Jackson
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PROJECT MANUAL

FOR THE

HIGH SCHOOL
BAND BUILDING

FOR

GREENBRIER
SCHOOL DISTRICT
GREENBRIER, AR

27 February 2026



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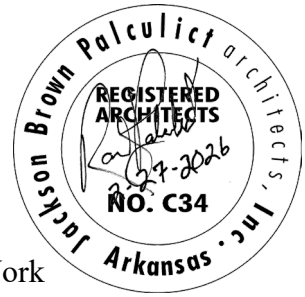
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NOT USED

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AIA® Document A701® – 2018

Instructions to Bidders

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

High School Band Building

THE OWNER:
(Name, legal status, address, and other information)

Greenbrier School District
4 School Drive
Greenbrier, AR 72058
(501) 679-4808

THE ARCHITECT:
(Name, legal status, address, and other information)

Jackson Brown Palculict Architects, Inc.
12921 Cantrell Road, Suite 201
Little Rock, AR 72223
(501) 664-8700

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ADDITIONS AND DELETIONS:
The author of this document may have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes 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 to or deleted from the original AIA text.

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

FEDERAL, STATE, AND LOCAL LAWS MAY IMPOSE REQUIREMENTS ON PUBLIC PROCUREMENT CONTRACTS. CONSULT LOCAL AUTHORITIES OR AN ATTORNEY TO VERIFY REQUIREMENTS APPLICABLE TO THIS PROCUREMENT BEFORE COMPLETING THIS FORM.

It is intended that AIA Document G612™–2017, Owner's Instructions to the Architect, Parts A and B will be completed prior to using this document.

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ARTICLE 1 DEFINITIONS

§ 1.1 Bidding Documents include the Bidding Requirements and the Proposed Contract Documents. The Bidding Requirements consist of the advertisement or invitation to bid, Instructions to Bidders, supplementary instructions to bidders, the bid form, and any other bidding forms. The Proposed Contract Documents consist of the unexecuted form of Agreement between the Owner and Contractor and that Agreement's Exhibits, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, all Addenda, and all other documents enumerated in Article 8 of these Instructions.

§ 1.2 Definitions set forth in the General Conditions of the Contract for Construction, or in other Proposed Contract Documents apply to the Bidding Documents.

§ 1.3 Addenda are written or graphic instruments issued by the Architect, which, by additions, deletions, clarifications, or corrections, modify or interpret the Bidding Documents.

§ 1.4 A Bid is a complete and properly executed proposal to do the Work for the sums stipulated therein, submitted in accordance with the Bidding Documents.

§ 1.5 The Base Bid is the sum stated in the Bid for which the Bidder offers to perform the Work described in the Bidding Documents, to which Work may be added or deleted by sums stated in Alternate Bids.

§ 1.6 An Alternate Bid (or Alternate) is an amount stated in the Bid to be added to or deducted from, or that does not change, the Base Bid if the corresponding change in the Work, as described in the Bidding Documents, is accepted.

§ 1.7 A Unit Price is an amount stated in the Bid as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, as described in the Bidding Documents.

§ 1.8 A Bidder is a person or entity who submits a Bid and who meets the requirements set forth in the Bidding Documents.

§ 1.9 A Sub-bidder is a person or entity who submits a bid to a Bidder for materials, equipment, or labor for a portion of the Work.

ARTICLE 2 BIDDER'S REPRESENTATIONS

§ 2.1 By submitting a Bid, the Bidder represents that:

- **.1** the Bidder has read and understands the Bidding Documents;
- **.2** the Bidder understands how the Bidding Documents relate to other portions of the Project, if any, being bid concurrently or presently under construction;
- **.3** the Bid complies with the Bidding Documents;
- **.4** the Bidder has visited the site, become familiar with local conditions under which the Work is to be performed, and has correlated the Bidder's observations with the requirements of the Proposed Contract Documents;
- **.5** the Bid is based upon the materials, equipment, and systems required by the Bidding Documents without exception; and
- **.6** the Bidder has read and understands the provisions for liquidated damages, if any, set forth in the form of Agreement between the Owner and Contractor.

ARTICLE 3 BIDDING DOCUMENTS

§ 3.1 Distribution

§ 3.1.1 Bidders shall obtain complete Bidding Documents from the issuing office designated in the advertisement or invitation to bid, for the deposit sum, if any, stated therein.
(Indicate how, such as by email, website, host site/platform, paper copy, or other method Bidders shall obtain Bidding Documents.)

§ 3.1.2 Any required deposit shall be refunded to Bidders who submit a bona fide Bid and return the paper Bidding Documents in good condition within ten days after receipt of Bids. The cost to replace missing or damaged paper documents will be deducted from the deposit. A Bidder receiving a Contract award may retain the paper Bidding Documents, and the Bidder's deposit will be refunded.

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§ 3.1.3 Bidding Documents will not be issued directly to Sub-bidders unless specifically offered in the advertisement or invitation to bid, or in supplementary instructions to bidders.

§ 3.1.4 Bidders shall use complete Bidding Documents in preparing Bids. Neither the Owner nor Architect assumes responsibility for errors or misinterpretations resulting from the use of incomplete Bidding Documents.

§ 3.1.5 The Bidding Documents will be available for the sole purpose of obtaining Bids on the Work. No license or grant of use is conferred by distribution of the Bidding Documents.

§ 3.2 Modification or Interpretation of Bidding Documents

§ 3.2.1 The Bidder shall carefully study the Bidding Documents, shall examine the site and local conditions, and shall notify the Architect of errors, inconsistencies, or ambiguities discovered and request clarification or interpretation pursuant to Section 3.2.2.

§ 3.2.2 Requests for clarification or interpretation of the Bidding Documents shall be submitted by the Bidder in writing and shall be received by the Architect at least seven days prior to the date for receipt of Bids.
(Indicate how, such as by email, website, host site/platform, paper copy, or other method Bidders shall submit requests for clarification and interpretation.)

§ 3.2.3 Modifications and interpretations of the Bidding Documents shall be made by Addendum. Modifications and interpretations of the Bidding Documents made in any other manner shall not be binding, and Bidders shall not rely upon them.

§ 3.3 Substitutions

§ 3.3.1 The materials, products, and equipment described in the Bidding Documents establish a standard of required function, dimension, appearance, and quality to be met by any proposed substitution.

§ 3.3.2 Substitution Process

§ 3.3.2.1 Written requests for substitutions shall be received by the Architect at least ten days prior to the date for receipt of Bids. Requests shall be submitted in the same manner as that established for submitting clarifications and interpretations in Section 3.2.2.

§ 3.3.2.2 Bidders shall submit substitution requests on a Substitution Request Form if one is provided in the Bidding Documents.

§ 3.3.2.3 If a Substitution Request Form is not provided, requests shall include (1) the name of the material or equipment specified in the Bidding Documents; (2) the reason for the requested substitution; (3) a complete description of the proposed substitution including the name of the material or equipment proposed as the substitute, performance and test data, and relevant drawings; and (4) any other information necessary for an evaluation. The request shall include a statement setting forth changes in other materials, equipment, or other portions of the Work, including changes in the work of other contracts or the impact on any Project Certifications (such as LEED), that will result from incorporation of the proposed substitution.

§ 3.3.3 The burden of proof of the merit of the proposed substitution is upon the proposer. The Architect's decision of approval or disapproval of a proposed substitution shall be final.

§ 3.3.4 If the Architect approves a proposed substitution prior to receipt of Bids, such approval shall be set forth in an Addendum. Approvals made in any other manner shall not be binding, and Bidders shall not rely upon them.

§ 3.3.5 No substitutions will be considered after the Contract award unless specifically provided for in the Contract Documents.

§ 3.4 Addenda

§ 3.4.1 Addenda will be transmitted to Bidders known by the issuing office to have received complete Bidding Documents.
(Indicate how, such as by email, website, host site/platform, paper copy, or other method Addenda will be transmitted.)

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§ 3.4.2 Addenda will be available where Bidding Documents are on file.

§ 3.4.3 Addenda will be issued no later than four days prior to the date for receipt of Bids, except an Addendum withdrawing the request for Bids or one which includes postponement of the date for receipt of Bids.

§ 3.4.4 Prior to submitting a Bid, each Bidder shall ascertain that the Bidder has received all Addenda issued, and the Bidder shall acknowledge their receipt in the Bid.

ARTICLE 4 BIDDING PROCEDURES

§ 4.1 Preparation of Bids

§ 4.1.1 Bids shall be submitted on the forms included with or identified in the Bidding Documents.

§ 4.1.2 All blanks on the bid form shall be legibly executed. Paper bid forms shall be executed in a non-erasable medium.

§ 4.1.3 Sums shall be expressed in both words and numbers, unless noted otherwise on the bid form. In case of discrepancy, the amount entered in words shall govern.

§ 4.1.4 Edits to entries made on paper bid forms must be initialed by the signer of the Bid.

§ 4.1.5 All requested Alternates shall be bid. If no change in the Base Bid is required, enter "No Change" or as required by the bid form.

§ 4.1.6 Where two or more Bids for designated portions of the Work have been requested, the Bidder may, without forfeiture of the bid security, state the Bidder's refusal to accept award of less than the combination of Bids stipulated by the Bidder. The Bidder shall neither make additional stipulations on the bid form nor qualify the Bid in any other manner.

§ 4.1.7 Each copy of the Bid shall state the legal name and legal status of the Bidder. As part of the documentation submitted with the Bid, the Bidder shall provide evidence of its legal authority to perform the Work in the jurisdiction where the Project is located. Each copy of the Bid shall be signed by the person or persons legally authorized to bind the Bidder to a contract. A Bid by a corporation shall further name the state of incorporation and have the corporate seal affixed. A Bid submitted by an agent shall have a current power of attorney attached, certifying the agent's authority to bind the Bidder.

§ 4.1.8 A Bidder shall incur all costs associated with the preparation of its Bid.

§ 4.2 Bid Security

§ 4.2.1 Each Bid shall be accompanied by the following bid security:
(Insert the form and amount of bid security.)

AIA Document A310 - Bid Bond in an amount equal to five percent (5%) of the bid amount, payable to the Owner, will be required of all Bidders.

§ 4.2.2 The Bidder pledges to enter into a Contract with the Owner on the terms stated in the Bid and shall, if required, furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder. Should the Bidder refuse to enter into such Contract or fail to furnish such bonds if required, the amount of the bid security shall be forfeited to the Owner as liquidated damages, not as a penalty. In the event the Owner fails to comply with Section 6.2, the amount of the bid security shall not be forfeited to the Owner.

§ 4.2.3 If a surety bond is required as bid security, it shall be written on AIA Document A310™, Bid Bond, unless otherwise provided in the Bidding Documents. The attorney-in-fact who executes the bond on behalf of the surety shall affix to the bond a certified and current copy of an acceptable power of attorney. The Bidder shall provide surety bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 4.2.4 The Owner will have the right to retain the bid security of Bidders to whom an award is being considered until (a) the Contract has been executed and bonds, if required, have been furnished; (b) the specified time has elapsed so that Bids may be withdrawn; or (c) all Bids have been rejected. However, if no Contract has been awarded or a Bidder has

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not been notified of the acceptance of its Bid, a Bidder may, beginningdays after the opening of Bids, withdraw its Bid and request the return of its bid security.

§ 4.3 Submission of Bids

§ 4.3.1 A Bidder shall submit its Bid as indicated below:
(Indicate how, such as by website, host site/platform, paper copy, or other method Bidders shall submit their Bid.)

as instructed in the Invitation for Bids

§ 4.3.2 Paper copies of the Bid, the bid security, and any other documents required to be submitted with the Bid shall be enclosed in a sealed opaque envelope. The envelope shall be addressed to the party receiving the Bids and shall be identified with the Project name, the Bidder's name and address, and, if applicable, the designated portion of the Work for which the Bid is submitted. If the Bid is sent by mail, the sealed envelope shall be enclosed in a separate mailing envelope with the notation "SEALED BID ENCLOSED" on the face thereof.

§ 4.3.3 Bids shall be submitted by the date and time and at the place indicated in the invitation to bid. Bids submitted after the date and time for receipt of Bids, or at an incorrect place, will not be accepted.

§ 4.3.4 The Bidder shall assume full responsibility for timely delivery at the location designated for receipt of Bids.

§ 4.3.5 A Bid submitted by any method other than as provided in this Section 4.3 will not be accepted.

§ 4.4 Modification or Withdrawal of Bid

§ 4.4.1 Prior to the date and time designated for receipt of Bids, a Bidder may submit a new Bid to replace a Bid previously submitted, or withdraw its Bid entirely, by notice to the party designated to receive the Bids. Such notice shall be received and duly recorded by the receiving party on or before the date and time set for receipt of Bids. The receiving party shall verify that replaced or withdrawn Bids are removed from the other submitted Bids and not considered. Notice of submission of a replacement Bid or withdrawal of a Bid shall be worded so as not to reveal the amount of the original Bid.

§ 4.4.2 Withdrawn Bids may be resubmitted up to the date and time designated for the receipt of Bids in the same format as that established in Section 4.3, provided they fully conform with these Instructions to Bidders. Bid security shall be in an amount sufficient for the Bid as resubmitted.

§ 4.4.3 After the date and time designated for receipt of Bids, a Bidder who discovers that it made a clerical error in its Bid shall notify the Architect of such error within two days, or pursuant to a timeframe specified by the law of the jurisdiction where the Project is located, requesting withdrawal of its Bid. Upon providing evidence of such error to the reasonable satisfaction of the Architect, the Bid shall be withdrawn and not resubmitted. If a Bid is withdrawn pursuant to this Section 4.4.3, the bid security will be attended to as follows:
(State the terms and conditions, such as Bid rank, for returning or retaining the bid security.)

Bid Security will be returned to the Bidder.

ARTICLE 5 CONSIDERATION OF BIDS

§ 5.1 Opening of Bids

If stipulated in an advertisement or invitation to bid, or when otherwise required by law, Bids properly identified and received within the specified time limits will be publicly opened and read aloud. A summary of the Bids may be made available to Bidders.

§ 5.2 Rejection of Bids

Unless otherwise prohibited by law, the Owner shall have the right to reject any or all Bids.

§ 5.3 Acceptance of Bid (Award)

§ 5.3.1 It is the intent of the Owner to award a Contract to the lowest responsive and responsible Bidder, provided the Bid has been submitted in accordance with the requirements of the Bidding Documents. Unless otherwise prohibited by law, the Owner shall have the right to waive informalities and irregularities in a Bid received and to accept the Bid which, in the Owner's judgment, is in the Owner's best interests.

§ 5.3.2 Unless otherwise prohibited by law, the Owner shall have the right to accept Alternates in any order or

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combination, unless otherwise specifically provided in the Bidding Documents, and to determine the lowest responsive and responsible Bidder on the basis of the sum of the Base Bid and Alternates accepted.

ARTICLE 6 POST-BID INFORMATION

§ 6.1 Contractor's Qualification Statement

Bidders to whom award of a Contract is under consideration shall submit to the Architect, upon request and within the timeframe specified by the Architect, a properly executed AIA Document A305™, Contractor's Qualification Statement, unless such a Statement has been previously required and submitted for this Bid.

§ 6.2 Owner's Financial Capability

A Bidder to whom award of a Contract is under consideration may request in writing, fourteen days prior to the expiration of the time for withdrawal of Bids, that the Owner furnish to the Bidder reasonable evidence that financial arrangements have been made to fulfill the Owner's obligations under the Contract. The Owner shall then furnish such reasonable evidence to the Bidder no later than seven days prior to the expiration of the time for withdrawal of Bids. Unless such reasonable evidence is furnished within the allotted time, the Bidder will not be required to execute the Agreement between the Owner and Contractor.

§ 6.3 Submittals

§ 6.3.1 After notification of selection for the award of the Contract, the Bidder shall, as soon as practicable or as stipulated in the Bidding Documents, submit in writing to the Owner through the Architect:

.1 a designation of the Work to be performed with the Bidder's own forces;

.2 names of the principal products and systems proposed for the Work and the manufacturers and suppliers of each; and

.3 names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for the principal portions of the Work.

§ 6.3.2 The Bidder will be required to establish to the satisfaction of the Architect and Owner the reliability and responsibility of the persons or entities proposed to furnish and perform the Work described in the Bidding Documents.

§ 6.3.3 Prior to the execution of the Contract, the Architect will notify the Bidder if either the Owner or Architect, after due investigation, has reasonable objection to a person or entity proposed by the Bidder. If the Owner or Architect has reasonable objection to a proposed person or entity, the Bidder may, at the Bidder's option, withdraw the Bid or submit an acceptable substitute person or entity. The Bidder may also submit any required adjustment in the Base Bid or Alternate Bid to account for the difference in cost occasioned by such substitution. The Owner may accept the adjusted bid price or disqualify the Bidder. In the event of either withdrawal or disqualification, bid security will not be forfeited.

§ 6.3.4 Persons and entities proposed by the Bidder and to whom the Owner and Architect have made no reasonable objection must be used on the Work for which they were proposed and shall not be changed except with the written consent of the Owner and Architect.

ARTICLE 7 PERFORMANCE BOND AND PAYMENT BOND

§ 7.1 Bond Requirements

§ 7.1.1 If stipulated in the Bidding Documents, the Bidder shall furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder.

§ 7.1.2 If the furnishing of such bonds is stipulated in the Bidding Documents, the cost shall be included in the Bid. If the furnishing of such bonds is required after receipt of bids and before execution of the Contract, the cost of such bonds shall be added to the Bid in determining the Contract Sum.

§ 7.1.3 The Bidder shall provide surety bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 7.1.4 Unless otherwise indicated below, the Penal Sum of the Payment and Performance Bonds shall be the amount of the Contract Sum.
(If Payment or Performance Bonds are to be in an amount other than 100% of the Contract Sum, indicate the dollar amount or percentage of the Contract Sum.)

§ 7.2 Time of Delivery and Form of Bonds

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§ 7.2.1 The Bidder shall deliver the required bonds to the Owner not later than three days following the date of execution of the Contract. If the Work is to commence sooner in response to a letter of intent, the Bidder shall, prior to commencement of the Work, submit evidence satisfactory to the Owner that such bonds will be furnished and delivered in accordance with this Section 7.2.1.

§ 7.2.2 Unless otherwise provided, the bonds shall be written on AIA Document A312, Performance Bond and Payment Bond.

§ 7.2.3 The bonds shall be dated on or after the date of the Contract.

§ 7.2.4 The Bidder shall require the attorney-in-fact who executes the required bonds on behalf of the surety to affix to the bond a certified and current copy of the power of attorney.

ARTICLE 8 ENUMERATION OF THE PROPOSED CONTRACT DOCUMENTS

§ 8.1 Copies of the proposed Contract Documents are available to the Bidder upon request and consist of the following documents:

.1 AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor, unless otherwise stated below.
(Insert the complete AIA Document number, including year, and Document title.)

.2 AIA Document A101™–2017, Exhibit A, Insurance and Bonds, unless otherwise stated below.
(Insert the complete AIA Document number, including year, and Document title.)

.3 AIA Document A201™–2017, General Conditions of the Contract for Construction, unless otherwise stated below.
(Insert the complete AIA Document number, including year, and Document title.)

.4 Building Information Modeling Exhibit, if completed:

.5 Drawings

Number	Title	Date
As issued for Bids		

.6 Specifications

Section	Title	Date	Pages
As issued for Bids			

.7 Addenda:

Number	Date	Pages
As issued for Bids		

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

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

[ ] The Sustainability Plan:

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Title	Date	Pages

[X] Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages
As included in the Project Manual			

.9 Other documents listed below:
(List here any additional documents that are intended to form part of the Proposed Contract Documents.)

N/

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00 22 13 – SUPPLEMENTAL INSTRUCTIONS TO BIDDERS

1. The modifications (additions, deletions and substitutions) to the American Institute of Architects "Instructions to Bidders" (AIA Document A701, 2018 edition), listed below are part of the Bidding Documents. Where any part of this document is modified by this Section, the unaltered provisions shall remain in effect.

   A. Article 3.3, after "SUBSTITUTIONS", add "Comply with requirements of Section 01 33 00".

   B. Article 7.1.2, after 1st sentence, delete remainder of paragraph.

   C. Article 7.2.1, in line 2, change "three days" to "ten days".

2. BID OPENING: The bid opening will be conducted at the time and place as stated in the "Invitation for Bids" - Document 00 11 16.

3. BONDS: Bonds will be required as stated in the "Invitation for Bids" - Document 00 11 16.

4. TIME: Time will be of the essence of the Contract and the Contractor must state in his proposal the number of days in which he will agree to complete the work after written Notice to Proceed.

5. NAMING OF SUBCONTRACTORS:

   A. Each bidder must submit on the Bid Form the name and license number of principal subcontractors to be employed if awarded the Contract.

   B. If bidder's name is listed as a subcontractor, include name of employee holding license, license number, and number of years employed by bidder.

6. RETAINAGE: Refer to General and Supplementary General Conditions for retainage amounts.

7. ALLOWANCES: Include in the Contract Sum, allowances as specified in Section 01 21 00.

8. LIQUIDATED DAMAGES: Liquidated damages will be required if stated in the Supplementary General Conditions.

9. CONDENSATION OF CLAUSES: The specifications are condensed in the interests of brevity and clarity. Incomplete sentences have been used; words such as "a", "the", "all", and the phrases, "the Contractor shall", "shall be", "as indicated on the drawings", have been intentionally omitted. "Provide" means furnish and install. Refer any questions of interpretation to the Architect immediately.

END OF DOCUMENT

If it is necessary to stand at the outboard or inboard edge of the deckload where less than 24 inches of bulwark, rail, coaming, or other protection exists, all employees shall be provided with a suitable means of protection against falling from the deckload.

(d) *First-aid and lifesaving equipment.* (1) Provisions for rendering first aid and medical assistance shall be in accordance with subpart D of this part.

(2) The employer shall ensure that there is in the vicinity of each barge in use at least one U.S. Coast Guard-approved 30-inch lifering with not less than 90 feet of line attached, and at least one portable or permanent ladder which will reach the top of the apron to the surface of the water. If the above equipment is not available at the pier, the employer shall furnish it during the time that he is working the barge.

