this section.

J. When subsurface materials at bottom of trench are loose or soft, excavate to greater depth as directed by Architect/Engineer until suitable material is encountered.

K. Cut out soft areas of subgrade not capable of compaction in place. Backfill with Structural Fill S1 and compact to density equal to or greater than requirements for subsequent backfill material.

L. Trim excavation. Hand trim for bell and spigot pipe joints. Remove loose matter.

M. Correct areas over excavated areas with compacted backfill as specified for authorized excavation or replace with fill concrete as directed by Architect/Engineer.

N. Remove excess subsoil not intended for reuse, from site.

O. Stockpile subsoil in area designated on site to depth not exceeding 8 feet and protect from erosion.

3.4 SHEETING AND SHORING

A. Sheet, shore, and brace excavations to prevent danger to persons, structures and adjacent properties and to prevent caving, erosion, and loss of surrounding subsoil.

B. Support trenches more than 5 feet deep excavated through unstable, loose, or soft material. Provide sheeting, shoring, bracing, or other protection to maintain stability of excavation.

C. Design sheeting and shoring to be removed at completion of excavation work.

D. Repair damage caused by failure of the sheeting, shoring, or bracing and for settlement of filled excavations or adjacent soil.

E. Repair damage to new and existing Work from settlement, water or earth pressure or other causes resulting from inadequate sheeting, shoring, or bracing.

3.5 BACKFILLING

A. Backfill trenches to contours and elevations with unfrozen fill materials.

B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.

C. Place geotextile fabric as specified in plans.

D. Place fill material in continuous layers as shown in plans and compact.

E. Employ placement method that does not disturb or damage foundation perimeter drainage, and utilities in trench.

F. Maintain optimum moisture content of fill materials to attain required compaction density.

G. Do not leave more than 50 feet of trench open at end of workday. All open excavations shall be maintained and protected in accordance with OSHA regulations.

H. Protect open trench to prevent danger to the public.

3.6 FIELD QUALITY CONTROL

A. Section 01 40 00.10 - Civil Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Perform laboratory material tests in accordance with ASTM D698.

C. Perform in place compaction tests in accordance with the following:
   1. Density Tests: ASTM D1556, ASTM D2167, or ASTM D2922.
   2. Moisture Tests: ASTM D3017.

D. When tests indicate Work does not meet specified requirements, remove Work, replace, compact, and retest.

E. Frequency of Tests: 1 for every 50 feet under structures.

3.7 PROTECTION OF FINISHED WORK

A. Section 01 70 00 - Execution and Closeout Requirements: Protecting finished work.

B. Reshape and re-compact fills subjected to vehicular traffic during construction.

END OF SECTION

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SECTION 31 23 23

FILL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Backfilling building perimeter to subgrade elevations.
2. Backfilling site structures to subgrade elevations.
3. Fill under slabs-on-grade.
4. Site filling and backfilling.
5. Fill under paving.
6. Fill for over-excavation.

B. Related Sections:
1. Geotechnical report; bore hole locations and findings of subsurface materials.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:
1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:
1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
2. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
3. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).
4. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
5. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
6. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data for geotextile fabric indicating fabric and construction.

C. Samples: Submit appropriate quantity, in air-tight containers, sample of each type of fill to testing laboratory.

D. Materials Source: Submit name of imported fill materials suppliers.

E. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with appropriate city and state agency requirements.

B. Maintain one copy of each document on site.

PART 2 - PRODUCTS

2.1 FILL MATERIALS

A. Subsoil Fill: Type S1, S2, or S3 as specified in Section 31 05 13.

B. Structural Fill: Type S1 as specified in Section 31 05 13.

C. Granular Fill: Pipe Bedding as specified in Section 31 05 16.

D. Concrete: Lean concrete or Class A Concrete.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify subdrainage, dampproofing, or waterproofing installation has been inspected.

C. Verify underground structures are anchored to their own foundations to avoid flotation after backfilling.

D. Verify structural ability of unsupported walls to support loads imposed by fill.

3.2 PREPARATION

A. Compact subgrade to density requirements for subsequent backfill materials.

B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with structural fill and compact to density equal to or greater than requirements for subsequent fill material.

C. 1.0’ minimum select fill subgrade compacted according to geotechnical report. Refer to geotechnical report for full subgrade requirements.

D. Exposed subgrade should be proof rolled prior to compaction or treatment in accordance with geotechnical report. Areas which prove unstable shall be stabilized according to the geotechnical report. When a geotechnical report is not provided, Architect/Engineer shall be contacted.

3.3 BACKFILLING

A. Backfill areas to contours and elevations with unfrozen materials.

B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen or spongy subgrade surfaces.

C. Place geotextile fabric over fill prior to placing next lift of fill.

D. Place fill material in continuous layers and compact to required density specifications.

E. Place material in continuous layers in depths accordance with geotechnical report. When geotechnical report is not provided, place lifts as follows:
   1. Subsoil Fill: Maximum 6 inches compacted depth.
   2. Structural Fill: Maximum 6 inches compacted depth.
   3. Granular Fill: Maximum 6 inches compacted depth.

F. Employ placement method that does not disturb or damage other work.

G. Maintain moisture content of backfill materials in accordance with geotechnical report to attain required compaction density. Where no geotechnical report is provided, maintain optimum moisture content.

H. Backfill against supported foundation walls and/or structures. Do not backfill against unsupported foundation walls.

I. Backfill simultaneously on each side of unsupported foundation walls until supports are in place.

J. Slope grade away from building in accordance with engineering plans.

K. Make gradual grade changes. Blend slope into level areas.

L. Remove surplus backfill materials from site.

M. Leave fill material stockpile areas free of excess fill materials.

3.4 TOLERANCES

A. Section 01 40 00.10 - Civil Quality Requirements: Tolerances.

B. Top Surface of Subgrade:
   1. Structures: Plus or minus 1/2 inch average from required elevation.
   2. Pavement: Plus or minus 1/2 inch average from required elevation.
   3. Other: Plus or minus 1/10 of a foot.

C. The variance shall not affect the required thickness of concrete or subsequent structures above subsoil.

D. The application of the tolerances will not relieve contractor from other requirements related to paving or structures above subsoils and accessibility requirements.

3.5 FIELD QUALITY CONTROL

A. Section 01 40 00.10 - Civil Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Perform laboratory material tests in accordance with ASTM D698.

C. Perform in place compaction tests in accordance with the following:
   1. Density Tests: ASTM D1556, ASTM D2167, or ASTM D2922.
   2. Moisture Tests: ASTM D3017.

D. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.

E. Frequency of Tests: 1 per every 1500 Square Yards of roadway and 1 per every 500 square yard of parking lots and/or building pads.

F. Proof roll compacted fill surfaces.

3.6 PROTECTION OF FINISHED WORK

A. Section 01 70 00 - Execution and Closeout Requirements: Protecting finished work.

B. Reshape and re-compact fills subjected to vehicular traffic.

END OF SECTION

SECTION 31 25 00

EROSION AND SEDIMENTATION CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Silt Fences
2. Hay Bales
3. Diversion Dikes
4. Construction Entrance/Exits
5. Channel Liners
6. Diversion Channels.
7. Rock Energy Dissipator.
8. Rock Filter Dams.
9. Sediment Ponds.
10. Sediment Traps.
11. Construction Entrances/Exits.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:
1. AASHTO T88 - Standard Specification for Particle Size Analysis of Soils.
2. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:
1. ASTM C127 - Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate.
2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
3. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).
4. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
5. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Provide necessary Stormwater Pollution Prevention Plan Documentation and required permitting by local Municipal Separate Storm Sewer System (MS4) and State regulations, as applicable.

C. Submit data on geosynthetics or other specified items.

D. Manufacturer's Certificate: Certify Products meet or exceed specified requirements .

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with appropriate city and state agency requirements.

PART 2 - PRODUCTS

2.1 ROCK AND GEOTEXTILE MATERIALS

A. Furnish materials in accordance with appropriate city and state agency requirements.

B. Rock: Sound, hard and angular shape; well graded; without shale seams, structural defects and foreign substances; with width and thickness greater than one third its length; minimum specific gravity of 2.5, as determined in accordance with AASHTO T88or ASTM C127, bulk saturated, and surface dry basis; minimum durability determined by petrographic examination; size and gradation in accordance with NCSA Class, within following limits and as shown on plans:

Square Opening inches	Percent Passing NCSA Size No.					
	R8	R7	R6	R5	R4	R3
42	100					
30		100				
24	15-50		100			
18		15-50		100		
15	0-15					
12		0-15	15-50		100	
9				15-50		
6		0-15	0-15		15-50	100
4				0-15		
3					0-15	15-50
2						0-15

C. Geotextile Fabric: as shown on plans.

D. Channel Liners: Geotextiles, blankets or mats as shown on plans and installed in accordance with manufacturer’s recommendations.

2.2 BLOCK, STONE, AGGREGATE, AND SOIL MATERIALS

A. Precast Solid Concrete Block: as shown in plans and installed in accordance with manufacturer’s recommendations.

B. Stone: As shown in plans.

C. Coarse Aggregate: Type A Grade 2 unless otherwise shown on plans. Soil Backfill: Soil Type S1 or S2. Subsoil with no rocks over 6 inches in diameter, frozen earth or foreign matter.

2.3 PLANTING MATERIALS

A. Seeding and Soil Supplements: Furnish in accordance with appropriate city and state agency requirements.

B. Mulch: Furnish in accordance with appropriate city and state agency requirements.

2.4 PIPE MATERIALS

A. Pipe: Corrugated steel, Concrete or Plastic, and as shown on plans. Furnish in accordance with appropriate city and state agency requirements.

2.5 FENCING AND DAMS

A. Reinforced Silt Fencing: Geotextile fabric with wire reinforcing and stakes as shown on plans and installed in accordance with manufacturers recommendations.

B. Hay Bales: Hay bales with stakes and as shown on plans.

C. Rock Filter Dams: Rock filter dams with baskets or enclosure and as shown on plans.

D. Wattles or Gutter Dams: Manufactured sediment control cylinders with inert organic materials, netting, geosynthetics and other materials as shown on plans and installed in accordance with manufacturers recommendations.

2.6 ACCESSORIES

A. Anti-Vortex Devices: Furnish in accordance with plans and with appropriate city and state agency requirements.

B. Anti-Seep Collar: Furnish in accordance with plans and with appropriate city and state agency requirements.

C. Trash Rack: Furnish in accordance with plans and with appropriate city and state agency requirements.

2.7 SOURCE QUALITY CONTROL (AND TESTS)

A. Perform tests on materials to ensure conformance with specified requirements.

PART 3 - EXECUTION

3.1 INITIAL REQUIREMENTS

A. Verify compacted subgrade is acceptable and ready to support devices and imposed loads.

B. Verify gradients and elevations of base or foundation for other work are correct.

C. Verify notices, postings, and permit compliance in accordance with appropriate city and state agency requirements.

3.2 DIVERSION CHANNELS

A. Windrow excavated material on low side of channel.

B. Compact to 95 percent maximum density, ASTM D-698.

C. On entire channel area, apply soil supplements and sow seed as specified.

D. Mulch seeded areas with hay as specified.

E. Install Work in accordance with plans and appropriate city and state agency requirements.

3.3 ROCK ENERGY DISSIPATOR

A. Excavate to indicated depth of rock lining or nominal placement thickness as follows. Remove loose, unsuitable material below bottom of rock lining, then replace with suitable material. Thoroughly compact and finish entire foundation area to firm, even surface.

NCSA Class	Nominal Placement Thickness inches
R8	48
R7	36
R6	30
R5	24
R4	18
R3	12

B. Lay and overlay geotextile fabric over substrate. Lay fabric parallel to flow from upstream to downstream. Place materials in accordance with manufacturer's recommendations. If none are available then overlap edges upstream over downstream and upslope over downslope. Provide a minimum overlap of 3 feet. Offset adjacent roll ends a minimum of 5 feet when lapped. Cover fabric as soon as possible and in no case leave fabric exposed more than 4 weeks.

C. Carefully place rock on geotextile fabric to produce an even distribution of pieces, with minimum of voids and without tearing geotextile.

D. Unless indicated otherwise, place full course thickness in one operation to prevent segregation and to avoid displacement of underlying material. Arrange individual rocks for uniform distribution.

1. Saturate rock with water. Fill voids between pieces with grout, for at least top 6 inches. Sweep surface with stiff broom to remove excess grout.
2. Moist cure grouted rock for at least 3 days after grouting, using water saturated burlap.

3.4 ROCK BASIN

A. Construct generally in accordance with rock energy dissipator requirements to indicated shape and depth. Rock courses may be placed in several operations but minimum depth of initial course must be 3 feet or greater.

3.5 ROCK BARRIER

A. Determine length required for ditch or depression slope and excavate, compact and foundation area to firm, even surface.

B. Produce an even distribution of rock pieces, with minimum voids to the indicated shape, height and slope.

C. Install Work in accordance with plans and with appropriate city and state agency requirements.

3.6 SEDIMENTATION POND

A. Clear and grub storage area and embankment foundation area site as shown in plans.

B. Excavate key trench for full length of dam. Excavate emergency spillway in natural ground.

C. Install pipe spillway, with anti-seep collar attached, at location indicated.

D. Place forms and reinforcing for concrete footing at bottom of riser pipe with trash rack and anti-vortex device, as shown in plans. Construction of embankment and trench prior to placing pipe is not required.

E. Do not use coarse aggregate as backfill material around pipe. Backfill pipe with suitable embankment material to prevent dam leakage along pipe.

F. On entire sedimentation pond area, apply soil supplements and sow seed as specified.

G. Mulch seeded areas with hay as specified.

H. Install Work in accordance with plans and with appropriate city and state agency requirements.

3.7 SEDIMENT TRAPS

A. Clear site, as shown in plans.

B. Construct trap by excavating and forming embankments as specified.

C. Place coarse aggregate or rock at outlet as indicated on Plans.

D. Place geotextile fabric, as specified for rock energy dissipator.

E. When required, obtain borrow excavation for formation of embankment, as specified.

F. On entire sediment trap area, apply soil supplements and sow seed as specified.

G. Mulch seeded areas with hay as specified.

H. Install Work in accordance with plans and with appropriate city and state agency requirements.

3.8 SITE STABILIZATION

A. Incorporate erosion control devices indicated on the Plans into the Project at the earliest practicable time in accordance with appropriate city and state agency requirements.

B. Construct, stabilize and activate erosion controls before site disturbance within tributary areas of those controls.

C. Temporary stockpile and waste pile heights shall not exceed 8 feet. Slope stockpile sides at 2: 1 or flatter.

D. Stabilize any disturbed area of affected erosion control devices on which activity has ceased and which will remain exposed for more than 20 days.
   1. During non-germinating periods, apply mulch at recommended rates.
   2. Stabilize disturbed areas which are not at finished grade and which will be disturbed within one year in accordance with temporary seeding specifications.
   3. Stabilize disturbed areas which are either at finished grade or will not be disturbed within one year in accordance with permanent seeding specifications.

E. Stabilize diversion channels, sediment traps, and stockpiles immediately.

3.9 DAMS, FENCING AND WATTLES

A. Place as indicated on plans and in accordance with manufacturers recommendations.

B. Secure by stakes, reinforcing, ties, etc.

C. Countersink materials and provide edge protection so that stormwater cannot circumvent controls.

D. Seed and mulch areas around controls to provide secure controls.

E. Install Work in accordance with plans and with appropriate city and state agency requirements.

3.10 CONSTRUCTION ENTRANCES/EXITS

A. Place as indicated on plans.

B. Secure site and provide controls to direct traffic to entrance/exit.

C. Countersink materials and provide edge protection so that stormwater cannot circumvent controls.

D. Seed and mulch areas around controls to provide secure controls.

E. Install Work in accordance with plans and with appropriate city and state agency requirements.

3.11 FIELD QUALITY CONTROL

A. Inspect erosion control devices in accordance with the Stormwater Pollution Prevention Plan or appropriate city and state agency requirements. Make necessary repairs within 5 days to ensure erosion and sediment controls are in good working order.

3.12 CLEANING

A. When sediment accumulation in sedimentation devices has reached a point one-third depth of sediment device, remove and dispose of sediment offsite. Sediment shall not hamper the hydraulic function of the sedimentation devices.

B. Do not damage structure or device during cleaning operations.

C. Do not allow sediment to erode into protected areas, offsite or natural waterways.

END OF SECTION

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SECTION 32 13 13

CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Concrete paving for:
      a. Concrete sidewalks.
      b. Concrete integral curbs and gutters.
      c. Concrete parking areas and roads.