(3) Employees walking or working on the unguarded decks of barges shall be protected with U.S. Coast Guard-approved work vests or buoyant vests.

(e) *Commercial diving operations.* Commercial diving operations shall be subject to subpart T of part 1910, §§ 1910.401–1910.441, of this chapter.

[39 FR 22801, June 24, 1974, as amended at 42 FR 37674, July 22, 1977]

§ 1926.606 Definitions applicable to this subpart.

(a) *Apron*—The area along the waterfront edge of the pier or wharf.

(b) *Bulwark*—The side of a ship above the upper deck.

(c) *Coaming*—The raised frame, as around a hatchway in the deck, to keep out water.

(d) *Jacob's ladder*—A marine ladder of rope or chain with wooden or metal rungs.

(e) *Rail,* for the purpose of § 1926.605, means a light structure serving as a guard at the outer edge of a ship's deck.

Subpart P—Excavations

AUTHORITY: Sec. 107, Contract Worker Hours and Safety Standards Act (Construction Safety Act) (40 U.S.C. 333); Secs. 4, 6, 8, Occupational Safety and Health Act of 1970 (29 U.S.C. 653, 655, 657); Secretary of Labor's Order No. 12–71 (36 FR 8754), 8–76 (41 FR 25059), or 9–83 (48 FR 35736), as applicable, and 29 CFR part 1911.

SOURCE: 54 FR 45959, Oct. 31, 1989, unless otherwise noted.

§ 1926.650 Scope, application, and definitions applicable to this subpart.

(a) *Scope and application.* This subpart applies to all open excavations made in the earth's surface. Excavations are defined to include trenches.

(b) *Definitions applicable to this subpart.*

Accepted engineering practices means those requirements which are compatible with standards of practice required by a registered professional engineer.

Aluminum Hydraulic Shoring means a pre-engineered shoring system comprised of aluminum hydraulic cylinders (crossbraces) used in conjunction with vertical rails (uprights) or horizontal rails (walers). Such system is designed, specifically to support the sidewalls of an excavation and prevent cave-ins.

Bell-bottom pier hole means a type of shaft or footing excavation, the bottom of which is made larger than the cross section above to form a belled shape.

Benching (Benching system) means a method of protecting employees from cave-ins by excavating the sides of an excavation to form one or a series of horizontal levels or steps, usually with vertical or near-vertical surfaces between levels.

Cave-in means the separation of a mass of soil or rock material from the side of an excavation, or the loss of soil from under a trench shield or support system, and its sudden movement into the excavation, either by falling or sliding, in sufficient quantity so that it could entrap, bury, or otherwise injure and immobilize a person.

Competent person means one who is capable of identifying existing and predictable hazards in the surroundings, or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.

Cross braces mean the horizontal members of a shoring system installed perpendicular to the sides of the excavation, the ends of which bear against either uprights or wales.

Excavation means any man-made cut, cavity, trench, or depression in an earth surface, formed by earth removal.

Faces or *sides* means the vertical or inclined earth surfaces formed as a result of excavation work.

Failure means the breakage, displacement, or permanent deformation of a structural member or connection so as to reduce its structural integrity and its supportive capabilities.

Hazardous atmosphere means an atmosphere which by reason of being explosive, flammable, poisonous, corrosive, oxidizing, irritating, oxygen deficient, toxic, or otherwise harmful, may cause death, illness, or injury.

Kickout means the accidental release or failure of a cross brace.

Protective system means a method of protecting employees from cave-ins, from material that could fall or roll from an excavation face or into an excavation, or from the collapse of adjacent structures. Protective systems include support systems, sloping and benching systems, shield systems, and other systems that provide the necessary protection.

Ramp means an inclined walking or working surface that is used to gain access to one point from another, and is constructed from earth or from structural materials such as steel or wood.

Registered Professional Engineer means a person who is registered as a professional engineer in the state where the work is to be performed. However, a professional engineer, registered in any state is deemed to be a ''registered professional engineer'' within the meaning of this standard when approving designs for ''manufactured protective systems'' or ''tabulated data'' to be used in interstate commerce.

Sheeting means the members of a shoring system that retain the earth in position and in turn are supported by other members of the shoring system.

Shield (Shield system) means a structure that is able to withstand the forces imposed on it by a cave-in and thereby protect employees within the structure. Shields can be permanent structures or can be designed to be portable and moved along as work progresses. Additionally, shields can be either premanufactured or job-built in accordance with §1926.652 (c)(3) or (c)(4). Shields used in trenches are usually referred to as ''trench boxes'' or ''trench shields.''

Shoring (Shoring system) means a structure such as a metal hydraulic, mechanical or timber shoring system that supports the sides of an excavation and which is designed to prevent cave-ins.

Sides. See ''Faces.''

Sloping (Sloping system) means a method of protecting employees from cave-ins by excavating to form sides of an excavation that are inclined away from the excavation so as to prevent cave-ins. The angle of incline required to prevent a cave-in varies with differences in such factors as the soil type, environmental conditions of exposure, and application of surcharge loads.

Stable rock means natural solid mineral material that can be excavated with vertical sides and will remain intact while exposed. Unstable rock is considered to be stable when the rock material on the side or sides of the excavation is secured against caving-in or movement by rock bolts or by another protective system that has been designed by a registered professional engineer.

Structural ramp means a ramp built of steel or wood, usually used for vehicle access. Ramps made of soil or rock are not considered structural ramps.

Support system means a structure such as underpinning, bracing, or shoring, which provides support to an adjacent structure, underground installation, or the sides of an excavation.

Tabulated data means tables and charts approved by a registered professional engineer and used to design and construct a protective system.

Trench (Trench excavation) means a narrow excavation (in relation to its length) made below the surface of the ground. In general, the depth is greater than the width, but the width of a trench (measured at the bottom) is not greater than 15 feet (4.6 m). If forms or other structures are installed or constructed in an excavation so as to reduce the dimension measured from the forms or structure to the side of the excavation to 15 feet (4.6 m) or less

(measured at the bottom of the excavation), the excavation is also considered to be a trench.

Trench box. See ''Shield.''

Trench shield. See ''Shield.''

Uprights means the vertical members of a trench shoring system placed in contact with the earth and usually positioned so that individual members do not contact each other. Uprights placed so that individual members are closely spaced, in contact with or interconnected to each other, are often called ''sheeting.''

Wales means horizontal members of a shoring system placed parallel to the excavation face whose sides bear against the vertical members of the shoring system or earth.

§ 1926.651 Specific excavation requirements.

(a) *Surface encumbrances*. All surface encumbrances that are located so as to create a hazard to employees shall be removed or supported, as necessary, to safeguard employees.

(b) *Underground installations*. (1) The estimated location of utility installations, such as sewer, telephone, fuel, electric, water lines, or any other underground installations that reasonably may be expected to be encountered during excavation work, shall be determined prior to opening an excavation.

(2) Utility companies or owners shall be contacted within established or customary local response times, advised of the proposed work, and asked to establish the location of the utility underground installations prior to the start of actual excavation. When utility companies or owners cannot respond to a request to locate underground utility installations within 24 hours (unless a longer period is required by state or local law), or cannot establish the exact location of these installations, the employer may proceed, provided the employer does so with caution, and provided detection equipment or other acceptable means to locate utility installations are used.

(3) When excavation operations approach the estimated location of underground installations, the exact location of the installations shall be determined by safe and acceptable means.

(4) While the excavation is open, underground installations shall be protected, supported or removed as necessary to safeguard employees.

(c) *Access and egress*—(1) *Structural ramps*. (i) Structural ramps that are used solely by employees as a means of access or egress from excavations shall be designed by a competent person. Structural ramps used for access or egress of equipment shall be designed by a competent person qualified in structural design, and shall be constructed in accordance with the design.

(ii) Ramps and runways constructed of two or more structural members shall have the structural members connected together to prevent displacement.

(iii) Structural members used for ramps and runways shall be of uniform thickness.

(iv) Cleats or other appropriate means used to connect runway structural members shall be attached to the bottom of the runway or shall be attached in a manner to prevent tripping.

(v) Structural ramps used in lieu of steps shall be provided with cleats or other surface treatments on the top surface to prevent slipping.

(2) *Means of egress from trench excavations*. A stairway, ladder, ramp or other safe means of egress shall be located in trench excavations that are 4 feet (1.22 m) or more in depth so as to require no more than 25 feet (7.62 m) of lateral travel for employees.

(d) *Exposure to vehicular traffic*. Employees exposed to public vehicular traffic shall be provided with, and shall wear, warning vests or other suitable garments marked with or made of reflectorized or high-visibility material.

(e) *Exposure to falling loads*. No employee shall be permitted underneath loads handled by lifting or digging equipment. Employees shall be required to stand away from any vehicle being loaded or unloaded to avoid being struck by any spillage or falling materials. Operators may remain in the cabs of vehicles being loaded or unloaded when the vehicles are equipped, in accordance with § 1926.601(b)(6), to provide adequate protection for the operator during loading and unloading operations.

(f) *Warning system for mobile equipment.* When mobile equipment is operated adjacent to an excavation, or when such equipment is required to approach the edge of an excavation, and the operator does not have a clear and direct view of the edge of the excavation, a warning system shall be utilized such as barricades, hand or mechanical signals, or stop logs. If possible, the grade should be away from the excavation.

(g) *Hazardous atmospheres*—(1) *Testing and controls.* In addition to the requirements set forth in subparts D and E of this part (29 CFR 1926.50–1926.107) to prevent exposure to harmful levels of atmospheric contaminants and to assure acceptable atmospheric conditions, the following requirements shall apply:

(i) Where oxygen deficiency (atmospheres containing less than 19.5 percent oxygen) or a hazardous atmosphere exists or could reasonably be expected to exist, such as in excavations in landfill areas or excavations in areas where hazardous substances are stored nearby, the atmospheres in the excavation shall be tested before employees enter excavations greater than 4 feet (1.22 m) in depth.

(ii) Adequate precautions shall be taken to prevent employee exposure to atmospheres containing less than 19.5 percent oxygen and other hazardous atmospheres. These precautions include providing proper respiratory protection or ventilation in accordance with subparts D and E of this part respectively.

(iii) Adequate precaution shall be taken such as providing ventilation, to prevent employee exposure to an atmosphere containing a concentration of a flammable gas in excess of 20 percent of the lower flammable limit of the gas.

(iv) When controls are used that are intended to reduce the level of atmospheric contaminants to acceptable levels, testing shall be conducted as often as necessary to ensure that the atmosphere remains safe.

(2) *Emergency rescue equipment.* (i) Emergency rescue equipment, such as breathing apparatus, a safety harness and line, or a basket stretcher, shall be readily available where hazardous atmospheric conditions exist or may reasonably be expected to develop during work in an excavation. This equipment shall be attended when in use.

(ii) Employees entering bell-bottom pier holes, or other similar deep and confined footing excavations, shall wear a harness with a life-line securely attached to it. The lifeline shall be separate from any line used to handle materials, and shall be individually attended at all times while the employee wearing the lifeline is in the excavation.

(h) *Protection from hazards associated with water accumulation.* (1) Employees shall not work in excavations in which there is accumulated water, or in excavations in which water is accumulating, unless adequate precautions have been taken to protect employees against the hazards posed by water accumulation. The precautions necessary to protect employees adequately vary with each situation, but could include special support or shield systems to protect from cave-ins, water removal to control the level of accumulating water, or use of a safety harness and lifeline.

(2) If water is controlled or prevented from accumulating by the use of water removal equipment, the water removal equipment and operations shall be monitored by a competent person to ensure proper operation.

(3) If excavation work interrupts the natural drainage of surface water (such as streams), diversion ditches, dikes, or other suitable means shall be used to prevent surface water from entering the excavation and to provide adequate drainage of the area adjacent to the excavation. Excavations subject to runoff from heavy rains will require an inspection by a competent person and compliance with paragraphs (h)(1) and (h)(2) of this section.

(i) *Stability of adjacent structures.* (1) Where the stability of adjoining buildings, walls, or other structures is endangered by excavation operations, support systems such as shoring, bracing, or underpinning shall be provided to ensure the stability of such structures for the protection of employees.

(2) Excavation below the level of the base or footing of any foundation or retaining wall that could be reasonably

expected to pose a hazard to employees shall not be permitted except when:

(i) A support system, such as underpinning, is provided to ensure the safety of employees and the stability of the structure; or

(ii) The excavation is in stable rock; or

(iii) A registered professional engineer has approved the determination that the structure is sufficently removed from the excavation so as to be unaffected by the excavation activity; or

(iv) A registered professional engineer has approved the determination that such excavation work will not pose a hazard to employees.

(3) Sidewalks, pavements, and appurtenant structure shall not be undermined unless a support system or another method of protection is provided to protect employees from the possible collapse of such structures.

(j) *Protection of employees from loose rock or soil.* (1) Adequate protection shall be provided to protect employees from loose rock or soil that could pose a hazard by falling or rolling from an excavation face. Such protection shall consist of scaling to remove loose material; installation of protective barricades at intervals as necessary on the face to stop and contain falling material; or other means that provide equivalent protection.

(2) Employees shall be protected from excavated or other materials or equipment that could pose a hazard by falling or rolling into excavations. Protection shall be provided by placing and keeping such materials or equipment at least 2 feet (.61 m) from the edge of excavations, or by the use of retaining devices that are sufficient to prevent materials or equipment from falling or rolling into excavations, or by a combination of both if necessary.

(k) *Inspections.* (1) Daily inspections of excavations, the adjacent areas, and protective systems shall be made by a competent person for evidence of a situation that could result in possible cave-ins, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions. An inspection shall be conducted by the competent person prior to the start of work and as needed throughout the shift. Inspections shall also be made after every rainstorm or other hazard increasing occurrence. These inspections are only required when employee exposure can be reasonably anticipated.

(2) Where the competent person finds evidence of a situation that could result in a possible cave-in, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions, exposed employees shall be removed from the hazardous area until the necessary precautions have been taken to ensure their safety.

(l) Walkways shall be provided where employees or equipment are required or permitted to cross over excavations. Guardrails which comply with §1926.502(b) shall be provided where walkways are 6 feet (1.8 m) or more above lower levels.

[54 FR 45959, Oct. 31, 1989, as amended by 59 FR 40730, Aug. 9, 1994]

§ 1926.652 Requirements for protective systems.

(a) *Protection of employees in excavations.* (1) Each employee in an excavation shall be protected from cave-ins by an adequate protective system designed in accordance with paragraph (b) or (c) of this section except when:

(i) Excavations are made entirely in stable rock; or

(ii) Excavations are less than 5 feet (1.52m) in depth and examination of the ground by a competent person provides no indication of a potential cave-in.

(2) Protective systems shall have the capacity to resist without failure all loads that are intended or could reasonably be expected to be applied or transmitted to the system.

(b) *Design of sloping and benching systems.* The slopes and configurations of sloping and benching systems shall be selected and constructed by the employer or his designee and shall be in accordance with the requirements of paragraph (b)(1); or, in the alternative, paragraph (b)(2); or, in the alternative, paragraph (b)(3), or, in the alternative, paragraph (b)(4), as follows:

(1) *Option (1)—Allowable configurations and slopes.* (i) Excavations shall be sloped at an angle not steeper than one and one-half horizontal to one vertical

(34 degrees measured from the horizontal), unless the employer uses one of the other options listed below.

(ii) Slopes specified in paragraph (b)(1)(i) of this section, shall be excavated to form configurations that are in accordance with the slopes shown for Type C soil in Appendix B to this subpart.

(2) *Option (2)—Determination of slopes and configurations using Appendices A and B.* Maximum allowable slopes, and allowable configurations for sloping and benching systems, shall be determined in accordance with the conditions and requirements set forth in appendices A and B to this subpart.

(3) *Option (3)—Designs using other tabulated data.* (i) Designs of sloping or benching systems shall be selected from and be in accordance with tabulated data, such as tables and charts.

(ii) The tabulated data shall be in written form and shall include all of the following:

(A) Identification of the parameters that affect the selection of a sloping or benching system drawn from such data;

(B) Identification of the limits of use of the data, to include the magnitude and configuration of slopes determined to be safe;

(C) Explanatory information as may be necessary to aid the user in making a correct selection of a protective system from the data.

(iii) At least one copy of the tabulated data which identifies the registered professional engineer who approved the data, shall be maintained at the jobsite during construction of the protective system. After that time the data may be stored off the jobsite, but a copy of the data shall be made available to the Secretary upon request.

(4) *Option (4)—Design by a registered professional engineer.* (i) Sloping and benching systems not utilizing Option (1) or Option (2) or Option (3) under paragraph (b) of this section shall be approved by a registered professional engineer.

(ii) Designs shall be in written form and shall include at least the following:

(A) The magnitude of the slopes that were determined to be safe for the particular project;

(B) The configurations that were determined to be safe for the particular project; and

(C) The identity of the registered professional engineer approving the design.

(iii) At least one copy of the design shall be maintained at the jobsite while the slope is being constructed. After that time the design need not be at the jobsite, but a copy shall be made available to the Secretary upon request.

(c) *Design of support systems, shield systems, and other protective systems.* Designs of support systems shield systems, and other protective systems shall be selected and constructed by the employer or his designee and shall be in accordance with the requirements of paragraph (c)(1); or, in the alternative, paragraph (c)(2); or, in the alternative, paragraph (c)(3); or, in the alternative, paragraph (c)(4) as follows:

(1) *Option (1)—Designs using appendices A, C and D.* Designs for timber shoring in trenches shall be determined in accordance with the conditions and requirements set forth in appendices A and C to this subpart. Designs for aluminum hydraulic shoring shall be in accordance with paragraph (c)(2) of this section, but if manufacturer's tabulated data cannot be utilized, designs shall be in accordance with appendix D.

(2) *Option (2)—Designs Using Manufacturer's Tabulated Data.* (i) Design of support systems, shield systems, or other protective systems that are drawn from manufacturer's tabulated data shall be in accordance with all specifications, recommendations, and limitations issued or made by the manufacturer.

(ii) Deviation from the specifications, recommendations, and limitations issued or made by the manufacturer shall only be allowed after the manufacturer issues specific written approval.

(iii) Manufacturer's specifications, recommendations, and limitations, and manufacturer's approval to deviate from the specifications, recommendations, and limitations shall be in written form at the jobsite during construction of the protective system. After that time this data may be stored off the jobsite, but a copy shall

be made available to the Secretary upon request.

(3) *Option (3)—Designs using other tabulated data.* (i) Designs of support systems, shield systems, or other protective systems shall be selected from and be in accordance with tabulated data, such as tables and charts.

(ii) The tabulated data shall be in written form and include all of the following:

(A) Identification of the parameters that affect the selection of a protective system drawn from such data;

(B) Identification of the limits of use of the data;

(C) Explanatory information as may be necessary to aid the user in making a correct selection of a protective system from the data.

(iii) At least one copy of the tabulated data, which identifies the registered professional engineer who approved the data, shall be maintained at the jobsite during construction of the protective system. After that time the data may be stored off the jobsite, but a copy of the data shall be made available to the Secretary upon request.

(4) *Option (4)—Design by a registered professional engineer.* (i) Support systems, shield systems, and other protective systems not utilizing Option 1, Option 2 or Option 3, above, shall be approved by a registered professional engineer.

(ii) Designs shall be in written form and shall include the following:

(A) A plan indicating the sizes, types, and configurations of the materials to be used in the protective system; and

(B) The identity of the registered professional engineer approving the design.

(iii) At least one copy of the design shall be maintained at the jobsite during construction of the protective system. After that time, the design may be stored off the jobsite, but a copy of the design shall be made available to the Secretary upon request.

(d) *Materials and equipment.* (1) Materials and equipment used for protective systems shall be free from damage or defects that might impair their proper function.

(2) Manufactured materials and equipment used for protective systems shall be used and maintained in a manner that is consistent with the recommendations of the manufacturer, and in a manner that will prevent employee exposure to hazards.

(3) When material or equipment that is used for protective systems is damaged, a competent person shall examine the material or equipment and evaluate its suitability for continued use. If the competent person cannot assure the material or equipment is able to support the intended loads or is otherwise suitable for safe use, then such material or equipment shall be removed from service, and shall be evaluated and approved by a registered professional engineer before being returned to service.

(e) *Installation and removal of support*—(1) *General.* (i) Members of support systems shall be securely connected together to prevent sliding, falling, kickouts, or other predictable failure.

(ii) Support systems shall be installed and removed in a manner that protects employees from cave-ins, structural collapses, or from being struck by members of the support system.

(iii) Individual members of support systems shall not be subjected to loads exceeding those which those members were designed to withstand.

(iv) Before temporary removal of individual members begins, additional precautions shall be taken to ensure the safety of employees, such as installing other structural members to carry the loads imposed on the support system.

(v) Removal shall begin at, and progress from, the bottom of the excavation. Members shall be released slowly so as to note any indication of possible failure of the remaining members of the structure or possible cave-in of the sides of the excavation.

(vi) Backfilling shall progress together with the removal of support systems from excavations.

(2) *Additional requirements for support systems for trench excavations.* (i) Excavation of material to a level no greater than 2 feet (.61 m) below the bottom of the members of a support system shall be permitted, but only if the system is designed to resist the forces calculated for the full depth of the trench, and

there are no indications while the trench is open of a possible loss of soil from behind or below the bottom of the support system.

(ii) Installation of a support system shall be closely coordinated with the excavation of trenches.

(f) *Sloping and benching systems.* Employees shall not be permitted to work on the faces of sloped or benched excavations at levels above other employees except when employees at the lower levels are adequately protected from the hazard of falling, rolling, or sliding material or equipment.

(g) *Shield systems*—(1) *General.* (i) Shield systems shall not be subjected to loads exceeding those which the system was designed to withstand.

(ii) Shields shall be installed in a manner to restrict lateral or other hazardous movement of the shield in the event of the application of sudden lateral loads.

(iii) Employees shall be protected from the hazard of cave-ins when entering or exiting the areas protected by shields.

(iv) Employees shall not be allowed in shields when shields are being installed, removed, or moved vertically.

(2) *Additional requirement for shield systems used in trench excavations.* Excavations of earth material to a level not greater than 2 feet (.61 m) below the bottom of a shield shall be permitted, but only if the shield is designed to resist the forces calculated for the full depth of the trench, and there are no indications while the trench is open of a possible loss of soil from behind or below the bottom of the shield.

APPENDIX A TO SUBPART P OF PART 1926—SOIL CLASSIFICATION

(a) *Scope and application*—(1) *Scope.* This appendix describes a method of classifying soil and rock deposits based on site and environmental conditions, and on the structure and composition of the earth deposits. The appendix contains definitions, sets forth requirements, and describes acceptable visual and manual tests for use in classifying soils.

(2) *Application.* This appendix applies when a sloping or benching system is designed in accordance with the requirements set forth in §1926.652(b)(2) as a method of protection for employees from cave-ins. This appendix also applies when timber shoring for excavations is designed as a method of protection from cave-ins in accordance with appendix C to subpart P of part 1926, and when aluminum hydraulic shoring is designed in accordance with appendix D. This Appendix also applies if other protective systems are designed and selected for use from data prepared in accordance with the requirements set forth in §1926.652(c), and the use of the data is predicated on the use of the soil classification system set forth in this appendix.

(b) *Definitions.* The definitions and examples given below are based on, in whole or in part, the following: American Society for Testing Materials (ASTM) Standards D653–85 and D2488; The Unified Soils Classification System, The U.S. Department of Agriculture (USDA) Textural Classification Scheme; and The National Bureau of Standards Report BSS–121.

Cemented soil means a soil in which the particles are held together by a chemical agent, such as calcium carbonate, such that a hand-size sample cannot be crushed into powder or individual soil particles by finger pressure.

Cohesive soil means clay (fine grained soil), or soil with a high clay content, which has cohesive strength. Cohesive soil does not crumble, can be excavated with vertical sideslopes, and is plastic when moist. Cohesive soil is hard to break up when dry, and exhibits significant cohesion when submerged. Cohesive soils include clayey silt, sandy clay, silty clay, clay and organic clay.

Dry soil means soil that does not exhibit visible signs of moisture content.

Fissured means a soil material that has a tendency to break along definite planes of fracture with little resistance, or a material that exhibits open cracks, such as tension cracks, in an exposed surface.

Granular soil means gravel, sand, or silt, (coarse grained soil) with little or no clay content. Granular soil has no cohesive strength. Some moist granular soils exhibit apparent cohesion. Granular soil cannot be molded when moist and crumbles easily when dry.

Layered system means two or more distinctly different soil or rock types arranged in layers. Micaceous seams or weakened planes in rock or shale are considered layered.

Moist soil means a condition in which a soil looks and feels damp. Moist cohesive soil can easily be shaped into a ball and rolled into small diameter threads before crumbling. Moist granular soil that contains some cohesive material will exhibit signs of cohesion between particles.

Plastic means a property of a soil which allows the soil to be deformed or molded without cracking, or appreciable volume change.

Saturated soil means a soil in which the voids are filled with water. Saturation does not require flow. Saturation, or near saturation, is necessary for the proper use of instruments such as a pocket penetrometer or sheer vane.

Soil classification system means, for the purpose of this subpart, a method of categorizing soil and rock deposits in a hierarchy of Stable Rock, Type A, Type B, and Type C, in decreasing order of stability. The categories are determined based on an analysis of the properties and performance characteristics of the deposits and the environmental conditions of exposure.

Stable rock means natural solid mineral matter that can be excavated with vertical sides and remain intact while exposed.

Submerged soil means soil which is underwater or is free seeping.

Type A means cohesive soils with an unconfined compressive strength of 1.5 ton per square foot (tsf) (144 kPa) or greater. Examples of cohesive soils are: clay, silty clay, sandy clay, clay loam and, in some cases, silty clay loam and sandy clay loam. Cemented soils such as caliche and hardpan are also considered Type A. However, no soil is Type A if:

(i) The soil is fissured; or

(ii) The soil is subject to vibration from heavy traffic, pile driving, or similar effects; or

(iii) The soil has been previously disturbed; or

(iv) The soil is part of a sloped, layered system where the layers dip into the excavation on a slope of four horizontal to one vertical (4H:1V) or greater; or

(v) The material is subject to other factors that would require it to be classified as a less stable material.

Type B means:

(i) Cohesive soil with an unconfined compressive strength greater than 0.5 tsf (48 kPa) but less than 1.5 tsf (144 kPa); or

(ii) Granular cohesionless soils including: angular gravel (similar to crushed rock), silt, silt loam, sandy loam and, in some cases, silty clay loam and sandy clay loam.

(iii) Previously disturbed soils except those which would otherwise be classed as Type C soil.

(iv) Soil that meets the unconfined compressive strength or cementation requirements for Type A, but is fissured or subject to vibration; or

(v) Dry rock that is not stable; or

(vi) Material that is part of a sloped, layered system where the layers dip into the excavation on a slope less steep than four horizontal to one vertical (4H:1V), but only if the material would otherwise be classified as Type B.

Type C means:

(i) Cohesive soil with an unconfined compressive strength of 0.5 tsf (48 kPa) or less; or

(ii) Granular soils including gravel, sand, and loamy sand; or

(iii) Submerged soil or soil from which water is freely seeping; or

(iv) Submerged rock that is not stable, or

(v) Material in a sloped, layered system where the layers dip into the excavation or a slope of four horizontal to one vertical (4H:1V) or steeper.

Unconfined compressive strength means the load per unit area at which a soil will fail in compression. It can be determined by laboratory testing, or estimated in the field using a pocket penetrometer, by thumb penetration tests, and other methods.

Wet soil means soil that contains significantly more moisture than moist soil, but in such a range of values that cohesive material will slump or begin to flow when vibrated. Granular material that would exhibit cohesive properties when moist will lose those cohesive properties when wet.

(c) *Requirements*—(1) *Classification of soil and rock deposits.* Each soil and rock deposit shall be classified by a competent person as Stable Rock, Type A, Type B, or Type C in accordance with the definitions set forth in paragraph (b) of this appendix.

(2) *Basis of classification.* The classification of the deposits shall be made based on the results of at least one visual and at least one manual analysis. Such analyses shall be conducted by a competent person using tests described in paragraph (d) below, or in other recognized methods of soil classification and testing such as those adopted by the America Society for Testing Materials, or the U.S. Department of Agriculture textural classification system.

(3) *Visual and manual analyses.* The visual and manual analyses, such as those noted as being acceptable in paragraph (d) of this appendix, shall be designed and conducted to provide sufficient quantitative and qualitative information as may be necessary to identify properly the properties, factors, and conditions affecting the classification of the deposits.

(4) *Layered systems.* In a layered system, the system shall be classified in accordance with its weakest layer. However, each layer may be classified individually where a more stable layer lies under a less stable layer.

(5) *Reclassification.* If, after classifying a deposit, the properties, factors, or conditions affecting its classification change in any way, the changes shall be evaluated by a competent person. The deposit shall be reclassified as necessary to reflect the changed circumstances.

(d) *Acceptable visual and manual tests*—(1) *Visual tests.* Visual analysis is conducted to determine qualitative information regarding the excavation site in general, the soil adjacent to the excavation, the soil forming the sides of the open excavation, and the soil taken as samples from excavated material.

(i) Observe samples of soil that are excavated and soil in the sides of the excavation. Estimate the range of particle sizes and the relative amounts of the particle sizes. Soil that is primarily composed of fine-grained

material is cohesive material. Soil composed primarily of coarse-grained sand or gravel is granular material.

(ii) Observe soil as it is excavated. Soil that remains in clumps when excavated is cohesive. Soil that breaks up easily and does not stay in clumps is granular.

(iii) Observe the side of the opened excavation and the surface area adjacent to the excavation. Crack-like openings such as tension cracks could indicate fissured material. If chunks of soil spall off a vertical side, the soil could be fissured. Small spalls are evidence of moving ground and are indications of potentially hazardous situations.

(iv) Observe the area adjacent to the excavation and the excavation itself for evidence of existing utility and other underground structures, and to identify previously disturbed soil.

(v) Observe the opened side of the excavation to identify layered systems. Examine layered systems to identify if the layers slope toward the excavation. Estimate the degree of slope of the layers.

(vi) Observe the area adjacent to the excavation and the sides of the opened excavation for evidence of surface water, water seeping from the sides of the excavation, or the location of the level of the water table.

(vii) Observe the area adjacent to the excavation and the area within the excavation for sources of vibration that may affect the stability of the excavation face.

(2) *Manual tests.* Manual analysis of soil samples is conducted to determine quantitative as well as qualitative properties of soil and to provide more information in order to classify soil properly.

(i) *Plasticity.* Mold a moist or wet sample of soil into a ball and attempt to roll it into threads as thin as ⅛-inch in diameter. Cohesive material can be successfully rolled into threads without crumbling. For example, if at least a two inch (50 mm) length of ⅛-inch thread can be held on one end without tearing, the soil is cohesive.

(ii) *Dry strength.* If the soil is dry and crumbles on its own or with moderate pressure into individual grains or fine powder, it is granular (any combination of gravel, sand, or silt). If the soil is dry and falls into clumps which break up into smaller clumps, but the smaller clumps can only be broken up with difficulty, it may be clay in any combination with gravel, sand or silt. If the dry soil breaks into clumps which do not break up into small clumps and which can only be broken with difficulty, and there is no visual indication the soil is fissured, the soil may be considered unfissured.

(iii) *Thumb penetration.* The thumb penetration test can be used to estimate the unconfined compressive strength of cohesive soils. (This test is based on the thumb penetration test described in American Society for Testing and Materials (ASTM) Standard designation D2488—''Standard Recommended Practice for Description of Soils (Visual—Manual Procedure).'') Type A soils with an unconfined compressive strength of 1.5 tsf can be readily indented by the thumb; however, they can be penetrated by the thumb only with very great effort. Type C soils with an unconfined compressive strength of 0.5 tsf can be easily penetrated several inches by the thumb, and can be molded by light finger pressure. This test should be conducted on an undisturbed soil sample, such as a large clump of spoil, as soon as practicable after excavation to keep to a miminum the effects of exposure to drying influences. If the excavation is later exposed to wetting influences (rain, flooding), the classification of the soil must be changed accordingly.

(iv) *Other strength tests.* Estimates of unconfined compressive strength of soils can also be obtained by use of a pocket penetrometer or by using a hand-operated shearvane.

(v) *Drying test.* The basic purpose of the drying test is to differentiate between cohesive material with fissures, unfissured cohesive material, and granular material. The procedure for the drying test involves drying a sample of soil that is approximately one inch thick (2.54 cm) and six inches (15.24 cm) in diameter until it is thoroughly dry:

(A) If the sample develops cracks as it dries, significant fissures are indicated.

(B) Samples that dry without cracking are to be broken by hand. If considerable force is necessary to break a sample, the soil has significant cohesive material content. The soil can be classified as a unfissured cohesive material and the unconfined compressive strength should be determined.

(C) If a sample breaks easily by hand, it is either a fissured cohesive material or a granular material. To distinguish between the two, pulverize the dried clumps of the sample by hand or by stepping on them. If the clumps do not pulverize easily, the material is cohesive with fissures. If they pulverize easily into very small fragments, the material is granular.

APPENDIX B TO SUBPART P OF PART 1926—SLOPING AND BENCHING

(a) *Scope and application.* This appendix contains specifications for sloping and benching when used as methods of protecting employees working in excavations from cave-ins. The requirements of this appendix apply when the design of sloping and benching protective systems is to be performed in accordance with the requirements set forth in §1926.652(b)(2).

(b) *Definitions.*

Actual slope means the slope to which an excavation face is excavated.

Distress means that the soil is in a condition where a cave-in is imminent or is likely

to occur. Distress is evidenced by such phenomena as the development of fissures in the face of or adjacent to an open excavation; the subsidence of the edge of an excavation; the slumping of material from the face or the bulging or heaving of material from the bottom of an excavation; the spalling of material from the face of an excavation; and ravelling, i.e., small amounts of material such as pebbles or little clumps of material suddenly separating from the face of an excavation and trickling or rolling down into the excavation.

Maximum allowable slope means the steepest incline of an excavation face that is acceptable for the most favorable site conditions as protection against cave-ins, and is expressed as the ratio of horizontal distance to vertical rise (H:V).

Short term exposure means a period of time less than or equal to 24 hours that an excavation is open.

(c) *Requirements*—(1) *Soil classification.* Soil and rock deposits shall be classified in accordance with appendix A to subpart P of part 1926.

(2) *Maximum allowable slope.* The maximum allowable slope for a soil or rock deposit shall be determined from Table B–1 of this appendix.

(3) *Actual slope.* (i) The actual slope shall not be steeper than the maximum allowable slope.

(ii) The actual slope shall be less steep than the maximum allowable slope, when there are signs of distress. If that situation occurs, the slope shall be cut back to an actual slope which is at least ½ horizontal to one vertical (½H:1V) less steep than the maximum allowable slope.

(iii) When surcharge loads from stored material or equipment, operating equipment, or traffic are present, a competent person shall determine the degree to which the actual slope must be reduced below the maximum allowable slope, and shall assure that such reduction is achieved. Surcharge loads from adjacent structures shall be evaluated in accordance with §1926.651(i).

(4) *Configurations.* Configurations of sloping and benching systems shall be in accordance with Figure B–1.

TABLE B-1

MAXIMUM ALLOWABLE SLOPES

SOIL OR ROCK TYPE	MAXIMUM ALLOWABLE SLOPES (H:V)[1] FOR EXCAVATIONS LESS THAN 20 FEET DEEP [3]
STABLE ROCK TYPE A [2] TYPE B TYPE C	VERTICAL (90°) 3/4 : 1 (53°) 1:1 (45°) 1½: 1 (34°)

NOTES:

1. Numbers shown in parentheses next to maximum allowable slopes are angles expressed in degrees from the horizontal. Angles have been rounded off.
2. A short-term maximum allowable slope of 1/2H:1V (63°) is allowed in excavations in Type A soil that are 12 feet (3.67 m) or less in depth. Short-term maximum allowable slopes for excavations greater than 12 feet (3.67 m) in depth shall be 3/4H:1V (53°).
3. Sloping or benching for excavations greater than 20 feet deep shall be designed by a registered professional engineer.

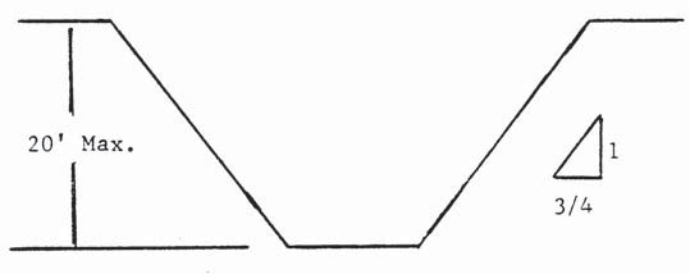
Figure B–1

Slope Configurations

(All slopes stated below are in the horizontal to vertical ratio)

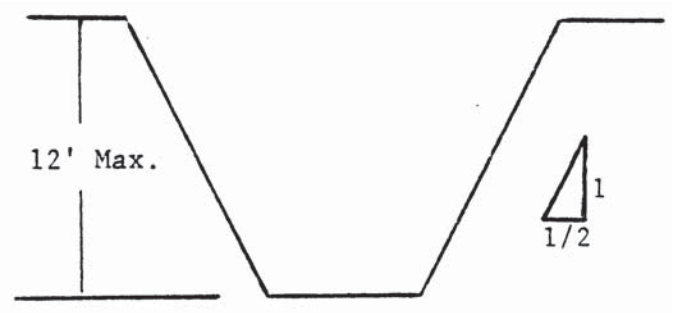
B–1.1 Excavations made in Type A soil.

1. All simple slope excavation 20 feet or less in depth shall have a maximum allowable slope of ¾:1.



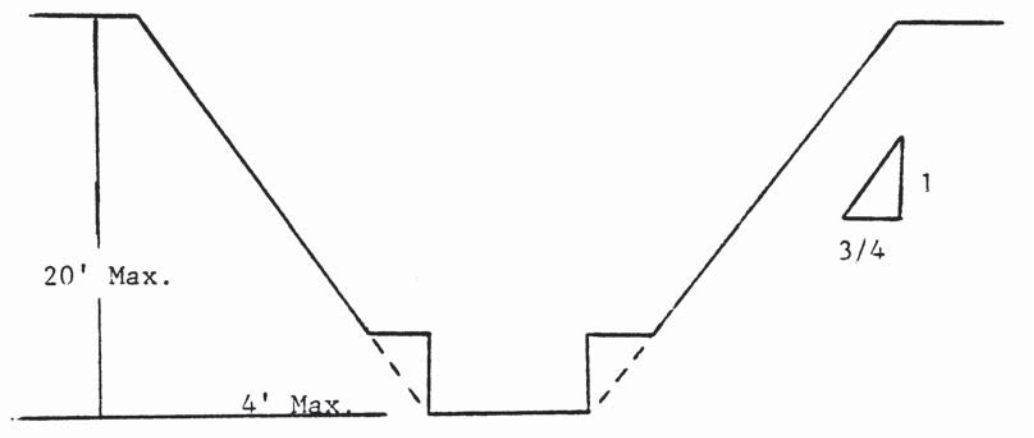
SIMPLE SLOPE—GENERAL

Exception: Simple slope excavations which are open 24 hours or less (short term) and which are 12 feet or less in depth shall have a maximum allowable slope of ½:1.

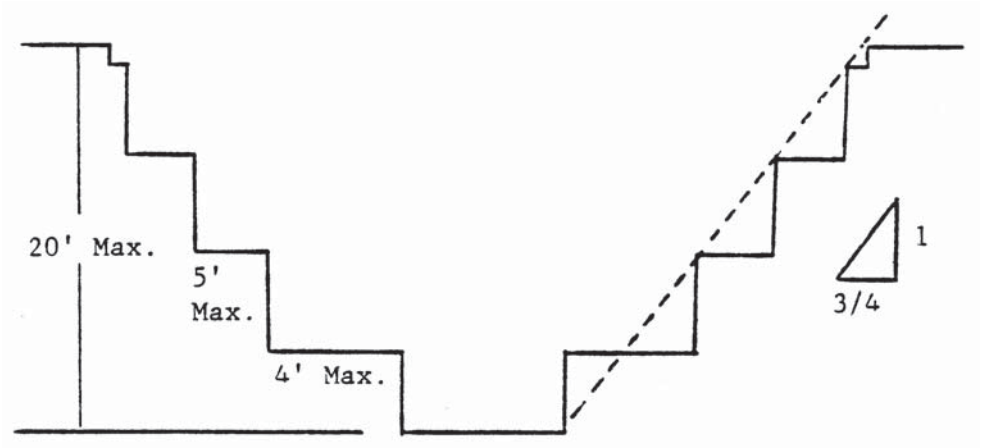


SIMPLE SLOPE—SHORT TERM

2. All benched excavations 20 feet or less in depth shall have a maximum allowable slope of ¾ to 1 and maximum bench dimensions as follows:

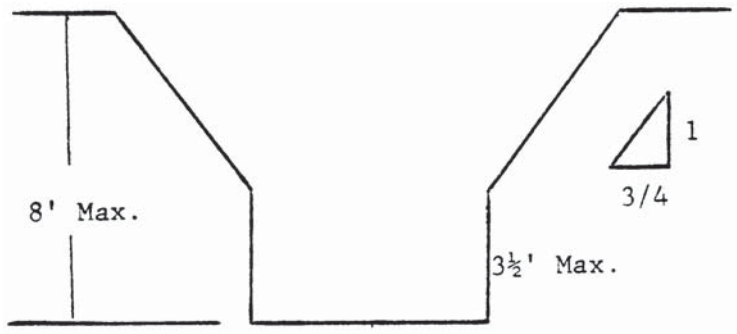


SIMPLE BENCH



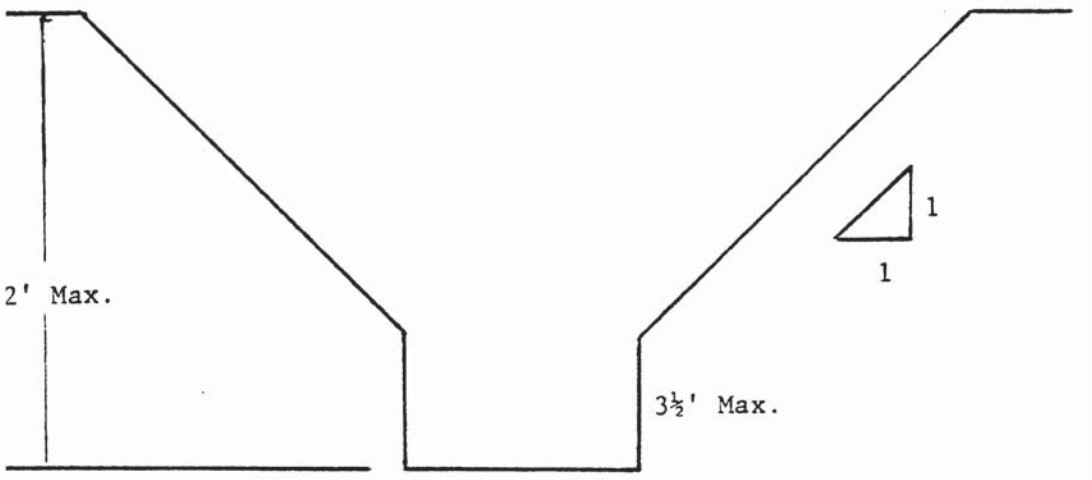
MULTIPLE BENCH

3. All excavations 8 feet or less in depth which have unsupported vertically sided lower portions shall have a maximum vertical side of 3½ feet.