1.2 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials:
   1. AASHTO M324 - Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.

B. American Concrete Institute:
   1. ACI 301 - Specifications for Structural Concrete.
   2. ACI 304 - Guide for Measuring, Mixing, Transporting, and Placing Concrete.

C. ASTM International:
   1. ASTM A184/A184M - Standard Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.
   2. ASTM A185/A185M - Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.
   3. ASTM A497/A497M - Standard Specification for Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement.
   4. ASTM A615/A615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
   5. ASTM A706/A706M - Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
   6. ASTM A767/A767M - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.
   7. ASTM A775/A775M - S Standard Specification for Epoxy-Coated Steel Reinforcing Bars.
   8. ASTM A884/A884M - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement.
   9. ASTM A934/A934M - Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars.
   10. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
   11. ASTM C33 - Standard Specification for Concrete Aggregates.

12. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
13. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.
14. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic Cement Concrete.
15. ASTM C150 - Standard Specification for Portland Cement.
16. ASTM C172 - Standard Practice for Sampling Freshly Mixed Concrete.
17. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
18. ASTM C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
19. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
20. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
21. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete.
22. ASTM C595 - Standard Specification for Blended Hydraulic Cements.
23. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.
24. ASTM C979 - Standard Specification for Pigments for Integrally Colored Concrete.
25. ASTM C989 - Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars.
26. ASTM C1017/C1017M - Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
27. ASTM C1064/C1064M - Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete.
28. ASTM C1116 - Standard Specification for Fiber-Reinforced Concrete and Shotcrete.
29. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
30. ASTM C1371-2004a - Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers.
31. ASTM C1549-2004 - Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer.
32. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
33. ASTM D1752 - Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
34. ASTM D6690 - Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.
35. ASTM E408-1971(1996)e1 - Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques.

36. ASTM E903-1996 - Standard Test Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres.
37. ASTM E1918-1997 - Standard Test Method for Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field.
38. ASTM E1980-2001 - Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data:
1. Submit data on concrete materials, joint filler admixtures, and curing compounds.

C. Design Data:
1. Submit concrete mix design for each concrete strength. Submit separate mix designs when admixtures are required for the following:
a. Hot and cold weather concrete work.
2. Identify mix ingredients and proportions, including admixtures.
3. Identify chloride content of admixtures and whether or not chloride was added during manufacture.

D. Source Quality Control Submittals: Indicate results of lab tests and inspections.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with TxDOT Standard Specification Item 360, Concrete Pavement, (or upon Engineer’s approval – appropriate Arkansas Department of Transportation specification) shall be the basis for materials, equipment, and construction.

B. Obtain cementitious materials from same source throughout.

C. Perform Work in accordance with appropriate city and state agency requirements.

D. Maintain one copy of each document on site.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years experience.

B. Installer: Company specializing in performing work of this section with minimum 3 years experience.

1.6 AMBIENT CONDITIONS

A. Section 01 50 00 - Temporary Facilities and Controls: Ambient conditions control facilities for product storage and installation.

B. Do not place concrete when base surface temperature is 40 degrees F and falling or 35 degrees F and rising, or surface is wet or frozen.

PART 2 - PRODUCTS

2.1 CONCRETE PAVING

A. Concrete Materials:
   1. Concrete Materials: As specified in TxDOT Standard Specification Item 360.

2.2 MIXES

A. Concrete Mix - By Performance Criteria:
   1. Mix and deliver concrete to specified compressive strength and water cement ratio in accordance with ASTM C94.
   2. Provide field test criteria to achieve specified performance for normal weight concrete in accordance with ACI 301.
   3. Provide concrete to the following criteria:
      a. In accordance with geotechnical report;
      b. If geotechnical report is not provided, provide in accordance with 03 30 00.

2.3 ACCESSORIES

A. Curing Compound: Translucent with dye (ASTMC309, Type ID), or White pigmented (ASTM C309, Type 2).

B. Joint Sealers: Rated 50% extension at 0 degrees F; ASTM D6690, Type I.

2.4 SOURCE QUALITY CONTROL

A. Submit proposed mix design of each class of concrete to appointed firm for review prior to commencement of Work.

B. Tests on cement, aggregates, and mixes will be performed to ensure conformance with specified requirements.

C. Test samples in accordance with ACI 301.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify compacted subbase is dry and ready to support paving and imposed loads.

B. Verify gradients and elevations of base are correct.

3.2 PREPARATION

A. Moisten substrate to minimize absorption of water from fresh concrete.

B. Coat surfaces of adjoining structure frames when directed by the engineer with oil to prevent bond with concrete paving.

C. Notify Architect/Engineer minimum 24 hours prior to commencement of concreting operations.

3.3 INSTALLATION

A. Placing Concrete:
   1. Place concrete as specified in TxDOT Standard Specification Item 360.
   2. Unless otherwise specified, place concrete roadways using an approved self-propelled paving machine.
   3. Ensure reinforcing, inserts, embedded parts, and formed joints are not disturbed during concrete placement.
   4. Place concrete continuously over the full width of the panel and between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.

B. Joints
   1. Place expansion and contraction joints as specified in the Plans and geotechnical report. Align curb, gutter, and sidewalk joints. Where Plans or geotechnical report do not specify joint separation, place expansion joints on 60 feet maximum separation and contraction joints at 15 feet maximum separation.
   2. Place joint filler between paving components and building or other appurtenances. Recess top of filler 1/2 inch for expansion joint sealant installation. Recess top of filler 1/8 to 1/4 inch for saw joint sealant installation.
   3. Provide sawn joints in accordance with plans and geotechnical report. Where Plans or geotechnical report do not specify joint separation, place sawn joints on 15 feet maximum separation. Provide sidewalk sawn joints with maximum separation equal to the width of the sidewalk.
   4. Provide keyed joints as indicated.

C. Finishing:
   1. Roadway Paving: Combination of a carpet drag and metal tining.
   2. Sidewalk Paving: Light broom, radius to 1/4 inch radius, and trowel joint edges.
   3. Site Paving: Heavy broom.
   4. Curbs and Gutters: Light broom.
   5. Direction of Texturing: Transverse to paving direction.
   6. Place curing compound on exposed concrete surfaces immediately after finishing in accordance with manufacturer’s recommendations.

D. Curing and Protection
   1. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
   2. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

3.4 TOLERANCES

A. Maximum Variation of Surface Flatness: 1/8 inch in 10 ft.

B. Pavement: Plus or minus 1/2 inch average from required elevation.

C. The variance shall not affect the required thickness of concrete.

D. The application of the tolerances will not relieve contractor from other requirements related to paving, and accessibility requirements.

E. All paved surfaces shall have positive drainage.

3.5 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with ASTM C94/C94M, ACI 301 , and appropriate city and state agency requirements.

B. Inspect reinforcing placement for size, spacing, location, support.

C. Testing firm will take cylinders and perform slump and air entrainment tests in accordance with ACI 301.

D. Strength Test Samples:
   1. Sampling Procedures: ASTM C172.
   2. Cylinder Molding and Curing Procedures: ASTM C31/C31M, cylinder specimens, standard cured.
   3. Sample concrete and make one set of three cylinders for every 1500 square yds or less of surface area paving or a minimum of one per day’s placement.
   4. Make one additional cylinder during cold weather concreting, and field cure.

E. Field Testing:
   1. Slump Test Method: ASTM C143/C143M.
   2. Air Content Test Method: ASTM C173/C173M or ASTM C231.
   3. Temperature Test Method: ASTM C1064/C1064M.
   4. Measure slump and temperature for each compressive strength concrete sample.
   5. Measure air content in air entrained concrete for each compressive strength concrete sample.

F. Cylinder Compressive Strength Testing:
   1. Test Method: ASTM C39/C39M.
   2. Test Acceptance: No compressive strength test shall fall below 10% of specified compressive strength or shall be in accordance with appropriate city and state agency requirements.
   3. Test one cylinder at 7 days.
   4. Test two cylinders at 28 days.

G. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

3.6 PROTECTION

A. Immediately after placement, protect paving from premature drying, excessive hot or cold temperatures, and mechanical injury.

B. Do not permit light vehicular traffic over paving until 75 percent design strength of concrete has been achieved and 100 percent design strength of concrete has been achieved for heavy duty vehicular traffic.

END OF SECTION

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SECTION 32 92 19

SEEDING & SODDING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Fertilizing.
2. Seeding.
3. Hydroseeding.
4. Mulching.
5. Sodding.
6. Maintenance.