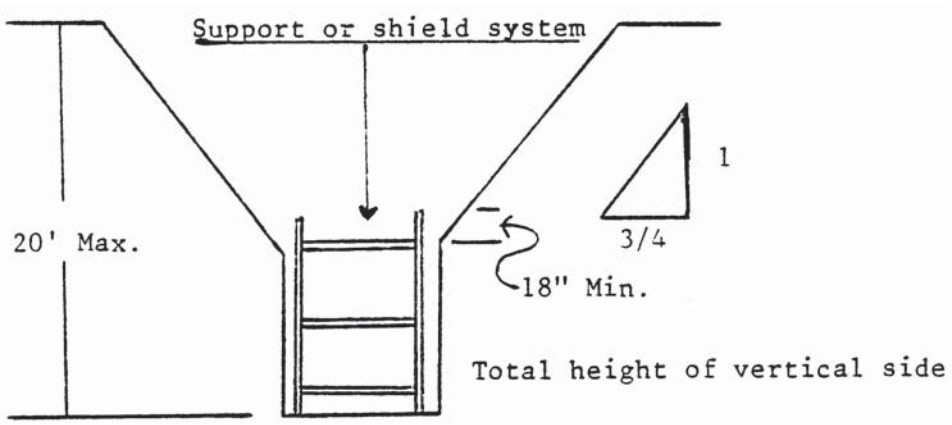
UNSUPPORTED VERTICALLY SIDED LOWER PORTION—MAXIMUM 8 FEET IN DEPTH

All excavations more than 8 feet but not more than 12 feet in depth which unsupported vertically sided lower portions shall have a maximum allowable slope of 1:1 and a maximum vertical side of 3½ feet.



UNSUPPORTED VERTICALLY SIDED LOWER PORTION—MAXIMUM 12 FEET IN DEPTH

All excavations 20 feet or less in depth which have vertically sided lower portions that are supported or shielded shall have a maximum allowable slope of ¾:1. The support or shield system must extend at least 18 inches above the top of the vertical side.

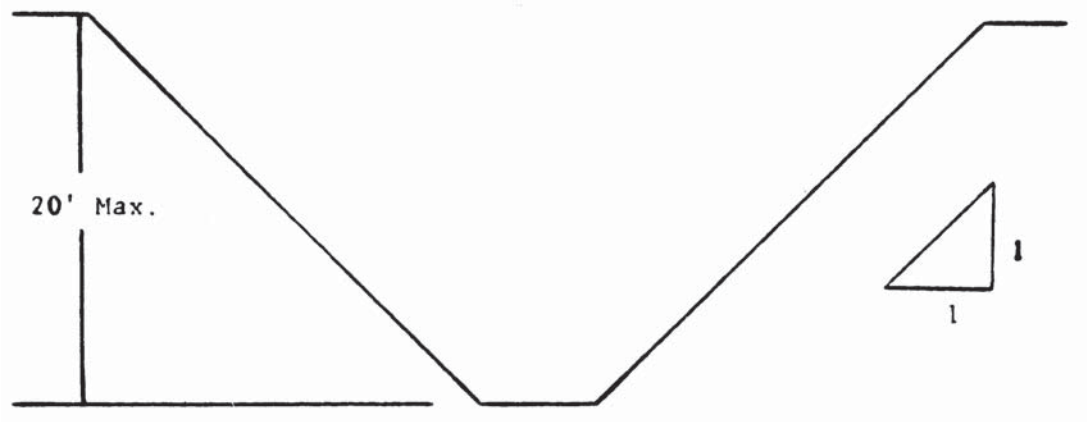


SUPPORTED OR SHIELDED VERTICALLY SIDED LOWER PORTION

4. All other simple slope, compound slope, and vertically sided lower portion excavations shall be in accordance with the other options permitted under §1926.652(b).

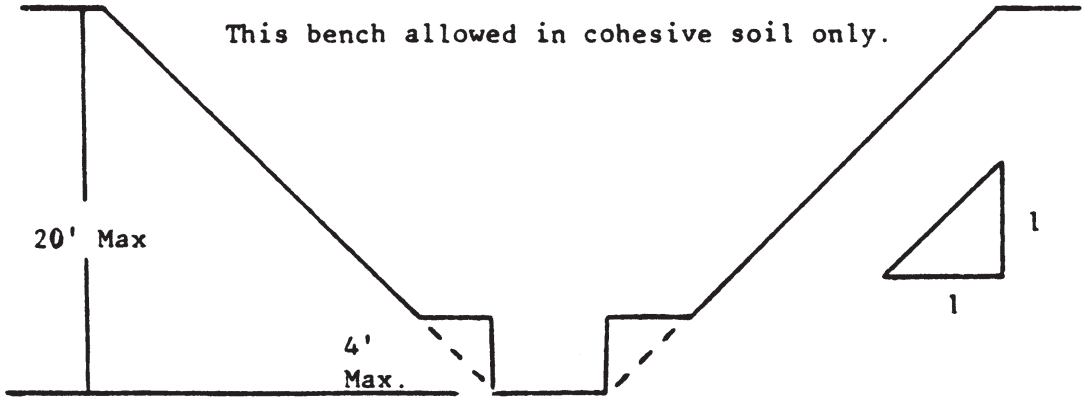
B–1.2 Excavations Made in Type B Soil

1. All simple slope excavations 20 feet or less in depth shall have a maximum allowable slope of 1:1.

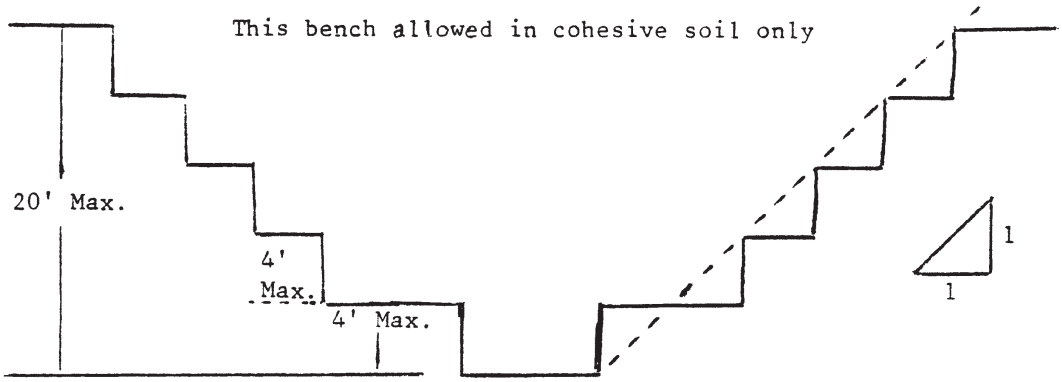


SIMPLE SLOPE

2. All benched excavations 20 feet or less in depth shall have a maximum allowable slope of 1:1 and maximum bench dimensions as follows:

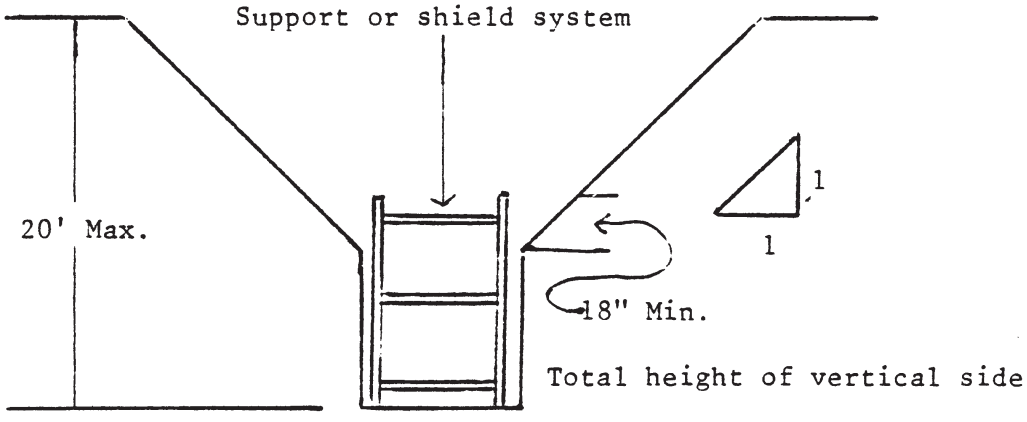


SINGLE BENCH



MULTIPLE BENCH

3. All excavations 20 feet or less in depth which have vertically sided lower portions shall be shielded or supported to a height at least 18 inches above the top of the vertical side. All such excavations shall have a maximum allowable slope of 1:1.

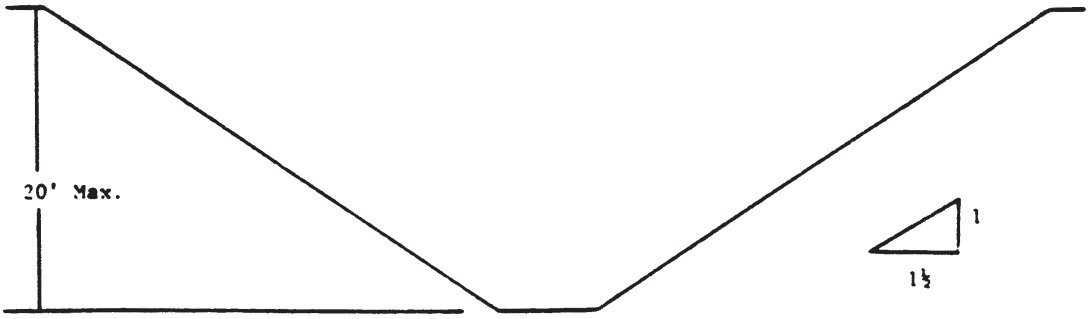


VERTICALLY SIDED LOWER PORTION

4. All other sloped excavations shall be in accordance with the other options permitted in §1926.652(b).

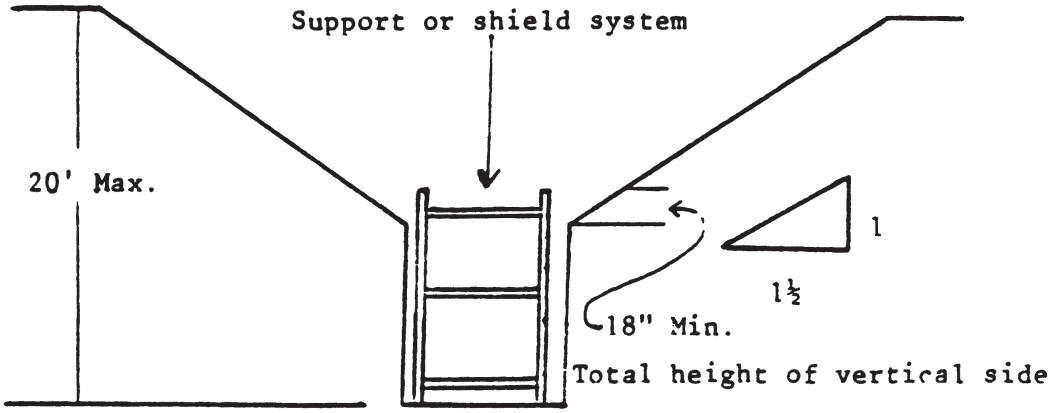
B–1.3 Excavations Made in Type C Soil

1. All simple slope excavations 20 feet or less in depth shall have a maximum allowable slope of 1½:1.



SIMPLE SLOPE

2. All excavations 20 feet or less in depth which have vertically sided lower portions shall be shielded or supported to a height at least 18 inches above the top of the vertical side. All such excavations shall have a maximum allowable slope of 1½:1.

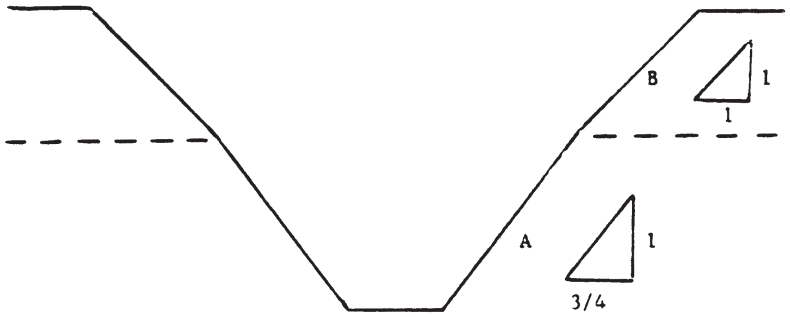


VERTICAL SIDED LOWER PORTION

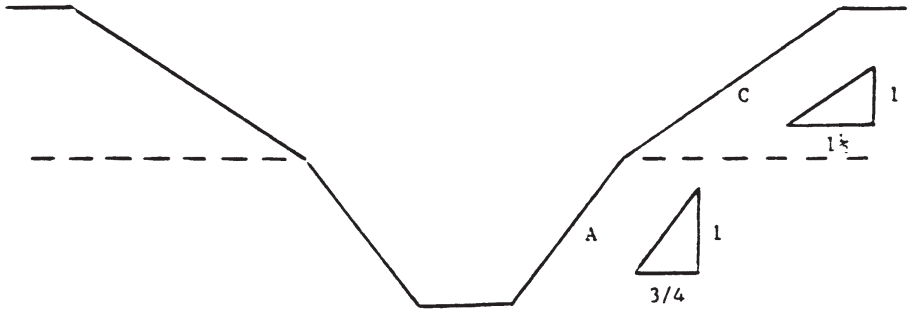
3. All other sloped excavations shall be in accordance with the other options permitted in §1926.652(b).

B–1.4 Excavations Made in Layered Soils

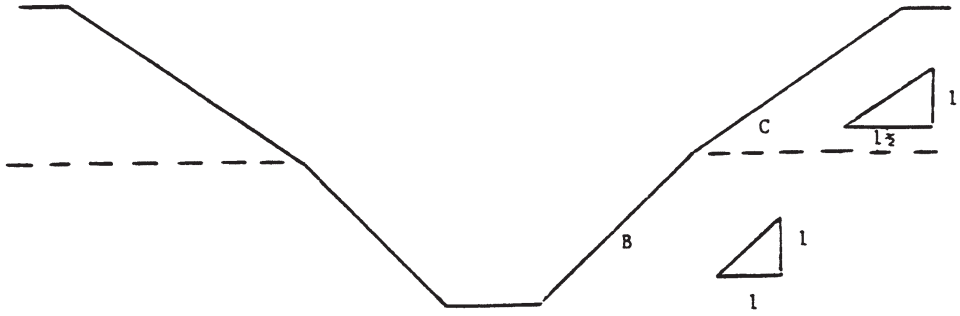
1. All excavations 20 feet or less in depth made in layered soils shall have a maximum allowable slope for each layer as set forth below.



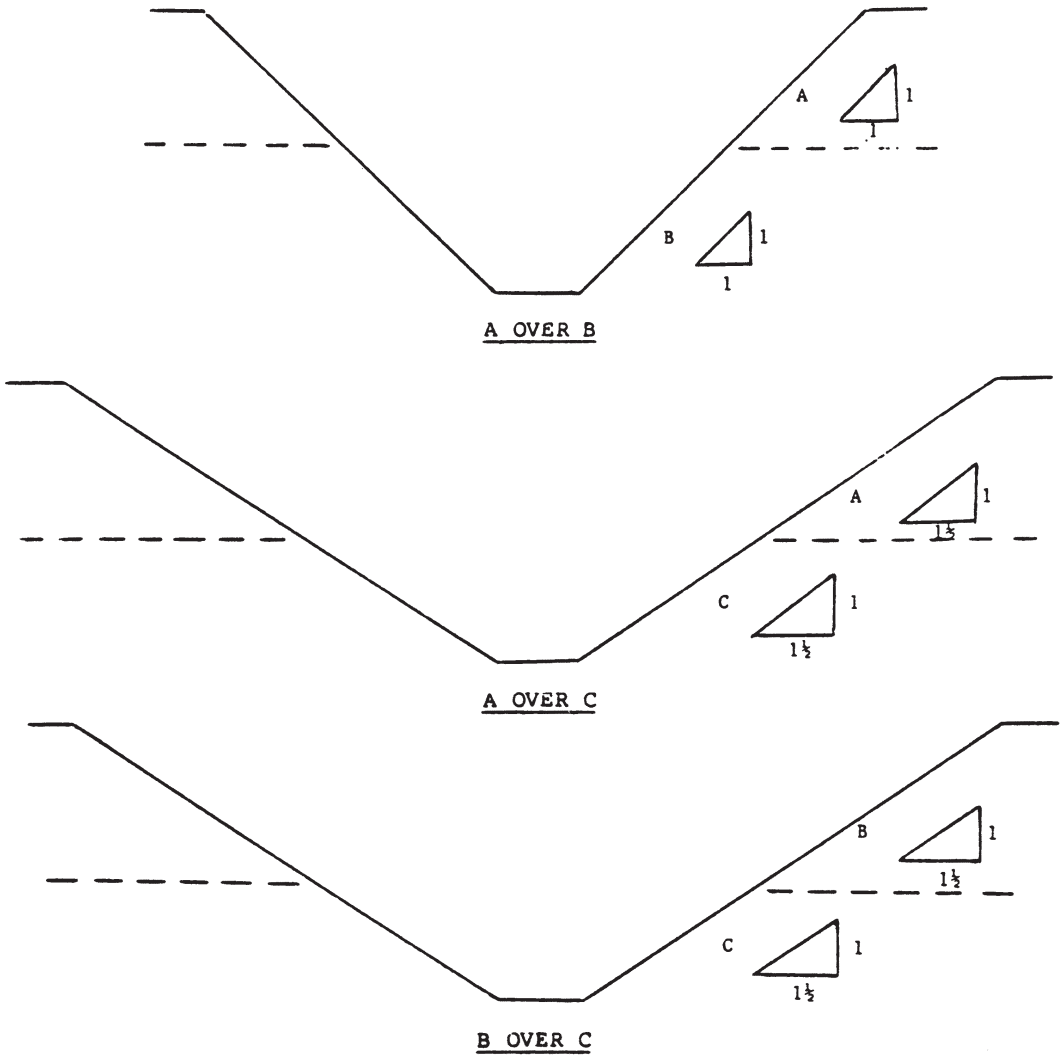
B OVER A



C OVER A



C OVER B



2. All other sloped excavations shall be in accordance with the other options permitted in §1926.652(b).

APPENDIX C TO SUBPART P OF PART 1926—TIMBER SHORING FOR TRENCHES

(a) *Scope.* This appendix contains information that can be used timber shoring is provided as a method of protection from caveins in trenches that do not exceed 20 feet (6.1 m) in depth. This appendix must be used when design of timber shoring protective systems is to be performed in accordance with §1926.652(c)(1). Other timber shoring configurations; other systems of support such as hydraulic and pneumatic systems; and other protective systems such as sloping, benching, shielding, and freezing systems must be designed in accordance with the requirements set forth in §1926.652(b) and §1926.652(c).

(b) *Soil Classification.* In order to use the data presented in this appendix, the soil type or types in which the excavation is made must first be determined using the soil classification method set forth in appendix A of subpart P of this part.

(c) *Presentation of Information.* Information is presented in several forms as follows:

(1) Information is presented in tabular form in Tables C–1.1, C–1.2, and C–1.3, and Tables C–2.1, C–2.2 and C–2.3 following paragraph (g) of the appendix. Each table presents the minimum sizes of timber members to use in a shoring system, and each table contains data only for the particular soil type in which the excavation or portion of

the excavation is made. The data are arranged to allow the user the flexibility to select from among several acceptable configurations of members based on varying the horizontal spacing of the crossbraces. Stable rock is exempt from shoring requirements and therefore, no data are presented for this condition.

(2) Information concerning the basis of the tabular data and the limitations of the data is presented in paragraph (d) of this appendix, and on the tables themselves.

(3) Information explaining the use of the tabular data is presented in paragraph (e) of this appendix.

(4) Information illustrating the use of the tabular data is presented in paragraph (f) of this appendix.

(5) Miscellaneous notations regarding Tables C–1.1 through C–1.3 and Tables C–2.1 through C–2.3 are presented in paragraph (g) of this Appendix.

(d) *Basis and limitations of the data*—(1) *Dimensions of timber members.* (i) The sizes of the timber members listed in Tables C–1.1 through C–1.3 are taken from the National Bureau of Standards (NBS) report, ''Recommended Technical Provisions for Construction Practice in Shoring and Sloping of Trenches and Excavations.'' In addition, where NBS did not recommend specific sizes of members, member sizes are based on an analysis of the sizes required for use by existing codes and on empirical practice.

(ii) The required dimensions of the members listed in Tables C–1.1 through C–1.3 refer to actual dimensions and not nominal dimensions of the timber. Employers wanting to use nominal size shoring are directed to Tables C–2.1 through C–2.3, or have this choice under §1926.652(c)(3), and are referred to The Corps of Engineers, The Bureau of Reclamation or data from other acceptable sources.

(2) *Limitation of application.* (i) It is not intended that the timber shoring specification apply to every situation that may be experienced in the field. These data were developed to apply to the situations that are most commonly experienced in current trenching practice. Shoring systems for use in situations that are not covered by the data in this appendix must be designed as specified in §1926.652(c).

(ii) When any of the following conditions are present, the members specified in the tables are not considered adequate. Either an alternate timber shoring system must be designed or another type of protective system designed in accordance with §1926.652.

(A) When loads imposed by structures or by stored material adjacent to the trench weigh in excess of the load imposed by a two-foot soil surcharge. The term ''adjacent'' as used here means the area within a horizontal distance from the edge of the trench equal to the depth of the trench.

(B) When vertical loads imposed on cross braces exceed a 240-pound gravity load distributed on a one-foot section of the center of the crossbrace.

(C) When surcharge loads are present from equipment weighing in excess of 20,000 pounds.

(D) When only the lower portion of a trench is shored and the remaining portion of the trench is sloped or benched unless: The sloped portion is sloped at an angle less steep than three horizontal to one vertical; or the members are selected from the tables for use at a depth which is determined from the top of the overall trench, and not from the toe of the sloped portion.

(e) *Use of Tables.* The members of the shoring system that are to be selected using this information are the cross braces, the uprights, and the wales, where wales are required. Minimum sizes of members are specified for use in different types of soil. There are six tables of information, two for each soil type. The soil type must first be determined in accordance with the soil classification system described in appendix A to subpart P of part 1926. Using the appropriate table, the selection of the size and spacing of the members is then made. The selection is based on the depth and width of the trench where the members are to be installed and, in most instances, the selection is also based on the horizontal spacing of the crossbraces. Instances where a choice of horizontal spacing of crossbracing is available, the horizontal spacing of the crossbraces must be chosen by the user before the size of any member can be determined. When the soil type, the width and depth of the trench, and the horizontal spacing of the crossbraces are known, the size and vertical spacing of the crossbraces, the size and vertical spacing of the wales, and the size and horizontal spacing of the uprights can be read from the appropriate table.