1.2 REFERENCES

A. ASTM International:
1. ASTM C602 - Standard Specification for Agricultural Liming Materials.

B. Turfgrass Producers International:
1. TPI - Guideline Specifications to Turfgrass Sodding.

1.3 DEFINITIONS

A. Weeds: Vegetative species other than specified species to be established in given area.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data for seed mix, fertilizer, mulch, sod grass species, and other accessories.

C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Provide seed mixture in containers showing percentage of seed mix, germination percentage, inert matter percentage, weed percentage, year of production, net weight, date of packaging, and location of packaging.

B. Sod: Root development capable of supporting its own weight without tearing, when suspended vertically by holding upper two corners.

C. Perform Work in accordance with appropriate city and state agency requirements.

D. Maintain one copy of each document on site.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Deliver grass seed mixture in sealed containers. Seed in damaged packaging is not acceptable.

C. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

D. Protect exposed roots from dehydration.

E. Do not deliver more sod than can be laid within 24 hours.

1.7 MAINTENANCE SERVICE

A. Maintain seeded or sodded areas immediately after placement until grass is well established and exhibits vigorous growing condition.

PART 2 - PRODUCTS

2.1 SEED MIXTURE

A. The seeding mixtures shall be as follows:
   1. Cold Season: Seeding shall be a 1:1 mixture of unhulled bermuda and winter rye each with a purity of 95% with 90% germination;
   2. Warm Season: Seeding shall be hulled bermuda grass (CYNODEN DACTOLYN) with a purity of 95% with 85% germination.

2.2 ACCESSORIES

A. Mulching Material:
   1. Oat or wheat straw, free from weeds, foreign matter detrimental to plant life, and dry. Hay or chopped cornstalks are acceptable.
   2. Cellulose fiber, free of growth or germination inhibiting ingredients.

B. Fertilizer: All fertilizer shall have an analysis of 13-13-13 and shall be delivered in bags or containers clearly labeled showing the analysis. A fertilizer of a different analysis may be substituted with approval of the Engineer. The total amounts of nutrients furnished and applied shall equal or exceed that specified for each nutrient. Fertilizer shall be applied at the rate of 400 pounds per acre. The fertilizer shall be dry and in good condition.

C. Water: Clean, fresh and free of substances or matter capable of inhibiting vigorous growth of grass.

D. Erosion Fabric: Jute matting, open weave.

E. Stakes: Softwood lumber, chisel pointed.

F. String: Inorganic fiber.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify prepared soil base is ready to receive the Work of this section.

3.2 FERTILIZING

A. Apply fertilizer at a rate of 400 pounds per acre.

B. Apply after smooth raking of topsoil and prior to roller compaction.

C. Do not apply fertilizer at same time or with same machine as will be used to apply seed.

D. Lightly water soil to aid dissipation of fertilizer. Irrigate top level of soil uniformly.

3.3 SEEDING

A. Cold Season: Apply seed at rate of 2 lbs per 1000 sq ft evenly in two intersecting directions. Rake in lightly.

B. Warm Season: Apply seed at rate of 1 lb per 1000 sq ft evenly in two intersecting directions. Rake in lightly.

C. Do not seed areas in excess of that which can be mulched on same day.

D. Planting Season:
   1. Cold Season: September 15 to March 1
   2. Warm Season: March 2 to September 14

E. Do not sow immediately following rain, when ground is too dry, or when winds are over 12 mph.

F. Roll seeded area with roller not exceeding 112 lbs/linear foot.

G. Mulch: When included in project, apply mulch, immediately following seeding at the following rates:
   1. Straw Mulch: 2-2.5 tons per acre
   2. Hay Mulch: 1.5-2 tons per acre
   3. Cellulose Fiber Mulch (Dry Weight of mulch per acre)
      a. Sandy Soil, slopes of 3:1 or less: 2,500 Pounds per acre
      b. Sandy Soil, slopes greater than 3:1: 3,000 Pounds per acre
      c. Clay Soil, slopes of 3:1 or less: 2,000 Pounds per acre
      d. Clay Soil, slopes greater than 3:1: 2,300 Pounds per acre

H. Crimping:
   1. Use crimper immediately after spreading mulch.
   2. Apply ballast to machine to achieve an anchoring depth of 2 to 3 inches to form soil-binding mulch and to prevent loss or bunching of mulch by wind.
   3. Anchor the machine to prevent the formation of ridges and ruts.
   4. Use coulters at least 10 inches in diameter.
   5. Traverse slopes horizontally. The number of passes needed, not to exceed 3, will be as directed.
   6. In areas where an anchoring machine cannot be used, the use of a tacking agent will be required, as directed.

I. Apply water with fine spray immediately after each area has been mulched and/or crimped. Saturate to 4 inches of soil.

3.4 HYDROSEEDING

A. Apply Fertilizer at rate above.

B. Apply mulch and seeded slurry with hydraulic seeder at rate of 1 lb per 1000 sq ft evenly in one pass.

C. After application, apply water with fine spray immediately after each area has been hydroseeded. Saturate to 4 inches of soil and maintain moisture levels two to four inches.

D. Maintain area until grass is well established and exhibits vigorous growing condition.

3.5 SEED PROTECTION

A. Cover seeded slopes where grade is 3:1 or greater with erosion fabric. Roll fabric onto slopes without stretching or pulling.

B. Lay fabric smoothly on surface, bury top end of each section in 6 inch deep excavated topsoil trench. Overlap edges and ends of adjacent rolls minimum 12 inches. Backfill trench and rake smooth, level with adjacent soil.

C. Secure outside edges and overlaps at 36 inch intervals with stakes.

D. Lightly dress slopes with topsoil to ensure close contact between fabric and soil.

E. At sides of ditches, lay fabric laps in direction of water flow. Lap ends and edges minimum 6 inches.

3.6 LAYING SOD

A. Moisten prepared surface immediately prior to laying sod.

B. Lay sod within 24 hours after harvesting to prevent deterioration.

C. Lay sod tight with no open joints visible, and no overlapping; stagger end joints 12 inches minimum. Do not stretch or overlap sod pieces.

D. Lay smooth. Align with adjoining grass areas.

E. Place top elevation of sod 1/2 inch below adjoining edging.

F. On slopes 3:1 or steeper, lay sod perpendicular to slope and secure every row with wooden pegs at maximum 2 feet on center. When using “big roll," lay sod parallel to slope. Drive pegs flush with soil portion of sod.

G. Do not place sod when temperature is lower than 32 degrees F.

H. After sod and soil have dried, roll sodded areas to bond sod to soil and to remove minor depressions and irregularities.

I. Roll before first watering.

J. Water sodded areas immediately after installation. Saturate sod to 4 inches of soil.

3.7 MAINTENANCE

A. Water to prevent grass and soil from drying out.

B. Repair washouts or gullies.

END OF SECTION

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SECTION 33 11 16

SITE WATER UTILITY DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Pipe and fittings for Site water line, including domestic water line and fire water line
2. Tapping sleeves and valves.
3. Gate valves, ball valves, swing check valves, and butterfly valves.
4. Hydrants and yard hydrants.
5. Positive displacement meters.
6. Backflow preventers.
7. Underground pipe markers.
8. Precast concrete vaults.
9. Valve boxes.
10. Bedding and cover materials.

B. Related Requirements:
1. Section 03 30 00 - Cast-in-Place Concrete: Concrete for thrust restraints.
2. Section 31 05 13 - Soils for Earthwork: Soils for backfill in trenches.
3. Section 31 05 16 - Aggregates for Earthwork: Aggregate for backfill in trenches.
4. Section 31 23 16 - Excavation: Product and execution requirements for excavation and backfill.
5. Section 31 23 17 - Trenching: Execution requirements for trenching.
6. Section 31 23 23 - Fill: Requirements for backfill to be placed by this Section.
7. Section 33 13 00 - Disinfecting of Water Utility Distribution: Disinfection of Site service utility water piping.
8. Basis of Payment: Includes tapping sleeve, tapping valves, and accessories.

1.2 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials:
1. AASHTO T180 - Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. American Society of Mechanical Engineers:
1. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings.
2. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
3. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.

C. American Society of Sanitary Engineering:
   1. ASSE 1012 - Performance Requirements for Backflow Preventers with an Intermediate Atmospheric Vent.
   2. ASSE 1013 - Reduced Pressure Principle Backflow Preventers and Reduced Pressure Principle Fire Protection Backflow Preventers.