(f) *Examples to Illustrate the Use of Tables C–1.1 through C–1.3.*

(1) *Example 1.*

A trench dug in Type A soil is 13 feet deep and five feet wide.

From *Table C–1.1,* for acceptable arrangements of timber can be used.

Arrangement #B1

Space 4×4 crossbraces at six feet horizontally and four feet vertically.

Wales are not required.

Space 3×8 uprights at six feet horizontally. This arrangement is commonly called ''skip shoring.''

Arrangement #B2

Space 4×6 crossbraces at eight feet horizontally and four feet vertically.

Space 8×8 wales at four feet vertically.

Space 2×6 uprights at four feet horizontally.

Arrangement #B3

Space 6×6 crossbraces at 10 feet horizontally and four feet vertically.

Space 8×10 wales at four feet vertically.

Space 2×6 uprights at five feet horizontally.

Arrangement #B4

Space 6×6 crossbraces at 12 feet horizontally and four feet vertically.

Space 10×10 wales at four feet vertically.

Spaces 3×8 uprights at six feet horizontally.

(2) *Example 2.*

A trench dug in Type B soil in 13 feet deep and five feet wide. From Table C–1.2 three acceptable arrangements of members are listed.

Arrangement #B1

Space 6×6 crossbraces at six feet horizontally and five feet vertically.

Space 8×8 wales at five feet vertically.

Space 2×6 uprights at two feet horizontally.

Arrangement #B2

Space 6×8 crossbraces at eight feet horizontally and five feet vertically.

Space 10×10 wales at five feet vertically.

Space 2×6 uprights at two feet horizontally.

Arrangement #B3

Space 8×8 crossbraces at 10 feet horizontally and five feet vertically.

Space 10×12 wales at five feet vertically.

Space 2×6 uprights at two feet vertically.

(3) *Example 3.*

A trench dug in Type C soil is 13 feet deep and five feet wide.

From Table C–1.3 two acceptable arrangements of members can be used.

Arrangement #B1

Space 8×8 crossbraces at six feet horizontally and five feet vertically.

Space 10×12 wales at five feet vertically.

Position 2×6 uprights as closely together as possible.

If water must be retained use special tongue and groove uprights to form tight sheeting.

Arrangement #B2

Space 8×10 crossbraces at eight feet horizontally and five feet vertically.

Space 12×12 wales at five feet vertically.

Position 2×6 uprights in a close sheeting configuration unless water pressure must be resisted. Tight sheeting must be used where water must be retained.

(4) *Example 4.*

A trench dug in Type C soil is 20 feet deep and 11 feet wide. The size and spacing of members for the section of trench that is over 15 feet in depth is determined using Table C–1.3. Only one arrangement of members is provided.

Space 8×10 crossbraces at six feet horizontally and five feet vertically.

Space 12×12 wales at five feet vertically.

Use 3×6 tight sheeting.

Use of Tables C–2.1 through C–2.3 would follow the same procedures.

(g) *Notes for all Tables.*

1. Member sizes at spacings other than indicated are to be determined as specified in §1926.652(c), ''Design of Protective Systems.''

2. When conditions are saturated or submerged use Tight Sheeting. Tight Sheeting refers to the use of specially-edged timber planks (e.g., tongue and groove) at least three inches thick, steel sheet piling, or similar construction that when driven or placed in position provide a tight wall to resist the lateral pressure of water and to prevent the loss of backfill material. Close Sheeting refers to the placement of planks side-by-side allowing as little space as possible between them.

3. All spacing indicated is measured center to center.

4. Wales to be installed with greater dimension horizontal.

5. If the vertical distance from the center of the lowest crossbrace to the bottom of the trench exceeds two and one-half feet, uprights shall be firmly embedded or a mudsill shall be used. Where uprights are embedded, the vertical distance from the center of the lowest crossbrace to the bottom of the trench shall not exceed 36 inches. When mudsills are used, the vertical distance shall not exceed 42 inches. Mudsills are wales that are installed at the toe of the trench side.

6. Trench jacks may be used in lieu of or in combination with timber crossbraces.

7. Placement cf crossbraces. When the vertical spacing of crossbraces is four feet, place the top crossbrace no more than two feet below the top of the trench. When the vertical spacing of crossbraces is five feet, place the top crossbrace no more than 2.5 feet below the top of the trench.

TABLE C-1.1

TIMBER TRENCH SHORING -- MINIMUM TIMBER REQUIREMENTS *

SOIL TYPE A P_a = 25 X H + 72 psf (2 ft Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (ACTUAL) AND SPACING OF MEMBERS **													
	CROSS BRACES						WALES		UPRIGHTS					
	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET)					VERT. SPACING (FEET)	SIZE (IN)	VERT. SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET)				
		UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15				CLOSE	4	5	6	8
5 TO 10	UP TO 6	4X4	4X4	4X6	6X6	6X6	4	Not Req'd	---				2X6	
	UP TO 8	4X4	4X4	4X6	6X6	6X6	4	Not Req'd	---					2X8
	UP TO 10	4X6	4X6	4X6	6X6	6X6	4	8X8	4			2X6		
	UP TO 12	4X6	4X6	6X6	6X6	6X6	4	8X8	4				2X6	
10 TO 15	UP TO 6	4X4	4X4	4X6	6X6	6X6	4	Not Req'd	---				3X8	
	UP TO 8	4X6	4X6	6X6	6X6	6X6	4	8X8	4		2X6			
	UP TO 10	6X6	6X5	6X6	6X8	6X8	4	8X10	4			2X6		
	UP TO 12	6X6	6X6	6X6	6X8	6X8	4	10X10	4				3X8	
15 TO 20	UP TO 6	6X6	6X6	6X6	6X8	6X8	4	6X8	4	3X6				
	UP TO 8	6X6	6X6	6X6	6X8	6X8	4	8X8	4	3X6				
	UP TO 10	8X8	8X8	8X8	8X8	8X10	4	8X10	4	3X6				
	UP TO 12	8X8	8X8	8X8	8X8	8X10	4	10X10	4	3X6				
OVER 20	SEE NOTE 1													

* Mixed oak or equivalent with a bending strength not less than 850 psi.
** Manufactured members of equivalent strength may by substituted for wood.

TABLE C-1.2

TIMBER TRENCH SHORING -- MINIMUM TIMBER REQUIREMENTS *

SOIL TYPE B $P_a = 45 \times H + 72$ psf (2 ft. Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (ACTUAL) AND SPACING OF MEMBERS**													
	CROSS BRACES						WALES		UPRIGHTS					
	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET)					VERT. SPACING (FEET)	SIZE (IN)	VERT. SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET)				
		UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15				CLOSE	2	3		
5 TO 10	UP TO 6	4X6	4X6	6X6	6X6	6X6	5	6X8	5			2X6		
	UP TO 8	6X6	6X6	6X6	6X8	6X8	5	8X10	5			2X6		
	UP TO 10	6X6	6X6	6X6	6X8	6X8	5	10X10	5			2X6		
	See Note 1													
10 TO 15	UP TO 6	6X6	6X6	6X6	6X8	6X8	5	8X8	5		2X6			
	UP TO 8	6X8	6X8	6X8	8X8	8X8	5	10X10	5		2X6			
	UP TO 10	8X8	8X8	8X8	8X8	8X10	5	10X12	5		2X6			
	See Note 1													
15 TO 20	UP TO 6	6X8	6X8	6X8	8X8	8X8	5	8X10	5	3X6				
	UP TO 8	8X8	8X8	8X8	8X8	8X10	5	10X12	5	3X6				
	UP TO 10	8X10	8X10	8X10	8X10	10X10	5	12X12	5	3X6				
	See Note 1													
OVER 20	SEE NOTE 1													

* Mixed oak or equivalent with a bending strength not less than 850 psi.
** Manufactured members of equivalent strength may by substituted for wood.

TABLE C-1.3

TIMBER TRENCH SHORING -- MINIMUM TIMBER REQUIREMENTS *

SOIL TYPE C P_a = 80 X H + 72 psf (2 ft. Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (ACTUAL) AND SPACING OF MEMBERS**												
	CROSS BRACES								UPRIGHTS				
	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET)					VERT. SPACING (FEET)	SIZE (IN)	VERT. SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET) (See Note 2)			
		UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15				CLOSE			
5 TO 10	UP TO 6	6X8	6X8	6X8	8X8	8X8	5	8X10	5	2X6			
	UP TO 8	8X8	8X8	8X8	8X8	8X10	5	10X12	5	2X6			
	UP TO 10	8X10	8X10	8X10	8X10	10X10	5	12X12	5	2X6			
	See Note 1												
10 TO 15	UP TO 6	8X8	8X8	8X8	8X10	8X10	5	10X12	5	2X6			
	UP TO 8	8X10	8X10	8X10	8X10	10X10	5	12X12	5	2X6			
	See Note 1												
	See Note 1												
15 TO 20	UP TO 6	8X10	8X10	8X10	8X10	10X10	5	12X12	5	3X6			
	See Note 1												
	See Note 1												
	See Note 1												
OVER 20	SEE NOTE 1												

* Mixed Oak or equivalent with a bending strength not less than 850 psi.
** Manufactured members of equivalent strength may be substituted for wood.

TABLE C-2.1

TIMBER TRENCH SHORING -- MINIMUM TIMBER REQUIREMENTS *

SOIL TYPE A P_a = 25 X H ± 72 psf (2 ft. Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (S4S) AND SPACING OF MEMBERS **												
	CROSS BRACES							WALES		UPRIGHTS			
	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET)					VERT. SPACING (FEET)	SIZE (IN)	VERT. SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET)			
		UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15				CLOSE	4	5	6	8
5 TO 10	UP TO 6	4X4	4X4	4X4	4X4	4X6	4	Not Req'd	Not Req'd				4X6	
	UP TO 8	4X4	4X4	4X4	4X6	4X6	4	Not Req'd	Not Req'd					4X8
	UP TO 10	4X6	4X6	4X6	6X6	6X6	4	8X8	4			4X6		
	UP TO 12	4X6	4X6	4X6	6X6	6X6	4	8X8	4				4X6	
10 TO 15	UP TO 6	4X4	4X4	4X4	6X6	6X6	4	Not Req'd	Not Req'd				4X10	
	UP TO 8	4X6	4X6	4X6	6X6	6X6	4	6X8	4		4X6			
	UP TO 10	6X6	6X6	6X6	6X6	6X6	4	8X8	4			4X8		
	UP TO 12	6X6	6X6	6X6	6X6	6X6	4	8X10	4		4X6		4X10	
15 TO 20	UP TO 6	6X6	6X6	6X6	6X6	6X6	4	6X8	4	3X6				
	UP TO 8	6X6	6X6	6X6	6X6	6X6	4	8X8	4	3X6	4X12			
	UP TO 10	6X6	6X6	6X6	6X6	6X8	4	8X10	4	3X6				
	UP TO 12	6X6	6X6	6X6	6X8	6X8	4	8X12	4	3X6	4X12			
OVER 20	SEE NOTE 1													

* Douglas fir or equivalent with a bending strength not less than 1500 psi.

** Manufactured members of equivalent strength may be substituted for wood.

TABLE C-2.2

TIMBER TRENCH SHORING -- MINIMUM TIMBER REQUIREMENTS *

SOIL TYPE B P_a = 45 X H + 72 psf (2 ft. Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (S4S) AND SPACING OF MEMBERS **												
	CROSS BRACES						WALES		UPRIGHTS				
	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET)				VERT. SPACING (FEET)	SIZE (IN)	VERT. SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET)				
		UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15			CLOSE	2	3	4	6
5 TO 10	UP TO 6	4X6	4X6	4X6	6X6	6X6	5	6X8	5			3X12 4X8		4X12
	UP TO 8	4X6	4X6	6X6	6X6	6X6	5	8X8	5		3X8		4X8	
	UP TO 10	4X6	4X6	6X6	6X6	6X8	5	8X10	5			4X8		
	See Note 1													
10 TO 15	UP TO 6	6X6	6X6	6X6	6X8	6X8	5	8X8	5	3X6	4X10			
	UP TO 8	6X8	6X8	6X8	8X8	8X8	5	10X10	5	3X6	4X10			
	UP TO 10	6X8	6X8	8X8	8X8	8X8	5	10X12	5	3X6	4X10			
	See Note 1													
15 TO 20	UP TO 6	6X8	6X8	6X8	6X8	8X8	5	8X10	5	4X6				
	UP TO 8	6X8	6X8	6X8	8X8	8X8	5	10X12	5	4X6				
	UP TO 10	8X8	8X8	8X8	8X8	8X8	5	12X12	5	4X6				
	See Note 1													
OVER 20	SEE NOTE 1													

* Douglas fir or equivalent with a bending strength not less than 1500 psi.

** Manufactured members of equivalent strength may be substituted for wood.

TABLE C-2.3

TIMBER TRENCH SHORING -- MINIMUM TIMBER REQUIREMENTS *

SOIL TYPE C P_a = 80 X H + 72 psf (2 ft. Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (S4S) AND SPACING OF MEMBERS **											
	CROSS BRACES						WALES		UPRIGHTS			
	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET)				VERT. SPACING (FEET)	SIZE (IN)	VERT. SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET)			
		UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15			CLOSE			
5 TO 10	UP TO 6	6X6	6X6	6X6	6X6	8X8	5	8X8	5	3X6		
	UP TO 8	6X6	6X6	6X6	8X8	8X8	5	10X10	5	3X6		
	UP TO 10	6X6	6X6	8X8	8X8	8X8	5	10X12	5	3X6		
	See Note 1											
10 TO 15	UP TO 6	6X8	6X8	6X8	8X8	8X8	5	10X10	5	4X6		
	UP TO 8	8X8	8X8	8X8	8X8	8X8	5	12X12	5	4X6		
	See Note 1											
	See Note 1											
15 TO 20	UP TO 6	8X8	8X8	8X8	8X10	8X10	5	10X12	5	4X6		
	See Note 1											
	See Note 1											
	See Note 1											
OVER 20	SEE NOTE 1											

* Douglas fir or equivalent with a bending strength not less than 1500 psi.

** Manufactured members of equivalent strength may be substituted for wood.

APPENDIX D TO SUBPART P OF PART 1926—ALUMINUM HYDRAULIC SHORING FOR TRENCHES

(a) *Scope.* This appendix contains information that can be used when aluminum hydraulic shoring is provided as a method of protection against cave-ins in trenches that do not exceed 20 feet (6.1m) in depth. This appendix must be used when design of the aluminum hydraulic protective system cannot be performed in accordance with §1926.652(c)(2).

(b) *Soil Classification.* In order to use data presented in this appendix, the soil type or types in which the excavation is made must

first be determined using the soil classification method set forth in appendix A of subpart P of part 1926.

(c) *Presentation of Information*. Information is presented in several forms as follows:

(1) Information is presented in tabular form in Tables D–1.1, D–1.2, D–1.3 and E–1.4. Each table presents the maximum vertical and horizontal spacings that may be used with various aluminum member sizes and various hydraulic cylinder sizes. Each table contains data only for the particular soil type in which the excavation or portion of the excavation is made. Tables D–1.1 and D–1.2 are for vertical shores in Types A and B soil. Tables D–1.3 and D1.4 are for horizontal waler systems in Types B and C soil.

(2) Information concerning the basis of the tabular data and the limitations of the data is presented in paragraph (d) of this appendix.

(3) Information explaining the use of the tabular data is presented in paragraph (e) of this appendix.

(4) Information illustrating the use of the tabular data is presented in paragraph (f) of this appendix.

(5) Miscellaneous notations (footnotes) regarding Table D–1.1 through D–1.4 are presented in paragraph (g) of this appendix.

(6) Figures, illustrating typical installations of hydraulic shoring, are included just prior to the Tables. The illustrations page is entitled ''Aluminum Hydraulic Shoring; Typical Installations.''

(d) *Basis and limitations of the data*. (1) Vertical shore rails and horizontal wales are those that meet the Section Modulus requirements in the D–1 Tables. Aluminum material is 6061–T6 or material of equivalent strength and properties.

(2) Hydraulic cylinders specifications. (i) 2-inch cylinders shall be a minimum 2-inch inside diameter with a minimum safe working capacity of no less than 18,000 pounds axial compressive load at maximum extension. Maximum extension is to include full range of cylinder extensions as recommended by product manufaturer.

(ii) 3-inch cylinders shall be a minimum 3-inch inside diameter with a safe working capacity of not less than 30,000 pounds axial compressive load at extensions as recommended by product manufacturer.

(3) Limitation of application.

(i) It is not intended that the aluminum hydraulic specification apply to every situation that may be experienced in the field. These data were developed to apply to the situations that are most commonly experienced in current trenching practice. Shoring systems for use in situations that are not covered by the data in this appendix must be otherwise designed as specified in §1926.652(c).

(ii) When any of the following conditions are present, the members specified in the Tables are not considered adequate. In this case, an alternative aluminum hydraulic shoring system or other type of protective system must be designed in accordance with §1926.652.

(A) When vertical loads imposed on cross braces exceed a 100 Pound gravity load distributed on a one foot section of the center of the hydraulic cylinder.

(B) When surcharge loads are present from equipment weighing in excess of 20,000 pounds.

(C) When only the lower portion or a trench is shored and the remaining portion of the trench is sloped or benched unless: The sloped portion is sloped at an angle less steep than three horizontal to one vertical; or the members are selected from the tables for use at a depth which is determined from the top of the overall trench, and not from the toe of the sloped portion.

(e) *Use of Tables D–1.1, D–1.2, D–1.3 and D–1.4*. The members of the shoring system that are to be selected using this information are the hydraulic cylinders, and either the vertical shores or the horizontal wales. When a waler system is used the vertical timber sheeting to be used is also selected from these tables. The Tables D–1.1 and D–1.2 for vertical shores are used in Type A and B soils that do not require sheeting. Type B soils that may require sheeting, and Type C soils that always require sheeting are found in the horizontal wale Tables D–1.3 and D–1.4. The soil type must first be determined in accordance with the soil classification system described in appendix A to subpart P of part 1926. Using the appropriate table, the selection of the size and spacing of the members is made. The selection is based on the depth and width of the trench where the members are to be installed. In these tables the vertical spacing is held constant at four feet on center. The tables show the maximum horizontal spacing of cylinders allowed for each size of wale in the waler system tables, and in the vertical shore tables, the hydraulic cylinder horizontal spacing is the same as the vertical shore spacing.

(f) *Example to Illustrate the Use of the Tables:*

(1) Example 1:

A trench dug in Type A soil is 6 feet deep and 3 feet wide. From Table D–1.1: Find vertical shores and 2 inch diameter cylinders spaced 8 feet on center (o.c.) horizontally and 4 feet on center (o.c.) vertically. (See Figures 1 & 3 for typical installations.)

(2) Example 2:

A trench is dug in Type B soil that does not require sheeting, 13 feet deep and 5 feet wide. From Table D–1.2: Find vertical shores and 2 inch diameter cylinders spaced 6.5 feet o.c. horizontally and 4 feet o.c. vertically. (See Figures 1 & 3 for typical installations.)

(3) A trench is dug in Type B soil that does not require sheeting, but does experience some minor raveling of the trench face. The

trench is 16 feet deep and 9 feet wide. From Table D–1.2: Find vertical shores and 2 inch diameter cylinder (with special oversleeves as designated by footnote #B2) spaced 5.5 feet o.c. horizontally and 4 feet o.c. vertically, plywood (per footnote (g)(7) to the D–1 Table) should be used behind the shores. (See Figures 2 & 3 for typical installations.)

(4) Example 4: A trench is dug in previously disturbed Type B soil, with characteristics of a Type C soil, and will require sheeting. The trench is 18 feet deep and 12 feet wide. 8 foot horizontal spacing between cylinders is desired for working space. From Table D–1.3: Find horizontal wale with a section modulus of 14.0 spaced at 4 feet o.c. vertically and 3 inch diameter cylinder spaced at 9 feet maximum o.c. horizontally. 3×12 timber sheeting is required at close spacing vertically. (See Figure 4 for typical installation.)

(5) Example 5: A trench is dug in Type C soil, 9 feet deep and 4 feet wide. Horizontal cylinder spacing in excess of 6 feet is desired for working space. From Table D–1.4: Find horizontal wale with a section modulus of 7.0 and 2 inch diameter cylinders spaced at 6.5 feet o.c. horizontally. Or, find horizontal wale with a 14.0 section modulus and 3 inch diameter cylinder spaced at 10 feet o.c. horizontally. Both wales are spaced 4 feet o.c. vertically. 3×12 timber sheeting is required at close spacing vertically. (See Figure 4 for typical installation.)

(g) *Footnotes, and general notes, for Tables D–1.1, D–1.2, D–1.3, and D–1.4.*

(1) For applications other than those listed in the tables, refer to §1926.652(c)(2) for use of manufacturer's tabulated data. For trench depths in excess of 20 feet, refer to §1926.652(c)(2) and §1926.652(c)(3).

(2) 2 inch diameter cylinders, at this width, shall have structural steel tube (3.5×3.5×0.1875) oversleeves, or structural oversleeves of manufacturer's specification, extending the full, collapsed length.

(3) Hydraulic cylinders capacities. (i) 2 inch cylinders shall be a minimum 2-inch inside diameter with a safe working capacity of not less than 18,000 pounds axial compressive load at maximum extension. Maximum extension is to include full range of cylinder extensions as recommended by product manufacturer.

(ii) 3-inch cylinders shall be a minimum 3-inch inside diameter with a safe work capacity of not less than 30,000 pounds axial compressive load at maximum extension. Maximum extension is to include full range of cylinder extensions as recommended by product manufacturer.

(4) All spacing indicated is measured center to center.

(5) Vertical shoring rails shall have a minimum section modulus of 0.40 inch.

(6) When vertical shores are used, there must be a minimum of three shores spaced equally, horizontally, in a group.

(7) Plywood shall be 1.125 in. thick softwood or 0.75 inch. thick, 14 ply, arctic white birch (Finland form). Please note that plywood is not intended as a structural member, but only for prevention of local raveling (sloughing of the trench face) between shores.

(8) See appendix C for timber specifications.

(9) Wales are calculated for simple span conditions.

(10) See appendix D, item (d), for basis and limitations of the data.

ALUMINUM HYDRAULIC SHORING
TYPICAL INSTALLATIONS

FIGURE NO. 1
VERTICAL ALUMINUM HYDRAULIC SHORING (SPOT BRACING)

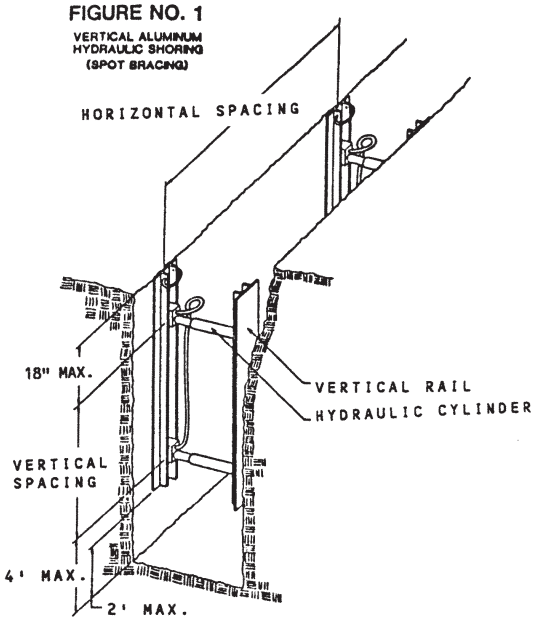


FIGURE NO. 2
VERTICAL ALUMINUM HYDRAULIC SHORING (WITH PLYWOOD)

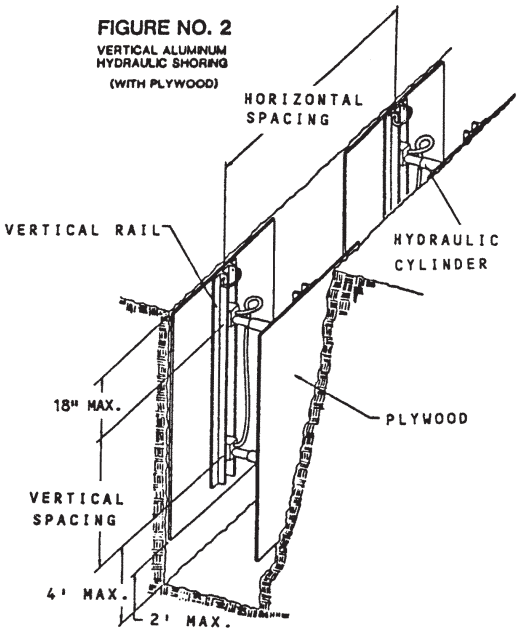


FIGURE NO. 3
VERTICAL ALUMINUM HYDRAULIC SHORING (STACKED)

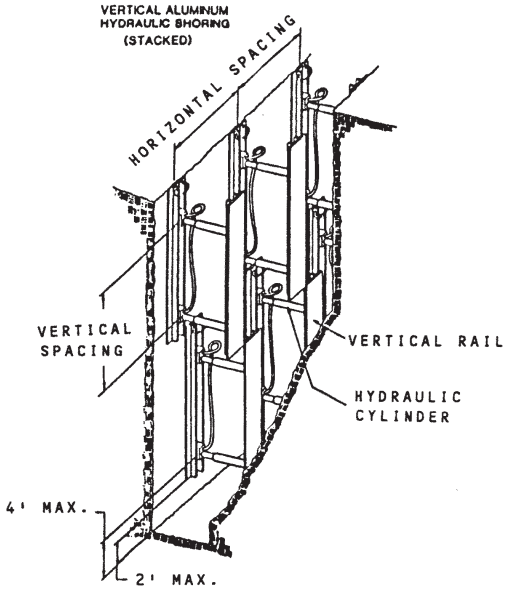


FIGURE NO. 4
ALUMINUM HYDRAULIC SHORING WALER SYSTEM (TYPICAL)

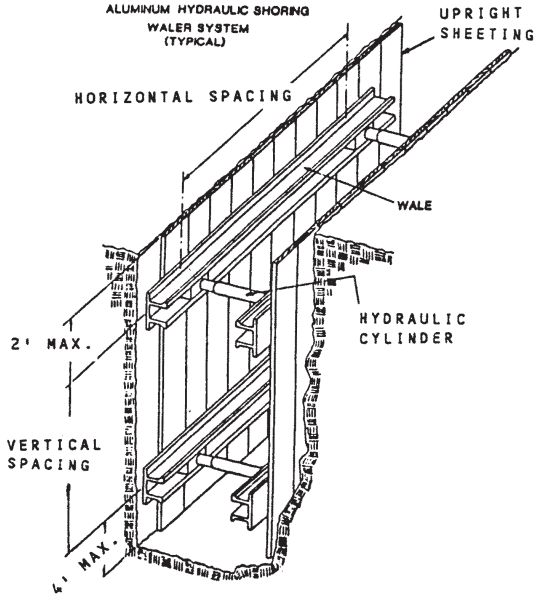


TABLE D - 1.1
ALUMINUM HYDRAULIC SHORING
VERTICAL SHORES
FOR SOIL TYPE A

DEPTH OF TRENCH (FEET)	HYDRAULIC CYLINDERS				
	MAXIMUM HORIZONTAL SPACING (FEET)	MAXIMUM VERTICAL SPACING (FEET)	WIDTH OF TRENCH (FEET)		
			UP TO 8	OVER 8 UP TO 12	OVER 12 UP TO 15
OVER 5 UP TO 10	8	4	2 INCH DIAMETER	2 INCH DIAMETER NOTE (2)	3 INCH DIAMETER
OVER 10 UP TO 15	8				
OVER 15 UP TO 20	7				
OVER 20	NOTE (1)				

Footnotes to tables, and general notes on hydraulic shoring, are found in Appendix D, Item (g)
Note (**1**): See Appendix D, Item (g) (1)
Note (**2**): See Appendix D, Item (g) (2)

TABLE D - 1.2
ALUMINUM HYDRAULIC SHORING
VERTICAL SHORES
FOR SOIL TYPE B

DEPTH OF TRENCH (FEET)	HYDRAULIC CYLINDERS				
	MAXIMUM HORIZONTAL SPACING (FEET)	MAXIMUM VERTICAL SPACING (FEET)	WIDTH OF TRENCH (FEET)		
			UP TO 8	OVER 8 UP TO 12	OVER 12 UP TO 15
OVER 5 UP TO 10	8	4	2 INCH DIAMETER	2 INCH DIAMETER NOTE (2)	3 INCH DIAMETER
OVER 10 UP TO 15	6.5				
OVER 15 UP TO 20	5.5				
OVER 20	NOTE (1)				

Footnotes to tables, and general notes on hydraulic shoring, are found in Appendix D, Item (g)
Note (1): See Appendix D, Item (g) (1)
Note (2): See Appendix D, Item (g) (2)

TABLE D - 1.3
ALUMINUM HYDRAULIC SHORING
WALER SYSTEMS
FOR SOIL TYPE B

DEPTH OF TRENCH (FEET)	WALES		HYDRAULIC CYLINDERS						TIMBER UPRIGHTS		
			WIDTH OF TRENCH (FEET)						MAX.HORIZ.SPACING (ON CENTER)		
	VERTICAL SPACING (FEET)	* SECTION MODULUS (IN^3)	UP TO 8		OVER 8 UP TO 12		OVER 12 UP TO15		SOLID SHEET	2 FT.	3 FT.
			HORIZ. SPACING	CYLINDER DIAMETER	HORIZ. SPACING	CYLINDER DIAMETER	HORIZ. SPACING	CYLINDER DIAMETER			
OVER 5 UP TO 10	4	3.5	8.0	2 IN	8.0	2 IN NOTE(2)	8.0	3 IN	—	—	3x12
		7.0	9.0	2 IN	9.0	2 IN NOTE(2)	9.0	3 IN			
		14.0	12.0	3 IN	12.0	3 IN	12.0	3 IN			
OVER 10 UP TO 15	4	3.5	6.0	2 IN	6.0	2 IN NOTE(2)	6.0	3 IN	—	3x12	—
		7.0	8.0	3 IN	8.0	3 IN	8.0	3 IN			
		14.0	10.0	3 IN	10.0	3 IN	10.0	3 IN			
OVER 15 UP TO 20	4	3.5	5.5	2 IN	5.5	2 IN NOTE(2)	5.5	3 IN	3x12	—	—
		7.0	6.0	3 IN	6.0	3 IN	6.0	3 IN			
		14.0	9.0	3 IN	9.0	3 IN	9.0	3 IN			
OVER 20	NOTE (1)										

Footnotes to tables, and general notes on hydraulic shoring, are found in Appendix D, Item (g)
Notes (1): See Appendix D, item (g) (1)
Notes (2): See Appendix D, Item (g) (2)
* Consult product manufacturer and/or qualified engineer for Section Modulus of available wales.

TABLE D - 1.4
ALUMINUM HYDRAULIC SHORING
WALER SYSTEMS
FOR SOIL TYPE C

DEPTH OF TRENCH (FEET)	WALES		HYDRAULIC CYLINDERS						TIMBER UPRIGHTS		
			WIDTH OF TRENCH (FEET)						MAX.HORIZ SPACING (ON CENTER)		
	VERTICAL SPACING (FEET)	* SECTION MODULUS (IN^3)	UP TO 8		OVER 8 UP TO 12		OVER 12 UP TO 15		SOLID SHEET	2 FT.	3 FT.
			HORIZ. SPACING	CYLINDER DIAMETER	HORIZ. SPACING	CYLINDER DIAMETER	HORIZ. SPACING	CYLINDER DIAMETER			
OVER 5 UP TO 10	4	3.5	6.0	2 IN	6.0	2 IN NOTE(2)	6.0	3 IN	3x12	——	——
		7.0	6.5	2 IN	6.5	2 IN NOTE(2)	6.5	3 IN			
		14.0	10.0	3 IN	10.0	3 IN	10.0	3 IN			
OVER 10 UP TO 15	4	3.5	4.0	2 IN	4.0	2 IN NOTE(2)	4.0	3 IN	3x12	——	——
		7.0	5.5	3 IN	5.5	3 IN	5.5	3 IN			
		14.0	8.0	3 IN	8.0	3 IN	8.0	3 IN			
OVER 15 UP TO 20	4	3.5	3.5	2 IN	3.5	2 IN NOTE(2)	3.5	3 IN	3x12	——	——
		7.0	5.0	3 IN	5.0	3 IN	5.0	3 IN			
		14.0	6.0	3 IN	6.0	3 IN	6.0	3 IN			
OVER 20	NOTE (1)										

Footnotes to tables, and general notes on hydraulic shoring, are found in Appendix D, Item (g)
Notes (**1**): See Appendix D, item (g) (1)
Notes (**2**): See Appendix D, Item (g) (2)
* Consult product manufacturer and/or qualified engineer for Section Modulus of available wales.

APPENDIX E TO SUBPART P OF PART 1926—ALTERNATIVES TO TIMBER SHORING

Figure 1. Aluminum Hydraulic Shoring

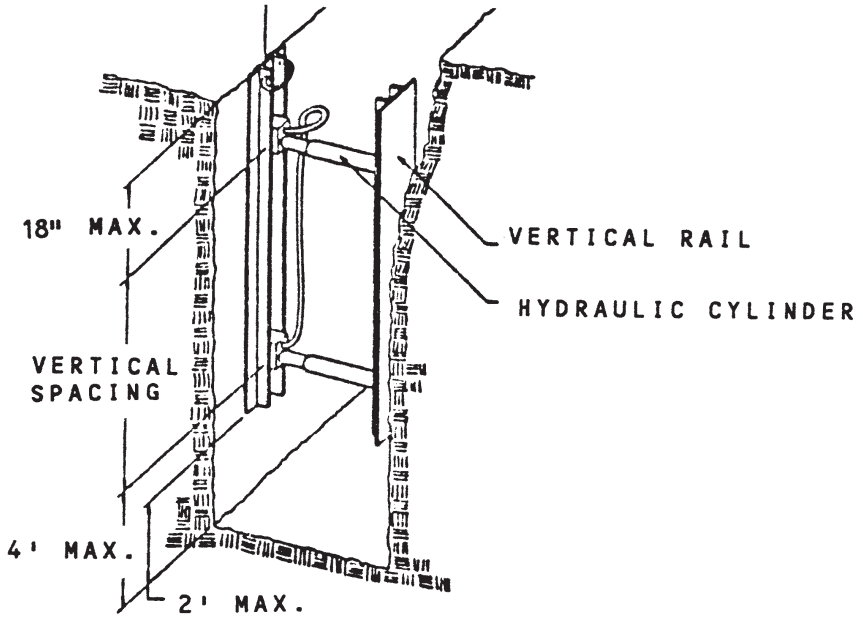


Figure 2. Pneumatic/hydraulic Shoring

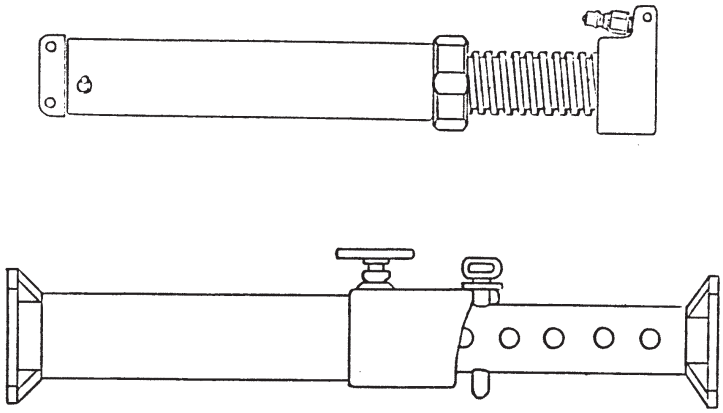


Figure 3. Trench Jacks (Screw Jacks)

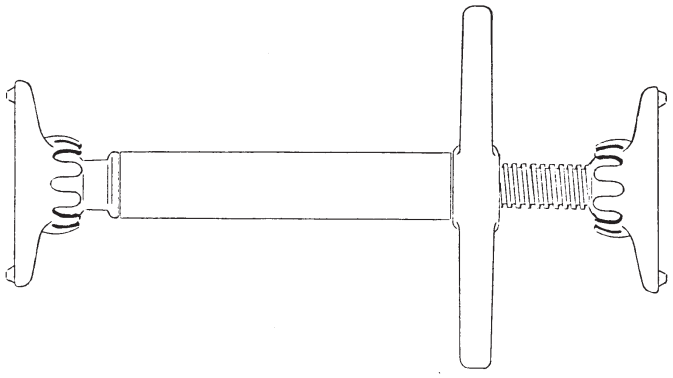
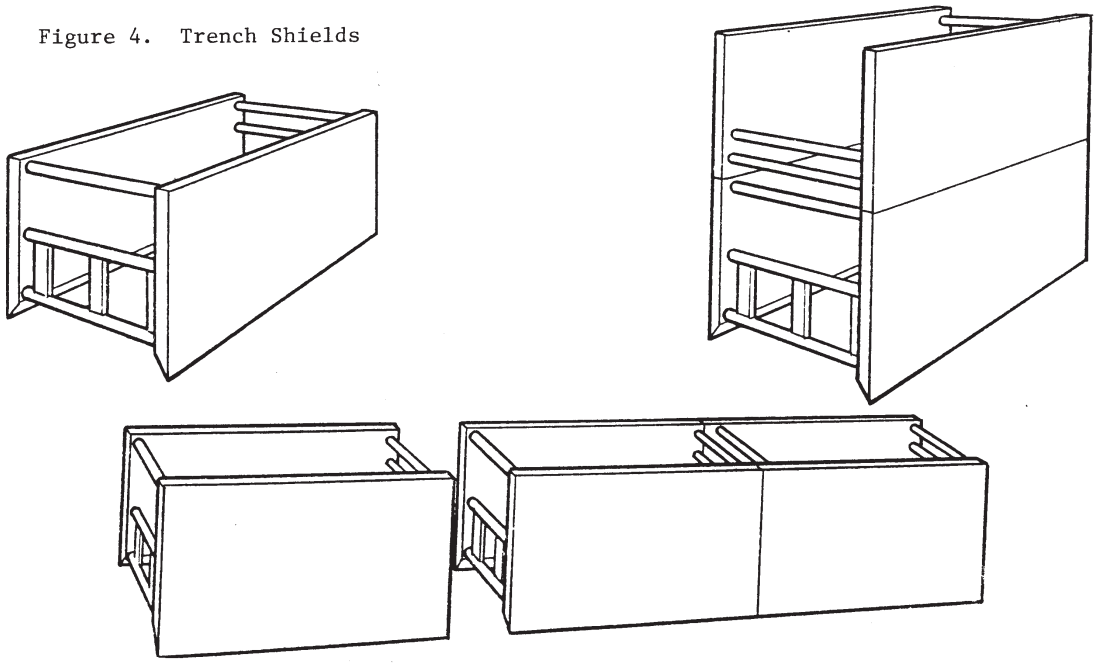


Figure 4. Trench Shields



APPENDIX F TO SUBPART P OF PART 1926—SELECTION OF PROTECTIVE SYSTEMS

The following figures are a graphic summary of the requirements contained in subpart P for excavations 20 feet or less in depth. Protective systems for use in excavations more than 20 feet in depth must be designed by a registered professional engineer in accordance with §1926.652 (b) and (c).