D. ASTM International:
   1. ASTM A48 - Standard Specification for Gray Iron Castings.
   2. ASTM A48M - Standard Specification for Gray Iron Castings.
   3. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
   4. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric).
   5. ASTM C858 - Standard Specification for Underground Precast Concrete Utility Structures.
   6. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
   7. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).
   8. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
   9. ASTM D2241 - Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure Rated Pipe (SDR Series).
   10. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
   11. ASTM D2855 - Standard Practice for Making Solvent Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings.
   12. ASTM D3035 - Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.
   13. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
   14. ASTM D6938 - Standard Test Method for In Place Density and Water Content of Soil and Soil Aggregate by Nuclear Methods (Shallow Depth).

E. American Welding Society:
   1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.

F. American Water Works Association:
   1. AWWA C104/A21.4 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
   2. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems.
   3. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
   4. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast.
   5. AWWA C500 - Metal-Seated Gate Valves for Water Supply Service.
   6. AWWA C502 - Dry-Barrel Fire Hydrants.
   7. AWWA C504 - Rubber-Seated Butterfly Valves.

8. AWWA C508 - Swing-Check Valves for Waterworks Service, 2-In. Through 24-In. (50-mm Through 600-mm) NPS.
9. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service.
10. AWWA C600 - Installation of Ductile-Iron Mains and Their Appurtenances.
11. AWWA C606 - Grooved and Shouldered Joints.
12. AWWA C700 - Cold-Water Meters - Displacement Type, Bronze Main Case.
13. AWWA C701 - Cold-Water Meters - Turbine Type, for Customer Service.
14. AWWA C702 - Cold-Water Meters - Compound Type.
15. AWWA C706 - Direct-Reading, Remote-Registration Systems for Cold-Water Meters.
16. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Transmission and Distribution.
17. AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 In. (13 mm) Through 3 In. (76 mm), for Water Service.
18. AWWA C906 - Polyethylene (PE) Pressure Pipe and Fittings, 4 In. (100 mm) Through 63 In. (1,600 mm), for Water Distribution and Transmission.
19. AWWA M6 - Water Meters - Selection, Installation, Testing, and Maintenance.

G. Manufacturer's Standardization Society of the Valve and Fittings Industry:
1. MSS SP-60 - Connecting Flange Joint Between Tapping Sleeves and Tapping Valves.

H. Underwriters Laboratories Inc.:
1. UL 246 - Standard for Safety Hydrants for Fire-Protection Service.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data on pipe materials, pipe fittings, valves, and accessories.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents:
1. Record actual locations of piping mains, valves, connections, thrust restraints, and invert elevations.
2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.5 QUALITY ASSURANCE

A. Perform Work according with state agency and local utility standards.

PART 2 - PRODUCTS

2.1 WATER PIPING

A. Ductile Iron Pipe: AWWA C151. Bituminous outside coating: AWWA C151. Pipe Mortar Lining: AWWA C104, double thickness. Polyethylene Encasement: AWWA C105.
   1. Pipe Class: AWWA C151, for nominal thickness, rated water working pressure and maximum depth of cover.
   2. Fittings: Ductile or Gray iron, AWWA C110. Compact fittings AWWA C153.
      a. Coating and Lining:
         1) Bituminous Coating: AWWA C110.
         2) Cement Mortar Lining: AWWA C104, double thickness.
   3. Joints:
      a. Mechanical and Push-On Joints: AWWA C111.
      b. Flanged Joints: AWWA C115.
      c. Restrained Joints: Boltless, push-on type, joint restraint independent of joint seal.
   4. Jackets: AWWA C105 polyethylene jacket as detailed on drawings.

B. Polyvinyl Chloride (PVC): AWWA C900 and AWWA C905, Class 235, DR-18 :
   1. Fittings: AWWA C900, AWWA C905, and AWWA C111, cast iron.
   2. Joints: ASTM D3139 and ASTM F477 PVC flexible elastomeric seals.
      a. All mechanical joints, bends, fittings, etc. must be locked on with mechanical joint restraints such as mega-lugs, restrained joints or restrained joints with thrust blocking.
      b. Solvent-cement couplings are not permitted.

2.2 TAPPING SLEEVES AND VALVES

A. Tapping Sleeves:
   1. Furnish materials in accordance with TCEQ Design, Testing, and Installation Standards.
   2. Description: Ductile iron or cast-iron dual compression type.
   3. Outlet Flange Dimensions and Drilling: ASME B16.1, Class 125 and MSS SP-60.

B. Tapping Valves:
   1. Furnish materials in accordance with TCEQ Design, Testing, and Installation Standards.
   2. Description: AWWA C500, double disc with non-rising stem. Inlet flanges shall conform to ANSI B16.1, Class 125 and MSS SP-60. Mechanical joint outlets shall conform to AWWA C111.

2.3 VALVES

A. Valves: Conform to Section 33 12 16.

2.4 POSITIVE DISPLACEMENT METERS

A. Furnish materials in accordance with TCEQ Design, Testing, and Installation Standards.

B. Description: , positive displacement disc type suitable for fluid with bronze case and cast iron bottom cap, hermetically sealed register, remote reading to AWWA C706.

C. Meter: Brass body turbine meter with magnetic drive register.
   1. Service: Cold water, 122 degrees F.
   2. Nominal Flow: 50 gpm.
   3. Pressure Drop at Nominal Flow: <1 psi.
   4. Maximum Flow: 100 gpm.
   5. Maximum Operating Pressure: 150 psi.
   6. Accuracy: 1-1/2 percent.
   7. Maximum Counter Reading: 10 million gallons.
   8. Pipe Size: typically 0.75 to 1 inch.

2.5 BACKFLOW PREVENTERS

A. Furnish materials according to TCEQ standards.

B. Reduced Pressure Backflow Preventers:
   1. Comply with ASSE 1013.
   2. Bronze body, with bronze internal parts and stainless steel springs.
   3. Two independently operating, spring-loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve opening under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two gate valves, strainer, and four test cocks.

C. Double Check Valve Assemblies:
   1. Comply with ASSE 1012.
   2. Bronze body with corrosion-resistant internal parts and stainless steel springs.
   3. Two independently operating check valves with intermediate atmospheric vent.

2.6 UNDERGROUND PIPE MARKERS

A. Description: Plastic Ribbon Tape: Bright colored, continuously printed, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

B. Trace Wire: Electronic detection materials for non-conductive piping products.
   1. Unshielded 10 gauge THWN insulated copper wire.
   2. Test stations: Snake Pit or approved equal.
   3. Conductive tape.

2.7 PRECAST CONCRETE VAULTS

A. Manufacturer List:
   1. Provide submittal of selected vault to engineer for approval.

B. Product Description: Precast vault designed according to ASTM C858, comprising modular, interlocking sections complete with accessories.

C. Shape as indicated on drawings.

2.8 VALVE BOXES

A. Manufacturer List:
   1. Provide submittal of selected valve boxes to engineer for approval.

B. Covers: Marked to indicate utility.

2.9 MATERIALS

A. Bedding and Cover:

B. Bedding: Conforming to ASTM D2321 and ASTM D2774. Bedding and haunching types as follows:
   1. Class IA (open graded manufactured) and Class IB (dense graded manufactured).
   2. Class II Clean Coarse Grained Soils (GW, GP, SW, and SP).
   3. Class III Coarse Grained Soils with Fines (GM, GC, SM, and SC).
   4. Concrete: Lean concrete or Class A Concrete.

C. Cover:
   1. Subsoil Fill: Type S1, S2, or S3 as specified in Section 31 05 13.
   2. Structural Fill: Type S1 as specified in Section 31 05 13.
   3. Granular Fill: As specified in Section 31 05 16.
   4. Concrete: Lean concrete or Class A Concrete

2.10 ACCESSORIES

A. Concrete for Thrust Restraints: Conform to Section 03 30 00.

B. Steel rods, bolt, lugs and brackets: ASTM A36/A36M or ASTM A307 Grade A carbon steel.

C. Protective Coating: Bituminous coating.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify existing utility water main size, location, and invert are as indicated on Drawings.

3.2 PREPARATION

A. Pre-Construction Site Photos (only if required by Engineer as listed in Section 01025):
   1. Take photographs along centerline of proposed pipe trench; minimum one photograph for each 50 feet of pipe trench.
   2. Show mail boxes, curbing, lawns, driveways, signs, culverts, and other existing site features.
   3. Include project description, date taken and sequential number on back of each photograph.

B. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs. Use only equipment specifically designed for pipe cutting. The use of chisels or hand saws will not be permitted. Grind edges smooth with beveled end for push-on connections.

C. Remove scale and dirt on inside and outside before assembly.

D. Prepare pipe connections to equipment with flanges or unions.

3.3 BEDDING

A. Excavate pipe trench in accordance with trenching specification. Hand trim excavation for accurate placement of pipe to elevations indicated on Drawings.

B. Dewater excavations to maintain dry conditions and preserve final grades at bottom of excavation.

C. Provide sheeting and shoring as needed .

D. Place bedding material at trench bottom, level fill materials in one continuous layer not exceeding 6 inches compacted depth; compact to 95 percent.

3.4 INSTALLATION - PIPE

A. Install pipe in accordance with AWWA C600 and AWWA C605.

B. Handle and assemble pipe in accordance with manufacturer’s instructions and as indicated on Drawings.

C. Steel Rods, Bolt, Lugs, and Brackets: Coat buried steel with one coat of coal tar coating before backfilling.

D. Maintain 10 ft horizontal separation of water main from sewer piping in accordance with TCEQ Standards.

E. Install pipe to indicated elevation to within tolerance of 1 inch.

F. Install ductile iron piping and fittings to AWWA C600.

G. Flanged Joints: Not to be used in underground installations except within structures.

H. Route pipe in straight line. Relay pipe that is out of alignment or grade.

I. Install pipe with no high points. If unforeseen field conditions arise which necessitate high points, install air release valves as directed by Engineer.

J. Install pipe to have bearing along entire length of pipe. Excavate bell holes to permit proper joint installation. Do not lay pipe in wet or frozen trench.

K. Prevent foreign material from entering pipe during placement.

L. Install pipe to allow for expansion and contraction without stressing pipe or joints.

M. Close pipe openings with watertight plugs during work stoppages.

N. Install access fittings to permit disinfection of water system.

O. Establish elevations of buried piping with not less than 3.5 ft of cover. Measure depth of cover from final surface grade to top of pipe barrel.

P. Install plastic ribbon tape continuous over top of pipe buried 6 inches below finish grade.

Q. Install trace wire continuous over top of pipe.
   1. Tracer wire shall be attached to the top of the pipe and be continuous between tracer wire test stations and secured to the test station.
   2. Test stations shall be Snake Pit or equal and located adjacent to all fire hydrants and at all water main intersections.
   3. Test stations shall be installed in a 2’x2’x6” concrete pad.

R. Install Work in accordance with TCEQ Design, Testing, and Installation Standards, local utility standards and drawings as noted.

3.5 INSTALLATION - VALVES AND HYDRANTS

A. Install valves in accordance with Section 33 12 16.

3.6 INSTALLATION - TAPPING SLEEVES AND VALVES

A. Install tapping sleeves and valves in accordance with Drawings and in accordance with manufacturer’s instructions.

3.7 POLYETHYLENE ENCASEMENT

A. Encase piping in polyethylene where indicated on Drawings to prevent contact with surrounding backfill material.

B. Install in accordance with AWWA C105.

C. Terminate encasement 3 to 6 inches above ground where pipe is exposed.

3.8 INSTALLATION - METERS

1. Install Work in accordance with TCEQ Design, Testing, and Installation Standards, local utility standards and drawings as noted.

3.9 THRUST RESTRAINT

A. Provide valves, tees, bends, caps, and plugs with concrete thrust blocks. Pour concrete thrust blocks against undisturbed earth. Locate thrust blocks at each elbow or change of pipe direction to resist resultant force and so pipe and fitting joints will be accessible for repair. Install tie rods, clamps, set screw retainer glands, or restrained joints. Protect metal restrained joint components against corrosion by applying a bituminous coating, or by concrete mortar encasement of metal area. Do not encase pipe and fitting joints to flanges.

B. Install thrust blocks, tie rods, and joint restraint at dead ends of water main.

3.10 BACKFILLING

A. Backfill around sides and to top of pipe with cover fill in minimum lifts of 6 inches, tamp in place and compact to 95 percent. Place and compact material immediately adjacent to pipes to avoid damage to pipe and prevent pipe misalignment.

B. Backfill around sides and to top of pipe in accordance with Section 31 23 17.

C. Maintain optimum moisture content of bedding material to attain required compaction density.

3.11 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Flush and disinfect system in accordance with Section 33 13 00.

3.12 FIELD QUALITY CONTROL

A. Pressure test system in accordance with AWWA C600, TCEQ Regulations, local utility standards and the following:

1. Test Pressure: Not less than 200 psi or 50 psi in excess of maximum static pressure, whichever is greater.
2. Conduct hydrostatic test for at least two-hour duration.
3. Fill section to be tested with water slowly, expel air from piping at high points. Install corporation cocks at high points. Close air vents and corporation cocks after air is expelled. Raise pressure to specified test pressure.
4. Observe joints, fittings, and valves under test. Remove and renew cracked pipe, joints, fittings, and valves showing visible leakage. Retest.

5. Correct visible deficiencies and continue testing at same test pressure for additional 2 hours to determine leakage rate. Maintain pressure within plus or minus 5.0 psig of test pressure. Leakage is defined as quantity of water supplied to piping necessary to maintain test pressure during period of test.
6. Compute maximum allowable leakage by the following formula:

$L = (SD\sqrt{P})/C$
L = testing allowance, in gallons per hour
S = length of pipe tested, in feet
D = nominal diameter of pipe, in inches
P = average test pressure during hydrostatic test, in psig
C = 148,000
When pipe under test contains sections of various diameters, calculate allowable leakage from sum of computed leakage for each size.

7. When test of pipe indicates leakage greater than allowed, locate source of leakage, make corrections and retest until leakage is within allowable limits. Correct visible leaks regardless of quantity of leakage.

B. Compaction Testing for Bedding: In accordance with ASTM D698.

C. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.

D. Frequency of Compaction Tests: 1 test per 200 linear feet.

END OF SECTION

SECTION 33 12 16

WATER UTILITY DISTRIBUTION VALVES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Valves.
   2. Valve boxes.

1.2 REFERENCES

A. American Water Works Association:
   1. AWWA C500 - Metal-Seated Gate Valves for Water Supply Service.
   2. AWWA C509 - Resilient-Seated Gate Valves for Water-Supply Service.
   3. AWWA C550 - Protecting Epoxy Interior Coating for Valves and Hydrants.
   4. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.

B. National Sanitation Foundation:
   1. NSF 61 - Drinking Water System Components - Health Effects

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Shop Drawing:
   1. Installation Plan: Submit description of proposed installation.

C. Design Data: Submit manufacturer's latest published literature include illustrations, installation instructions, maintenance instructions and parts lists.

D. Manufacturer’s Certificates: Submit Statement of Compliance, supporting data, from material suppliers attesting that valves and accessories provided meet or exceed AWWA Standards and specification requirements.

1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of valves.

B. Provide Operation and Maintenance Data for valves.

1.5 QUALITY ASSURANCE

A. Perform work in accordance with local and state agency standards.

1.6 QUALIFICATIONS

A. Manufacturer: company specializing in manufacturing Products specified in this section with minimum three years experience.

B. Installer: Company specializing in performing work of this section with minimum 3 years experience.

1.7 PRE-INSTALLATION MEETINGS

A. Convene minimum one week prior to commencing work of this section.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing and protecting products.

B. Prepare valves and accessories for shipment according to AWWA Standards and seal valve and ends to prevent entry of foreign matter into product body.

C. Store products in areas protected from weather, moisture, or possible damage; do not store products directly on ground; handle products to prevent damage to interior or exterior surfaces.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.

B. Conduct operations not to interfere with, interrupt, damage, destroy, or endanger integrity of surface or subsurface structures or utilities, and landscape in immediate or adjacent areas.

1.10 COORDINATION

A. Coordinate work with local and state agency standards and utilities within construction area.

1.11 MAINTENANCE MATERIALS

A. Furnish one tee wrench to Owner; required length.

PART 2 - PRODUCTS

2.1 DOUBLE-DISC GATE VALVES

A. Furnish materials in accordance with Texas Commission of Environmental Quality Standards.

B. Double-Disc Gate Valves: AWWA C500, NSF 61; iron body, bronze trim; including the manufacturer's name, pressure rating, and year of fabrication cast into valve body.
   1. Gate: Double disc parallel seat gate.
   2. Stem: Non-rising stem.
   3. Seals: O-ring stem seals.
   4. Operating Nut: Square; open counterclockwise unless otherwise indicated.
   5. Sizes 12 inches diameter and smaller: 200 psig.
   6. Sizes 14 inches diameter and larger: 150 psig.