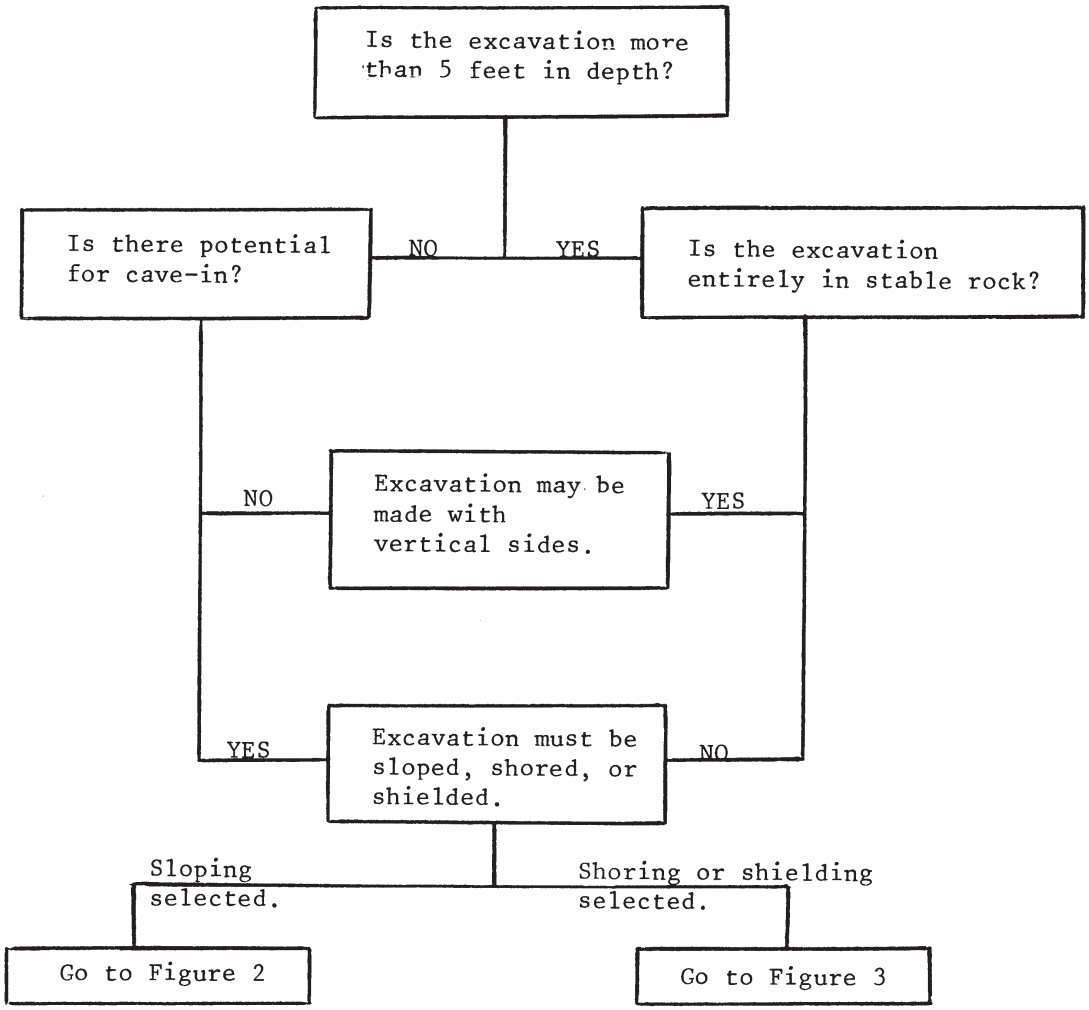


FIGURE 1 - PRELIMINARY DECISIONS

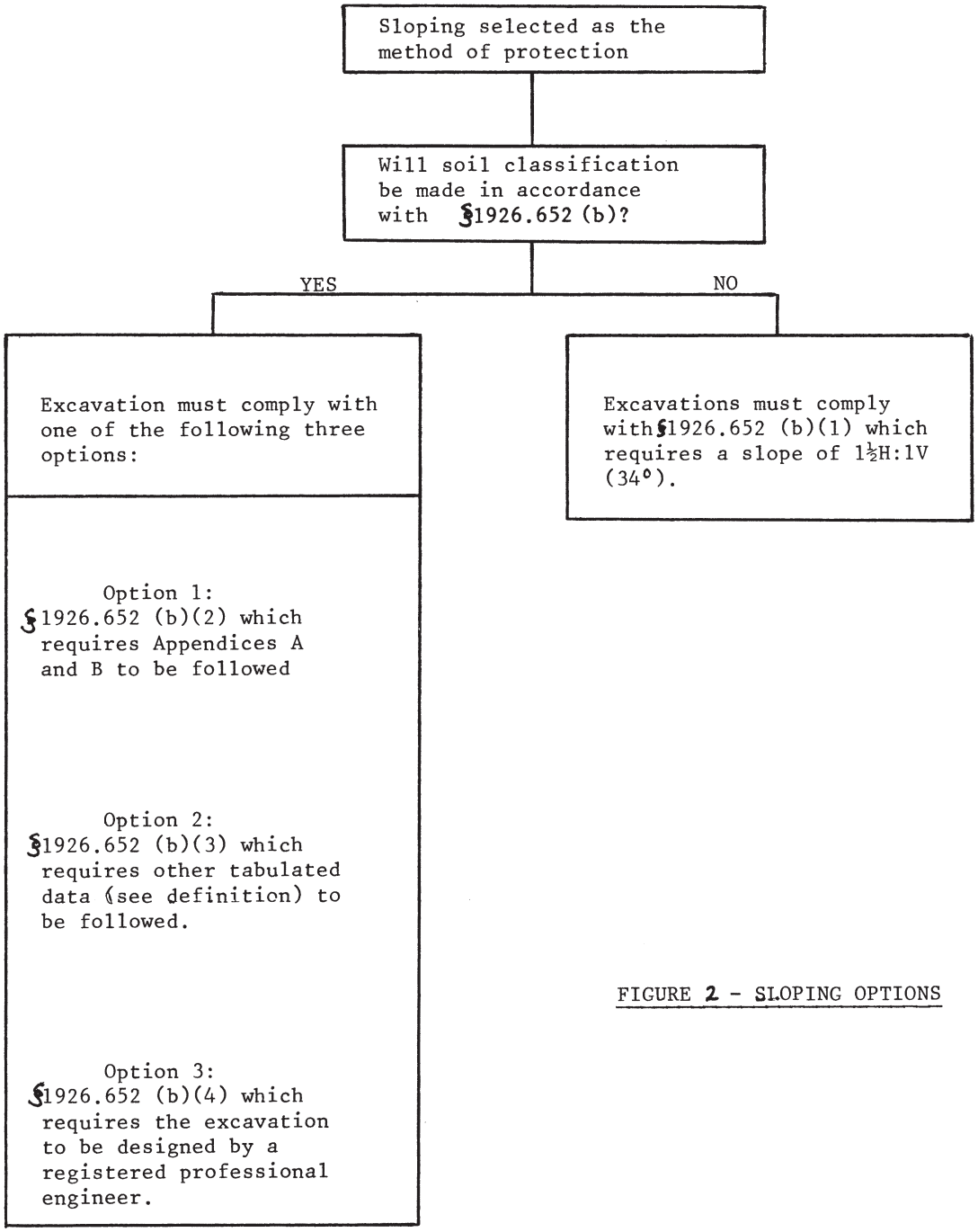


FIGURE 2 - SLOPING OPTIONS

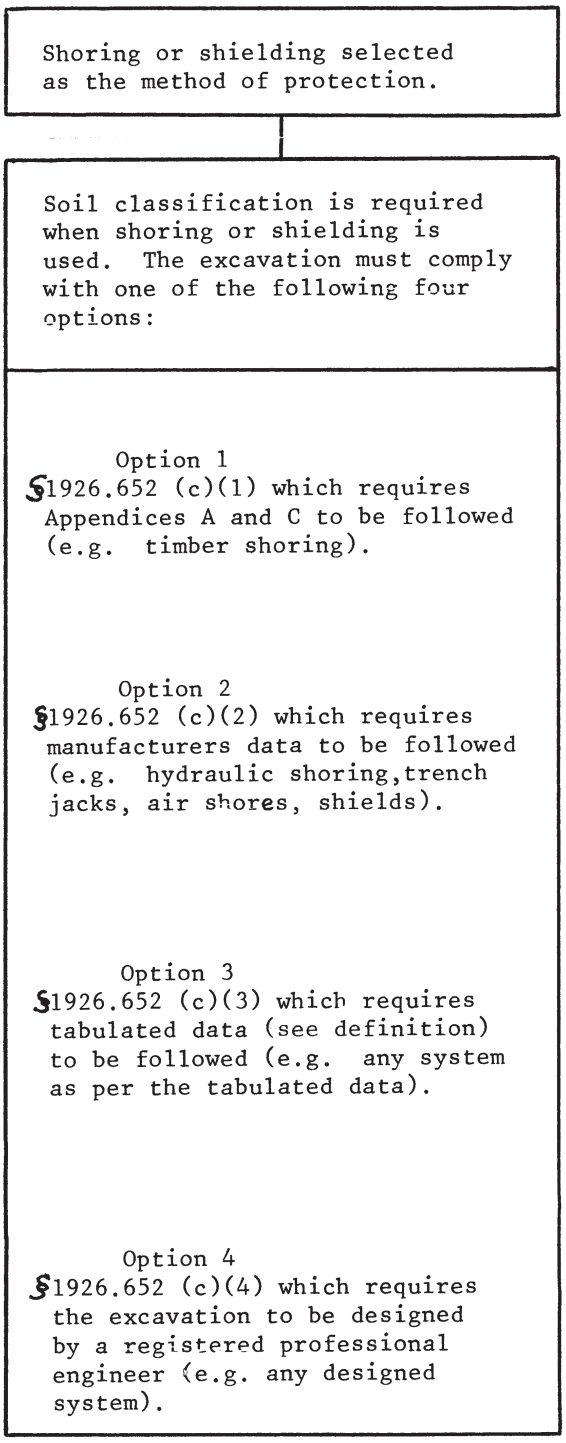


FIGURE 3 - SHORING AND SHIELDING OPTIONS







Report of Subsurface Exploration and Geotechnical Evaluation
Greenbrier High School Band Building
Greenbrier, Arkansas
Building & Earth Project No.: LR250093-Reviision 1

Prepared For:
Jackson Brown Palculict Architects

August, 29, 2025

BUILDING & EARTH
Geotechnical, Environmental, and Materials Engineers

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August, 29, 2025

Jackson Brown Palculict Architects
12921 Cantrell Road, Suite 201
Little Rock, Arkansas 72223

Attention: Mr. Randy Palculict, AIA

Subject: Report of Subsurface Exploration and Geotechnical Evaluation
Greenbrier High School Band Building
Greenbrier, Arkansas
Building & Earth Project No: LR250093-Revision 1

Dear Mr. Palculict:

Building & Earth Sciences, Inc. has completed the authorized subsurface exploration and geotechnical engineering evaluation for the Greenbrier High School Band Building located at 72 Green Valley Drive in Greenbrier, Arkansas.

The purpose of this exploration and evaluation was to determine general subsurface conditions at the site and to address applicable geotechnical aspects of the proposed construction and site development. The recommendations in this report are based on a physical reconnaissance of the site and observation and classification of samples obtained from four (4) test borings conducted at the site. Confirmation of the anticipated subsurface conditions during construction is an essential part of geotechnical services.

We appreciate the opportunity to provide consultation services for the proposed project. If you have any questions regarding the information in this report or need any additional information, please call us.

Respectfully Submitted,
BUILDING & EARTH SCIENCES, INC.
AR Certificate of Authorization No. 569. Expiration Date 12/31/25

Ali Al-Saadi, Ph.D
Staff Professional

Joseph D. Vistad, P.E.
Regional Manager, Principal
AR 18294

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APPENDIX

1.0 PROJECT & SITE DESCRIPTION

The subject site is located at 72 Green Valley Drive in Greenbrier, Arkansas. Information relative to the proposed site and the proposed development is listed in Table 1 below. Photographs depicting the current site condition are presented on the following page.

Development Item	Detail	Description
General Site	Size (Ac.)	±0.23
	Existing Development	The site is located close to the northeast of the existing stadium
	Vegetation	Mostly manicured grass and weeds
	Slopes	No
	Retaining Walls	None notes or planned
	Drainage	The site is relatively flat lying and appears moderately well drained towards the southwest
	Cuts & Fills	No
Proposed Buildings	No. of Bldgs	One (1)
	Square Ft.	10,000
	Stories	Single-story
	Construction	Conventional steel framed (assumed)
	Column Loads	40 kips (assumed)
	Wall Loads	2 kips per linear foot (klf) (assumed)
	Preferred Foundation	Conventional Shallow Foundation
	Preferred Slab	Slab-on- Grade
	Retaining Wall	None planned
	Cuts & Fill	Limited cut/fill of up to 2 feet (assumed)

Table 1: Project and Site Description

Reference: Site Plan created by Jackson Brown Palculict Architects dated 07/09/2025

Notes:

1. ***If actual loading conditions exceed the assumed loads, Building & Earth Sciences should be allowed to review the proposed structural design and its effects on our recommendations for foundation design.***
2. ***When a grading plan is finalized, Building & Earth should be allowed to review the plan and its effects on our recommendations.***



Figure 1: Northeast Property Boundary Looking West

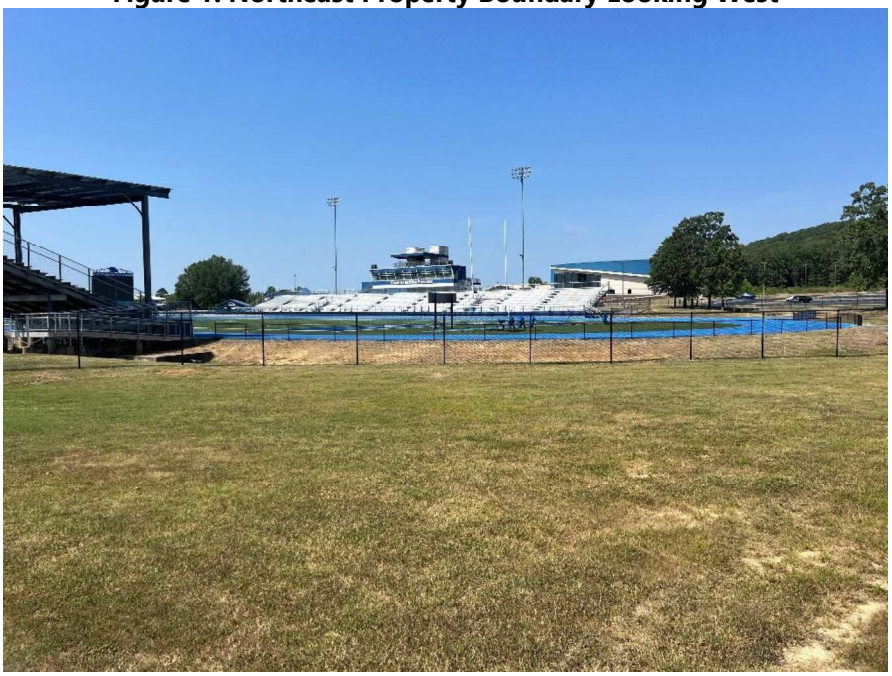


Figure 2: Northeast Property Boundary Looking Southwest



Figure 1: West Property Boundary Looking East

2.0 SCOPE OF SERVICES

The authorized subsurface exploration was performed on August 8, 2025 in conformance with our proposal LR27123, dated August 1, 2025. Notice to proceed was provided by returning our signed contract document on August 4, 2025.

The purpose of the geotechnical exploration was to determine general subsurface conditions at specific boring locations and to gather data on which to base a geotechnical evaluation with respect to the proposed construction. The subsurface exploration for this project consisted of four (4) test borings. The site was drilled using a Geoprobe 7822DT equipped with automatic hammer for performing Standard Penetration Tests (SPT) to help evaluate the relative soil strength. Refer to the Appendix for a description of the drilling and sampling procedures.

The boring locations were determined in the field by a representative of our staff using a handheld GPS unit. As such, the boring locations shown on the Boring Location Plan attached to this report should be considered approximate.

The soil/rock samples recovered during our site investigation were visually classified and specific samples were selected by the project engineer for laboratory analysis. The laboratory analysis consisted of:

Test	ASTM	No. of Tests
Natural Moisture Content	D2216	23
Atterberg Limits	D4318	3
Material Finer Than No. 200 Sieve by Washing	D1140	3

Table 2: Scope of Laboratory Tests

The results of the laboratory analysis are presented on the enclosed Boring Logs and in tabular form in the Appendix of this report. Descriptions of the laboratory tests that were performed are also included in the Appendix.

The information gathered from the exploration was evaluated to determine a suitable foundation type for the proposed structure. The information was also evaluated to help determine if any special subgrade preparation procedures will be required during the earthwork phase of the project.

The results of the work are presented within this report that addresses:

- General site geology.
- Summary of existing surface conditions.
- A description of the subsurface conditions encountered at the boring locations.
- A description of the groundwater conditions observed in the boreholes during drilling. Long-term monitoring was not included in the scope of work.
- Presentation of laboratory test results.
- Site preparation considerations including material types to be expected at the site, treatment of any encountered unsuitable soils, excavation considerations, and surface drainage**.**
- Recommendations to be used for foundation design, including appropriate including appropriate foundation types, bearing pressures, and depths.
- Presentation of expected total and differential settlements, and recommendations to reduce the expected movements, if appropriate**.**
- Recommendations to be used for design of slabs-on-grade, including modulus of subgrade reaction.
- Seismic Site Classification per IBC based on SPT test boring information.
- Compaction requirements and recommended criteria to establish suitable material for structural backfill.

3.0 GEOTECHNICAL SITE CHARACTERIZATION

The following discussion is intended to create a general understanding of the site from a geotechnical engineering perspective. It is not intended to be a discussion of every potential geotechnical issue that may arise, nor to provide every possible interpretation of the conditions identified. The following conditions and subsequent recommendations are based on the assumption that significant changes in subsurface conditions do not occur between boreholes. However, anomalous conditions can occur due to the geologic conditions at the site, and it will be necessary to evaluate the assumed conditions during site grading and foundation installation.

3.1 GEOLOGY

The Geologic Map of Arkansas, published by the Arkansas Geologic Commission in cooperation with the United States Geological Survey, indicates the project is located within the upper part of Atoka Formation. The Atoka is described by the reference as follows:

> The Atoka is a sequence of marine, mostly tan to gray silty sandstones and grayish-black shales. Some rare calcareous beds and siliceous shales are known. This unit has the largest areal extent of any of the Paleozoic formations in the state. It is the surface rock of the Boston Mountains and dominates the exposures in the Arkansas River Valley and the frontal Ouachita Mountains. It is also present in the southern part of the Ouachita Mountains. In the Arkansas River Valley and the frontal Ouachita Mountains the Atoka has been subdivided into upper, middle, and lower lithic members based on regionally mappable shale or sandstone intervals. The unit locally contains discontinuous streaks of coal and coaly shale in the Boston Mountains and Arkansas River Valley. Fossil plants are common throughout the section but are generally poorly preserved. Poorly preserved invertebrate fossils are much less common and are found at several horizons. Trace fossils are relatively common in the Atoka. The Atoka is conformable with the Bloyd Shale in the Boston Mountains and the Johns Valley Shale in the Ouachita Mountains. The unit may reach up to 25,000 feet thick in the Ouachita Mountains although only large incomplete sections are known.

3.2 EXISTING SURFACE CONDITIONS

At the time of our exploration, the site was covered with manicured grass and weeds. The existing stadium and its associated fence were located close to the west side of the planned building.

The site is relatively flat lying with an elevation change of about 3 feet across the property according to Google Earth elevation information. The site appears to be moderately well drained towards the southwest.

Topsoil was encountered at the surface in all test borings with a thickness of about 2 inches. Topsoil thicknesses could vary in unexplored areas of the project site. For this report, topsoil is defined as the soil horizon which contains the root mat of the noted vegetation. No testing has been performed to verify that soils meet any requirements of "topsoil".

3.3 Subsurface Conditions

A generalized stratification summary has been prepared using data from the soil test borings and is presented in the table below. The stratification depicts the general soil conditions and strata types encountered during our field investigation.

Stratum No.	Description	Consistency/ Relative Density/ Rock Hardness
1	**Residuum** – Silty Clay (CL-ML)	Very stiff
2	**Residuum** – Lean Clay (CL)	Generally stiff to very stiff
3	**Atoka Formation** – Clayey and Weathered Shale	Soft to moderately hard

Table 3: Stratification Summary

Subsurface profiles which show the thickness of the stratum referenced above have also been prepared based on the data obtained and are presented in the Appendix. For specific details on the information obtained from individual borings, please refer to the Boring Logs included in the Appendix. The elevations of the borings indicated in this report were estimated based on Google Earth elevation information.

3.3.1 Residual - Silty Clay (CL-ML)

Silty clay (CL-ML) with various amounts of sand and gravel was encountered beneath the topsoil in all test borings except B-04 and extend for about 2.5 feet below present grades. This material was light brown to brown in color and exhibit low plasticity. The natural moisture content ranged from 3% to 10%.

3.3.2 Residual - Lean Clay (CL)

Lean clay (CL) with various amounts of sand and shale was encountered beneath the silty clay (CL-ML) and extended to depths of 8.5 to 13.5 feet below present grades. Generally, this soil layer is transitioning to shaley lean clay at depths ranged from 8.5 feet to 13.5

below existing grade. Representative samples tested had liquid limit (LL) values ranged from 31 to 45, plasticity index (PI) values ranged from 11 to 25 and fine content (material finer than #200 sieve) ranged from 80% to 83%. The natural moisture contents ranged from 4% to 23%.

3.3.3 ATOKA FORMATION

Clayey shale, and weathered shale of the Atoka Formation was encountered across the site during our exploration. These layers were various shades and combinations of brown, yellow, and gray. The natural moisture contents ranged from 2% to 14%.

Weathered rock is formed by the natural in-place physical and chemical weathering of the parent bedrock formation. Weathered rock is typically considered a transition zone from residual soil to hard bedrock. During SPT sampling, the weathered rock is pulverized by the sampling equipment to the degree that is retrieved as soil. Weathered rock is typically distinguished from residual soil when the SPT N-value is in excess of 50 bpf.

3.3.4 GROUNDWATER

Groundwater was not encountered at the time of drilling or prior to backfilling during our subsurface exploration. Water levels reported are accurate only for the time and date that the borings were drilled. Long term monitoring of the boreholes was not included as part of our subsurface exploration. The borings were backfilled the same day that they were drilled.

3.3.5 SEISMIC SITE CLASSIFICATION

Basis of Evaluation	Recommended Site Classification
2021 International Building Code (IBC) and ASCE 7, Chapter 20	**C**
This recommended seismic site classification is based on the 2021 Edition of the International Building Code, the subsurface conditions encountered in the borings, and our knowledge of the geologic conditions of the site. Our subsurface exploration extended to a maximum depth of about 19 feet; hence the seismic site classification should be re-evaluated in the event subsurface information is made available to a depth of 100 feet.	

Table 4: Seismic Site Classification

4.0 SITE DEVELOPMENT CONSIDERATIONS

A grading plan was not available at the time of this report. For the purposes of this report, we assume finished grades will have cuts and fills of less than 2 feet being required to achieve design grades across the site. ***When a grading plan is finalized, Building & Earth should be allowed to review the plan and its effects on our recommendations.***

Based on our evaluation of the subsurface soil information, and the anticipated foundation loads, it appears that construction with a conventional shallow foundation system is feasible. The site development recommendations outlined below are intended for development of the site to support construction with a conventional shallow foundation system. ***If a different type of foundation system is preferred, Building & Earth should be allowed to review the site development recommendations to verify that they are appropriate for the preferred foundation system.***

The primary geotechnical concerns for this project are:

- Moisture sensitive silty clays, and lean clays were encountered near the surface across the site. These soils are prone to losing strength and stability with increases in the soil moisture content.
- Although groundwater was not encountered during our exploration, due to the relatively shallow weathered rock units at the site there is a moderate to high risk for the development of perched groundwater conditions during and following rainy periods.
- Existing development is present immediately adjacent to the site consisting of a fence separating the site from the existing Greenbriar High School track and field.

Recommendations addressing the site conditions are presented in the following sections.

4.1 Initial Site Preparation

All trees, roots, topsoil and deleterious materials should be removed from the proposed construction areas. Approximately 2 inches of topsoil were observed in the borings. The topsoil thickness is accurate only at specific boring locations but can be extrapolated between boreholes for initial cost estimating purposes. The geotechnical engineer or their designated representative should observe stripping and grubbing operations to evaluate that all unsuitable materials are removed from locations for proposed construction.

Because of the current uses of the site, buried structures could be encountered such as foundations, utility lines, septic tanks, etc. If encountered, they should be removed and backfilled in accordance with requirements outlined in the *Structural Fill* section of this report.

Materials disturbed during clearing operations should be stabilized in place or, if necessary, undercut to undisturbed materials and backfilled with properly compacted, approved structural fill.

During site preparation activities, the contractor should identify borrow source materials that will be used as structural fill and provide samples to the testing laboratory so that conformance to the Structural Fill requirements outlined below and appropriate moisture-density relationship curves can be determined.

4.2 Moisture Sensitive Soils

Moisture sensitive silty clays (CL-ML) and lean clays (Cl) were encountered across the site during the subsurface exploration. These soils will degrade if allowed to become saturated. Therefore, not allowing water to pond by maintaining positive drainage and temporary dewatering methods (if required) is important to help avoid degradation and softening of the soils.

The contractor should anticipate some difficulty during the earthwork phase of this project if moisture levels are moderate to high during construction. Increased moisture levels will soften the subgrade and the soils may become unstable under the influence of construction traffic. Accordingly, construction during wet weather conditions should be avoided, as this could result in soft and unstable soil conditions that would require ground modification, such as in place stabilization or undercutting.

4.3 Subgrade Evaluation

We recommend that the project geotechnical engineer their designated representative evaluate the subgrade after the site is prepared. Some unsuitable or unstable areas may be present in unexplored areas of the site. All areas that will require fill or that will support structures should be carefully proofrolled with a heavy (20- to 25-ton), rubber-tired vehicle at the following times.