2.2 RESILIENT WEDGE GATE VALVES

A. Furnish materials in accordance with Texas Commission of Environmental Quality Standards.

B. Resilient Wedge Gate Valves: AWWA C509; iron body, bronze or ductile iron; including the manufacturer's name, pressure rating, and year of fabrication cast into valve body.
   1. Resilient seats.
   2. Stem: Non-rising bronze stem.
   3. Operating Nut: Square; open counterclockwise unless otherwise indicated.
   4. Ends: Flanged, mechanical joint or bell end connections.
   5. Coating: AWWA C550; interior/exterior.
   6. Sizes 12 inch diameter and smaller: 200 psig.
   7. Sizes 16 inch diameter and larger: 150 psig.

2.3 VALVE BOXES

A. 12 inch diameter Valves and Smaller: Domestic cast iron, two-piece, screw type.

B. Valves Larger than 12 inch diameter: Domestic cast iron, three-piece, screw type; round base.

C. Cast iron lid, marked "Water."

2.4 ACCESSORIES

A. Concrete for Thrust Restraints: Concrete type specified in Section 03 30 00.

B. Valve Box Aligner: High-strength, plastic device designed to automatically center valve box base and prevent valve box base from shifting off center during backfilling.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Determine exact location and size of valves from Drawings; obtain clarification and directions from Architect/Engineer prior to execution of work.

B. Verify invert elevations of existing work prior to excavation and installation of valves.

3.2 PREPARATION

A. Identify required lines, levels, contours and datum locations.

B. Locate, identify, and protect utilities to remain from damage.

C. Do not interrupt existing utilities without permission and without making arrangements to provide temporary utility services.
   1. Notify Architect/Engineer not less than five days in advance of proposed utility interruption.
   2. Do not proceed without written permission from the Architect/Engineer.

D. Perform trench excavation, backfilling and compaction in accordance with Section 31 23 17.

3.3 INSTALLATION

A. Install valves in conjunction with pipe laying; set valves plumb.

B. Provide buried valves with valve boxes installed flush with finished grade.

3.4 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Flush and disinfect system in accordance with Section 33 13 00.

3.5 FIELD QUALITY CONTROL

A. Perform pressure test on domestic site water distribution system in accordance with AWWA C600 and TCEQ standards (see appendix to this specification).

B. Pressure test system in accordance with AWWA C600 and the following:
   1. Test Pressure: Not less than 200 psi or 50 psi in excess of maximum static pressure, whichever is greater.
   2. Conduct hydrostatic test for at least two-hour duration.
   3. Fill section to be tested with water slowly, expel air from piping at high points. Install corporation cocks at high points. Close air vents and corporation cocks after air is expelled. Raise pressure to specified test pressure.
   4. Observe joints, fittings, and valves under test. Remove and renew cracked pipe, joints, fittings, and valves showing visible leakage. Retest.

5. Correct visible deficiencies and continue testing at same test pressure for additional 2 hours to determine leakage rate. Maintain pressure within plus or minus 5.0 psig of test pressure. Leakage is defined as quantity of water supplied to piping necessary to maintain test pressure during period of test.
6. Compute maximum allowable leakage by the following formula:

$L = (SD\sqrt{P})/C$
L = testing allowance, in gallons per hour
S = length of pipe tested, in feet
D = nominal diameter of pipe, in inches
P = average test pressure during hydrostatic test, in psig
C = 148,000
When pipe under test contains sections of various diameters, calculate allowable leakage from sum of computed leakage for each size.

7. When test of pipe indicates leakage greater than allowed, locate source of leakage, make corrections and retest until leakage is within allowable limits. Correct visible leaks regardless of quantity of leakage.

END OF SECTION

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SECTION 33 13 00

DISINFECTING OF WATER UTILITY DISTRIBUTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes disinfection of potable water distribution and transmission system; and testing and reporting results.

B. For all Texas projects, disinfection will also meet or exceed the requirements as required by the Texas Commission on Environmental Quality (TCEQ).

1.2 REFERENCES

A. American Water Works Association:
   1. AWWA B300 - Hypochlorites.
   2. AWWA B301 - Liquid Chlorine.
   3. AWWA B302 - Ammonium Sulfate.
   4. AWWA B303 - Sodium Chlorite.
   5. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.
   6. AWWA C651 - Disinfecting Water Mains.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit procedures, proposed chemicals, and treatment levels for review.

C. Test Reports: Indicate results comparative to specified requirements.

D. Certificate: Certify cleanliness of water distribution system meets or exceeds specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Disinfection Report:
   1. Type and form of disinfectant used.
   2. Date and time of disinfectant injection start and time of completion.
   3. Test locations.
   4. Name of person collecting samples.
   5. Initial and 24 hour disinfectant residuals in treated water in ppm for each outlet tested.
   6. Date and time of flushing start and completion.

7. Disinfectant residual after flushing in ppm for each outlet tested.

B. Bacteriological Report:
1. Date issued, project name, and testing laboratory name, address, and telephone number.
2. Time and date of water sample collection.
3. Name of person collecting samples.
4. Test locations.
5. Initial and 24 hour disinfectant residuals in ppm for each outlet tested.
6. Coliform bacteria test results for each outlet tested.
7. Certify water conforms, or fails to conform, to bacterial standards of authority having jurisdiction.

C. Water Quality Certificate: Certify water conforms to local water provider quality, suitable for human consumption.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with AWWA C651.

B. Perform Work in accordance with local and state agency standards.

1.6 QUALIFICATIONS

A. Water Treatment Firm: Company specializing in disinfecting potable water systems specified in this section with minimum three years experience.

B. Testing Firm: Company specializing in testing potable water systems, certified by appropriate state certified agency.

C. Submit bacteriologist's signature and authority associated with testing.

PART 2 - PRODUCTS

2.1 DISINFECTION CHEMICALS

A. Chemicals: AWWA B300, Hypochlorite, AWWA B301, Liquid Chlorine, and AWWA B303, Sodium Chlorite.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify piping system has been cleaned, inspected, and pressure tested.

B. Perform scheduling and disinfecting activity with start-up, water pressure testing, adjusting and balancing, demonstration procedures, including coordination with related systems.

3.2 INSTALLATION

A. Provide and attach required equipment to perform the Work of this section.

B. Perform disinfection of water distribution system and installation of system and pressure testing. Refer to Section 33 11 16.

C. Inject treatment disinfectant into piping system.

D. Maintain disinfectant in system for 24 hours.

E. Flush, circulate, and clean until required cleanliness is achieved; use municipal domestic water.

F. Replace permanent system devices removed for disinfection.

3.3 FIELD QUALITY CONTROL

A. Disinfection, Flushing, and Sampling:

1. Disinfect pipeline installation in accordance with AWWA C651. Use of liquid chlorine is not permitted.
2. Upon completion of retention period required for disinfection, flush pipeline until chlorine concentration in water leaving pipeline is no higher than that generally prevailing in existing system or is acceptable for domestic use.
3. Legally dispose of chlorinated water. When chlorinated discharge may cause damage to environment, apply neutralizing chemical to chlorinated water to neutralize chlorine residual remaining in water.
4. After final flushing and before pipeline is connected to existing system, or placed in service, employ an approved independent testing laboratory to sample, test and certify water quality suitable for human consumption.

END OF SECTION

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SECTION 33 31 13

PUBLIC SANITARY UTILITY SEWERAGE PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Sanitary sewer pipe and fittings.
2. Underground pipe markers.
3. Connection to existing manholes.
4. Manholes.
5. Wye branches and tees.
6. Sanitary Laterals.
7. Pile support systems.
8. Bedding and cover materials.

B. For all Texas projects, materials and installation will also meet or exceed the requirements listed in TAC Chapter 217 as required by the Texas Commission on Environmental Quality (TCEQ).

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:
1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:
1. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings.
2. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
3. ASTM C14 - Standard Specification for Concrete Sewer, Storm Drain, and Culvert Pipe.
4. ASTM C76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
5. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
6. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
7. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
8. ASTM C923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals.

9. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).
10. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
11. ASTM D2235 - Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
12. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
13. ASTM D2466 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
14. ASTM D2564 - Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
15. ASTM D2729 - Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
16. ASTM D2751 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.
17. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
18. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
19. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
20. ASTM D3034 - Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
21. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

C. American Water Works Association:
1. AWWA C104 - American National Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
2. AWWA C105 - American National Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.
3. AWWA C110 - American National Standard for Ductile-Iron and Grey-Iron Fittings, 3 in. through 48 in. (75 mm through 1200 mm), for Water and Other Liquids.
4. AWWA C111 - American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
5. AWWA C150 - ANSI Standard for the Thickness Design of Ductile Iron Pipe.
6. AWWA C151 - American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.
7. AWWA C153 - American National Standard for Ductile-Iron Compact Fittings for Water Service.

D. National Fire Protection Association:
1. NFPA 24 - Installation of Private Fire Service Mains and Their Appurtenances.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Manufacturer's Installation Instructions:
   1. Indicate special procedures required to install Products specified.

C. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record location of pipe runs, connections, manholes, cleanouts, and invert elevations.

B. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with appropriate state agency and local utility standards.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years experience.

B. Installer: Company and/or staff specializing in performing work of this section with minimum 3 years experience.

1.7 PRE-INSTALLATION MEETINGS

A. Convene minimum one week prior to commencing work of this section.

B. Include affected utility companies and appropriate local officials.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Deliver and store valves in shipping containers with labeling in place.

C. Block individual and stockpiled pipe lengths to prevent moving.

1.9 FIELD MEASUREMENTS

A. Verify field measurements and elevations are as indicated.

1.10 COORDINATION

A. Coordinate the Work with jurisdictional utility.

B. Notify affected utility companies minimum of 72 hours prior to construction.

PART 2 - PRODUCTS

2.1 SANITARY SEWER PIPE AND FITTINGS

A. Ductile Iron Pipe: AWWA C150 or AWWA C151, 350 minimum pressure class, bell and spigot ends.

B. Plastic Pipe: ASTM D3034, SDR 26 (SDR 35, only if approved by Engineer for use on this project), Poly Vinyl Chloride (PVC) material;, bell and spigot style rubber ring sealed gasket joint.

1. Fittings: PVC.
2. Joints: ASTM F477, elastomeric gaskets.

2.2 FLEXIBLE COUPLINGS

A. Furnish materials in accordance with TCEQ Design, Testing and Installation guidelines.

B. Flexible Coupling: Resilient chemical-resistant elastomeric polyvinyl chloride (PVC) coupling, two Series 300 stainless steel clamps and stainless steel screws and housings.

2.3 FLEXIBLE PIPE BOOT FOR MANHOLE PIPE ENTRANCES

A. Furnish materials in accordance with appropriate state agency, Testing and Installation guidelines and local utility standards.

B. Flexible Pipe Boot: ASTM C923, ethylene propylene rubber (EPDM) or Series 300 stainless steel clamp and stainless steel hardware.

2.4 PIPE SUPPORTS

A. Metal for pipe support brackets: Structural steel thoroughly coated with bituminous paint.

2.5 CONCRETE ENCASEMENT AND CRADLES

A. Concrete: Conforming as per Construction Plans.

B. Concrete Reinforcement: Conform as per Construction Plans.

2.6 UNDERGROUND PIPE MARKERS

A. Furnish materials in accordance with drawings and local utility standards.

B. Plastic Ribbon Tape: Bright colored, continuously printed, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

2.7 BEDDING AND COVER MATERIALS

A. Bedding/Haunching: as specified in Construction Plans.
   1. Class IA (open graded manufactured) and Class IB (dense graded manufactured).
   2. Class II Clean Coarse Grained Soils (GW, GP, SW, and SP).
   3. Class III Coarse Grained Soils with Fines (GM, GC, SM and SC).
   4. Cover Soils can consist of the above classes and/or Class IV materials (ML, CL, MH or CH).

B. Cover: Fill Type Native soil.

C. Subsoil shall have no rocks over 2 inches in diameter, frozen earth or foreign matter.

2.8 FINISHING - STEEL

A. Galvanizing: ASTM A123/A123M; hot dip galvanize after fabrication.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify excavation base is ready to receive work and excavations, dimensions, and elevations are as indicated on drawings.

3.2 PREPARATION

A. Correct over excavation with soils as outlined and in accordance with manufacturer's recommendations.

B. Remove large stones or other hard matter capable of damaging pipe or impeding consistent backfilling or compaction.

C. Protect and support existing sewer lines, utilities and appurtenances.

D. Maintain profiles of utilities. Coordinate with other utilities to eliminate interference. Notify Architect/Engineer where crossing conflicts occur.

3.3 BEDDING

A. Excavate pipe trench in accordance with Section 31 23 17.

B. Excavate to lines and grades shown on Drawings or required to accommodate installation of encasement.

C. Dewater excavations to maintain dry conditions and preserve final grades at bottom of excavation.

D. Place bedding material at trench bottom, level materials in continuous layer not exceeding 4 inches compacted depth; compact to 95 percent.

3.4 INSTALLATION - PIPE

A. Install pipe, fittings, and accessories in accordance with ASTM D2321. Seal joints watertight.

B. Lay pipe to slope gradients noted on drawings; with maximum variation from indicated slope of 1/8 inch in10 feet. Begin at downstream end and progress upstream.

C. Assemble and handle pipe in accordance with manufacturer's instructions except as modified on the Drawings or by Architect/Engineer.

D. Keep pipe and fittings clean until work is completed and accepted by Architect/Engineer. Cap open ends during periods of work stoppage.

E. Lay bell and spigot pipe with bells upstream.

F. Polyethylene Pipe Encasement: AWWA C105, as directed.

G. Connect pipe to existing sewer system at existing manhole.

H. Install plastic ribbon tape continuous over top of pipe and buried 24 inches below finish grade; coordinate with Section 31 23 23.

I. Install Work in accordance with TCEQ Design, Testing and Installation and local utility standards.

3.5 INSTALLATION - CONNECTION TO EXISTING MANHOLE

A. Core drill existing manhole to clean opening. Using pneumatic hammers, chipping guns or sledge hammers is not permitted.

B. Install watertight neoprene gasket and seal with non-shrink concrete grout.

C. Concrete encase new sewer pipe minimum of 24 inches to nearest pipe joint. Use epoxy binder between new and existing concrete.

D. Prevent construction debris from entering existing sewer line when making connection.

3.6 INSTALLATION - WYE BRANCHES AND TEES

A. Install wye branches or pipe tees at locations indicated on Drawings concurrent with pipe laying operations. Use standard fittings of same material and joint type as sewer main.

B. Maintain minimum 5 feet separation distance between wye connection and manhole.

C. Use saddle wye or tee with stainless steel clamps for taps into existing piping. Mount saddles with solvent cement or gasket and secure with metal bands. Layout holes with template and cut holes with mechanical cutter.

3.7 INSTALLATION - SANITARY LATERALS

A. Construct laterals from wye branch to terminal point at right-of-way.

B. Where depth of main pipeline warrants, construct riser type laterals from wye branch.

C. Maintain 2 feet minimum depth of cover over pipe.

D. Maintain minimum 5 feet separation distance between laterals.

E. Install watertight plug, braced to withstand pipeline test pressure thrust, at termination of lateral. Install temporary marker stake extending from end of lateral to 12 inches above finished grade. Paint top 6 inches of stake with fluorescent orange paint.

3.8 BACKFILLING

A. Backfill around sides and to top of pipe with cover fill in minimum lifts of 6 inches, tamp in place and compact to 95 percent. Place and compact material immediately adjacent to pipes to avoid damage to pipe and prevent pipe misalignment.

B. Backfill around sides and to top of pipe in accordance with Section 31 23 23.

C. Maintain optimum moisture content of bedding material to attain required compaction density.

3.9 FIELD QUALITY CONTROL

A. Pressure Test: Test in accordance with Section 33 01 30.

B. Infiltration Test: Test in accordance with Section 33 01 30.

C. Deflection Test: Test in accordance with Section 33 01 30.

D. Request inspection prior to and immediately after placing bedding.

E. Compaction Testing: In accordance with ASTM D698.

F. When tests indicate Work does not meet specified requirements, remove work, replace and retest.

G. Frequency of Compaction Tests: One test per 500 linear feet.

3.10 PROTECTION OF FINISHED WORK

A. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

END OF SECTION

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