- After an area has been stripped, and undercut if required, prior to the placement of any fill.
- After grading an area to the finished subgrade elevation in a building or pavement area.
- After areas have been exposed to any precipitation, and/or have been exposed for more than 48 hours.

Some instability may exist during construction, depending on climatic and other factors immediately preceding and during construction. If any soft or otherwise unsuitable soils are identified during the proofrolling process, they must be undercut or stabilized prior to fill placement, pavement construction, or floor slab construction. All unsuitable material

identified during construction shall be removed and replaced in accordance with the *Structural Fill* section of this report.

4.4 STRUCTURAL FILL

Requirements for structural fill on this project are as follows:

Soil Type	USCS Classification	Property Requirements	Placement Location
Imported Lean Clay, Clayey Sand, Clayey Gravel	CL, SC, GC	LL<40, PI<20, P200>15%, Maximum 3" particle size in any dimension	**Low Plasticity Structural Fill** to be used for construction of building pads
Onsite Lean Clay, Silty Clay, and Weathered/Clayey Shales	CL, CL-ML	Same as above	***Likely suitable*** for placement as low plasticity structural fill in building pads (5)

Table 5: Structural Fill Requirements

Notes:

1. All structural fill should be free of vegetation, topsoil, and any other deleterious materials. The organic content of materials to be used for fill should be less than 3 percent unless approved by the geotechnical engineer.
2. LL indicates the soil Liquid Limit; PI indicates the soil Plasticity Index; γ_d indicates the maximum dry density as defined by the density standard outlined in the table below.
3. Laboratory testing of the soils proposed for fill must be performed in order to verify their conformance with the above recommendations.
4. Any fill to be placed at the site should be reviewed by the geotechnical engineer.
5. If onsite residual soils are to be used for structural fill, bulk samples of the material should be provided prior to construction for laboratory analysis to determine suitability. It should be noted that these soils are moisture sensitive and may require extra care to maintain appropriate moisture contents during construction. As such, the contractor should anticipate drying or double-handling of the soils prior to placement as structural fill material.

Placement requirements for structural fill are as follows:

Specification	Requirement
Lift Thickness	Maximum 8-inch loose lifts when compacted with large heavy compaction equipment. Maximum 6-inch loose lifts when compacted with lightweight compaction equipment. (thinner lifts may be required in confined locations).
Density	Minimum of 98 percent of maximum dry density as defined by ASTM D698 at all locations and depths.
Moisture	±2 percent of optimum moisture as defined by ASTM D698 for cohesive soils. For cohesionless soils with greater than 12 percent passing the US Standard No. 200 sieve, ±3 percent of optimum moisture as defined above. Moisture requirement is waived for cohesionless soil with less than 12 percent passing the No. 200 sieve
Density Testing Frequency	One test per 2,500 sf in building areas and one test per 5,000 sf in pavement areas with minimum of 3 tests per lift. One test per 200 feet of trench backfill with minimum of 2 tests per lift. The testing frequency can be increased or decreased by the Geotechnical Engineer of Record in the field based on uniformity of material being placed and compactive effort used.

Table 6: Structural Fill Placement Requirements

4.5 Excavation Considerations

All excavations performed at the site should follow OSHA guidelines for temporary excavations. Excavated soils should be stockpiled according to OSHA regulations to limit the potential cave-in of soils.

4.5.1 Groundwater and Perched Water

Although groundwater was not encountered during our subsurface exploration, due to the prevalence of relatively shallow rock units at the site, there is a high risk of developing perched water during rainy periods.

Perched water could be encountered during construction, particularly during undercutting operations or utility installation and at the interface between the clayey/weathered rock units and the overlying residuum. It should be noted that fluctuations in the water level could occur due to seasonal variations in rainfall. The contractor must be prepared to remove groundwater, or perched water, and seepage from excavations if encountered during construction. Excavations extending below groundwater levels will require dewatering systems (such as sump pumps or trench drains). The contractor should evaluate the most economical and practical dewatering method.

4.6 Utility Trench Backfill

All utility trenches must be backfilled and compacted in the manner specified above for structural fill. It may be necessary to reduce the lift thickness to 4 to 6 inches to achieve compaction using hand-operated equipment.

At the perimeter wall crossings, we recommend that clay soils or a flowable fill be used to backfill the utility trench. The clay or flowable fill will act as a relatively impermeable plug reducing the risk of water migration from the outside into the interior of the building. The plug should be at least 36 inches wide and should extend below the perimeter walls to provide for a proper seal.

We recommend utility trenches be completed at all foundation crossings prior to the construction of shallow foundations. Once constructed, soils which support shallow foundations must be protected from undermining by utility excavation or any other means.

4.7 Landscaping and Drainage Consideration

The potential for soil moisture fluctuations within building areas and pavement subgrades should be reduced to lessen the potential of subgrade movement. Site grading should include positive drainage away from buildings and pavements. Excessive irrigation of landscaping poses a risk of saturating and softening soils below shallow footings and pavements, which could result in settlement of footings and premature failure of pavements.

4.8 Wet Weather Construction

Excessive movement of construction equipment across the site during wet weather may result in ruts, which will collect rainwater, prolonging the time required to dry the subgrade soils.

During rainy periods, additional effort will be required to properly prepare the site and establish/maintain an acceptable subgrade. The difficulty will increase in areas where clay or silty soils are exposed at the subgrade elevation. Grading contractors typically postpone grading operations during wet weather to wait for conditions that are more favorable. Contractors can typically disk or aerate the upper soils to promote drying during intermittent periods of favorable weather. When deadlines restrict postponement of grading operations, additional measures such as undercutting and replacing saturated soils or stabilization can be utilized to facilitate placement of additional fill material.

5.0 FOUNDATION RECOMMENDATIONS

Specific structural loading conditions were not known at the time of this report; however, based on our experience with similar projects, we anticipate that the individual column loads will be less than 40 kips and wall loads will be less than 2 kips per linear foot. ***If these assumptions concerning structural loading are incorrect, our office should be contacted, such that our recommendations can be reviewed.***

Based on the conditions encountered during our field investigation and after our site preparation and grading recommendations are implemented, the proposed structure can be supported on conventional shallow foundations bearing in stiff to very stiff residuum or newly placed and compacted structural fill. Footings bearing in the anticipated materials may be designed using an allowable soil bearing pressure of 2,500 psf.

Even though computed footing dimensions may be less, column footings should be at least 24 inches wide and strip footings should be at least 18 inches wide. These dimensions facilitate hand cleaning of footing subgrades disturbed by the excavation process and the placement of reinforcing steel. They also reduce the potential for localized punching shear failure. ***All exterior footings should bear at least 24 inches below the adjacent exterior grade.*** Total settlement of footings designed and constructed as recommended above should be 1 inch or less. We anticipate differential settlement of ½ inch or less across any two points spaced 40 feet or more across floor slabs or along foundation lines.

The following items should be considered during the preparation of construction documents and foundation installation:

- The geotechnical engineer of record should observe the exposed foundation bearing surfaces prior to concrete placement to verify that the conditions anticipated during the subsurface exploration are encountered.
- All bearing surfaces must be free of soft or loose soil prior to placing concrete.
- Concrete should be placed the same day the excavations are completed and bearing materials verified by the engineer. If the excavations are left open for an extended period, or if the bearing surfaces are disturbed after the initial observation, then the bearing surfaces should be reevaluated prior to concrete placement.
- Water should not be allowed to pond in foundation excavations prior to concrete placement or above the concrete after the foundation is completed.

- Wherever possible, the foundation concrete should be placed "neat", using the sides of the excavations as forms. Where this is not possible, the excavations created by forming the foundations must be backfilled with suitable structural fill and properly compacted.
- The building pad should be sloped to drain away from the building foundations.
- Roof drains should be routed away from the foundation soils.

6.0 FLOOR SLABS

Site development recommendations presented in this report should be followed to provide for subgrade conditions suitable for support of grade supported slabs. Floor slabs will be supported on approved existing residuum or newly placed and compacted structural fill.

We recommend floor slabs for the proposed structure be supported on a minimum four-inch layer of clean, densely-graded granular material commonly referred to as "crusher-run" materials. Alternatively, DOT approved road base with 100% passing the 1-1/2 in sieve, 15% to 55% passing the No. 4 sieve and less than 12% passing the No 200 sieve. The material passing the #200 sieve should be clean, granular fill with less than 3% clay or friable particles. The purpose of this layer is to help provide a uniform loading condition and act as a capillary break for moisture migration through the subgrade soil. This gravel material should be consolidated in-place with vibratory equipment. a modulus of subgrade reaction of 150 pci can be used in the design of a grade-supported building floor slab.

We recommend a minimum 10-mil thick vapor retarder meeting ASTM E 1745, Class C requirements be placed directly below the slab-on-grade floors. A higher quality vapor retarder (Class A or B) may be used if desired to further inhibit the migration of moisture through the slab-on-grade and should be evaluated based on the floor covering and use. The vapor retarder should extend to the edge of the slab-on-grade floors and should be sealed at all seams and penetrations. The slab should be appropriately reinforced (if required) to support the proposed loads.

Where applicable, we recommend that the floor slab be isolated from the foundation footings so differential settlement of the structure will not induce shear stresses on the floor slab. Temperature and shrinkage reinforcements in slabs on grade maybe considered and incorporated accordingly in the slab design. ACI 360-10 provides guidance on the proper quantity of such reinforcement. The slab should also be appropriately reinforced to support the proposed loads as required. If welded-wire mesh reinforcement is utilized, the mesh reinforcement should be placed 2 inches below the

slab surface or upper one-third of the slab thickness, whichever is closer to the surface. Adequate construction joints, contraction joints and isolation joints should also be provided in the slab to reduce the impacts of cracking and shrinkage, in general accordance with ACI standards and guidelines (ACI360R-10).

7.0 SUBGRADE REHABILITATION

The subgrade soils often become disturbed during the period between initial site grading and construction of surface improvements. The amount and depth of disturbance will vary with soil type, weather conditions, construction traffic, and drainage.

The engineer should evaluate the subgrade soil during final grading to verify that the subgrade is suitable to receive pavement and/or concrete slab base materials. The final evaluation may include proofrolling or density tests.

Subgrade rehabilitation can become a point of controversy when different contractors are responsible for site grading and building construction. The construction documents should specifically state which contractor will be responsible for maintaining and rehabilitating the subgrade. Rehabilitation may include moisture conditioning and re-compacting soils. When deadlines or weather restrict grading operations, additional measures such as undercutting and replacing saturated soils or chemical stabilization can often be utilized.

8.0 CONSTRUCTION MONITORING

Field verification of site conditions is an essential part of the services provided by the geotechnical consultant. In order to confirm our recommendations, it will be necessary for Building & Earth personnel to make periodic visits to the site during site grading. Typical construction monitoring services are listed below.

- Periodic observations and consultations by a member of our engineering staff during site development.
- Continuous monitoring during structural fill placement.
- Field density test during structural fill placement.
- Observations and verification of the bearing surface exposed after foundation excavation.
- Reinforcing steel inspections.
- Molding and testing of concrete cylinders

9.0 CLOSING AND LIMITATIONS

This report was prepared for Jackson Brown Palculict Architects, for specific application to the Greenbrier High School Band Building located in Greenbrier, Arkansas. The information in this report is not transferable. This report should not be used for a different development on the same property without first being evaluated by the engineer.

The recommendations in this report were based on the information obtained from our field exploration and laboratory analysis. The data collected is representative of the locations tested. Variations are likely to occur at other locations throughout the site. Engineering judgment was applied in regards to conditions between borings. It will be necessary to confirm the anticipated subsurface conditions during construction.

This report has been prepared in accordance with generally accepted standards of geotechnical engineering practice. No other warranty is expressed or implied. In the event that changes are made, or anticipated to be made, to the nature, design, or location of the project as outlined in this report, Building & Earth must be informed of the changes and given the opportunity to either verify or modify the conclusions of this report in writing, or the recommendations of this report will no longer be valid.

The scope of services for this project did not include any environmental assessment of the site or identification of pollutants or hazardous materials or conditions. If the owner is concerned about environmental issues Building & Earth would be happy to provide an additional scope of services to address those concerns.

This report is intended for use during design and preparation of specifications and may not address all conditions at the site during construction. Contractors reviewing this information should acknowledge that this document is for design information only.

An article published by the Geoprofessional Business Association (GBA), titled *Important Information About Your Geotechnical Report*, has been included in the Appendix. We encourage all individuals to become familiar with the article to help manage risk.

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GEOTECHNICAL INVESTIGATION METHODOLOGIES

The subsurface exploration, which is the basis of the recommendations of this report, has been performed in accordance with industry standards. Detailed methodologies employed in the investigation are presented in the following sections.

DRILLING PROCEDURES – STANDARD PENETRATION TEST (ASTM D1586)

At each boring location, soil samples were obtained at standard sampling intervals with a split-spoon sampler. The borehole was first advanced to the sample depth by augering and the sampling tools were placed in the open hole. The sampler was then driven 18 inches into the ground with a 140-pound automatic hammer free-falling 30 inches. The number of blows required to drive the sampler each 6-inch increment was recorded. The initial increment is considered the "seating" blows, where the sampler penetrates loose or disturbed soil in the bottom of the borehole.

The blows required to penetrate the final two (2) increments are added together and are referred to as the Standard Penetration Test (SPT) N-value. The N-value, when properly evaluated, gives an indication of the soil's strength and ability to support structural loads. Many factors can affect the SPT N-value, so this result cannot be used exclusively to evaluate soil conditions.

The SPT testing was performed using a drill rig equipped with an automatic hammer. Automatic hammers mechanically control the height of the hammer drop, and doing so, deliver higher energy efficiency (90 to 99 % efficiency) than manual hammers (60 % efficiency) which are dropped using a manually operated rope and cathead system. Because historic data correlations were developed based on use of a manual hammer, it is necessary to adjust the N-values obtained using an automatic hammer to make these correlations valid. Therefore, an energy correction factor of 1.3 was applied to the recorded field N-values from the automatic hammer for the purpose of our evaluation. The N-values discussed or mentioned in this report and shown on the boring logs are recorded field values.

Samples retrieved from the boring locations were labeled and stored in plastic bags at the jobsite before being transported to our laboratory for analysis. The project engineer prepared Boring Logs summarizing the subsurface conditions at the boring locations.

BORING LOG DESCRIPTION

Building & Earth Sciences, Inc. used the gINT software program to prepare the attached boring logs. The gINT program provides the flexibility to custom design the boring logs to include the pertinent information from the subsurface exploration and results of our laboratory analysis. The soil and laboratory information included on our logs is summarized below:

DEPTH AND ELEVATION

The depth below the ground surface and the corresponding elevation are shown in the first two columns.

SAMPLE TYPE

The method used to collect the sample is shown. The typical sampling methods include Split Spoon Sampling, Shelby Tube Sampling, Grab Samples, and Rock Core. A key is provided at the bottom of the log showing the graphic symbol for each sample type.

SAMPLE NUMBER

Each sample collected is numbered sequentially.

BLOWS PER INCREMENT, REC%, RQD%

When Standard Split Spoon sampling is used, the blows required to drive the sampler each 6-inch increment are recorded and shown in column 5. When rock core is obtained the recovery ration (REC%) and Rock Quality Designation (RQD%) is recorded.

SOIL DATA

Column 6 is a graphic representation of four different soil parameters. Each of the parameters use the same graph, however, the values of the graph subdivisions vary with each parameter. Each parameter presented on column 6 is summarized below:

- N-value- The Standard Penetration Test N-value, obtained by adding the number of blows required to drive the sampler the final 12 inches, is recorded . The graph labels range from 0 to 50.
- Qu – Unconfined Compressive Strength estimate from the Pocket Penetrometer test in tons per square foot (tsf). The graph labels range from 0 to 5 tsf.
- Atterberg Limits – The Atterberg Limits are plotted with the plastic limit to the left, and liquid limit to the right, connected by a horizontal line. The difference in the plastic and liquid limits is referred to as the Plasticity Index. The Atterberg Limits test results are also included in the Remarks column on the far right of the boring log. The Atterberg Limits graph labels range from 0 to 100%.
- Moisture – The Natural Moisture Content of the soil sample as determined in our laboratory.

SOIL DESCRIPTION

The soil description prepared in accordance with ASTM D2488, Visual Description of Soil Samples. The Munsel Color chart is used to determine the soil color. Strata changes are indicated by a solid line, with the depth of the change indicated on the left side of the line and the elevation of the change indicated on the right side of the line. If subtle changes within a soil type occur, a broken line is used. The Boring Termination or Auger Refusal depth is shown as a solid line at the bottom of the boring.

GRAPHIC

The graphic representation of the soil type is shown. The graphic used for each soil type is related to the Unified Soil Classification chart. A chart showing the graphic associated with each soil classification is included.

REMARKS

Remarks regarding borehole observations, and additional information regarding the laboratory results and groundwater observations.

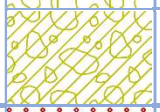
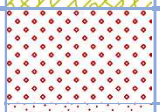
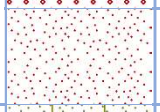
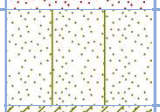
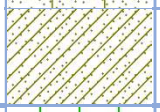
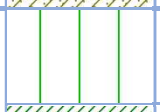
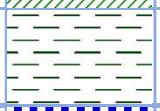
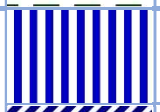
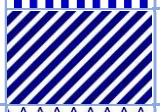
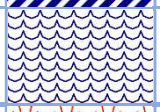
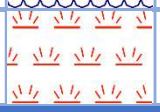
Major Divisions			Symbols		Group Name & Typical Description
			Lithology	Group	
Coarse Grained Soils *More than 50% of material is larger than No. 200 sieve size*	**Gravel and Gravelly Soils** *More than 50% of coarse fraction is larger than No. 4 sieve*	**Clean Gravels** *(Less than 5% fines)*		**GW**	*Well-graded gravels, gravel – sand mixtures, little or no fines*
				**GP**	*Poorly-graded gravels, gravel – sand mixtures, little or no fines*
		Gravels with Fines *(More than 12% fines)*		**GM**	*Silty gravels, gravel – sand – silt mixtures*
				**GC**	*Clayey gravels, gravel – sand – clay mixtures*
	Sand and Sandy Soils *More than 50% of coarse fraction is smaller than No. 4 sieve*	**Clean Sands** *(Less than 5% fines)*		**SW**	*Well-graded sands, gravelly sands, little or no fines*
				**SP**	*Poorly-graded sands, gravelly sands, little or no fines*
		Sands with Fines *(More than 12% fines)*		**SM**	*Silty sands, sand – silt mixtures*
				**SC**	*Clayey sands, sand – clay mixtures*
Fine Grained Soils *More than 50% of material is smaller than No. 200 sieve size*	**Silts and Clays** *Liquid Limit less than 50*	**Inorganic**		**ML**	*Inorganic silts and very find sands, rock flour, silty or clayey fine sands or clayey silt with slight plasticity*
				**CL**	*Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays*
		Organic		**OL**	*Organic silts and organic silty clays of low plasticity*
	Silts and Clays *Liquid Limit greater than 50*	**Inorganic**		**MH**	*Inorganic silts, micaceous or diatomaceous fine sand, or silty soils*
				**CH**	*Inorganic clays of high plasticity*
		Organic		**OH**	*Organic clays of medium to high plasticity, organic silts*
Highly Organic Soils				**PT**	*Peat, humus, swamp soils with high organic contents*

Table 1: Soil Classification Chart (based on ASTM D2487)

Building & Earth Sciences classifies soil in general accordance with the Unified Soil Classification System (USCS) presented in ASTM D2487. Table 1 and Figure 1 exemplify the general guidance of the USCS. Soil consistencies and relative densities are presented in general accordance with Terzaghi, Peck, & Mesri's (1996) method, as shown on Table 2, when quantitative field and/or laboratory data is available. Table 2 includes Consistency and Relative Density correlations with N-values obtained using either a manual hammer (60 percent efficiency) or automatic hammer (90 percent efficiency). The *Blows Per Increment* and *SPT N-values* displayed on the boring logs are the unaltered values measured in the field. When field and/or laboratory data is not available, we may classify soil in general accordance with the Visual Manual Procedure presented in ASTM D2488.

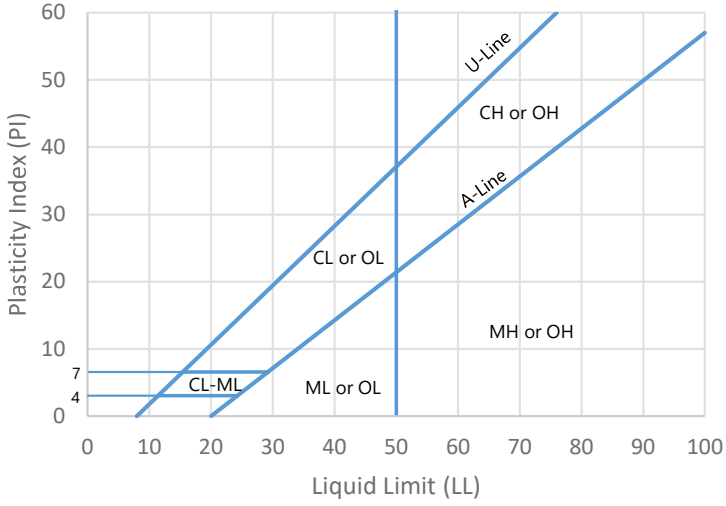


Figure 1: Plasticity Chart (based on ASTM D2487)

Non-cohesive: Coarse-Grained Soil			**Cohesive: Fine-Grained Soil**			
SPT Penetration (blows/foot)		**Relative Density**	**SPT Penetration (blows/foot)**		**Consistency**	**Estimated Range of Unconfined Compressive Strength (tsf)**
			Automatic Hammer*	Manual Hammer		
Automatic Hammer*	Manual Hammer		< 2	< 2	Very Soft	< 0.25
0 - 3	0 - 4	Very Loose	2 - 3	2 - 4	Soft	0.25 – 0.50
3 - 8	4 - 10	Loose	3 - 6	4 - 8	Medium Stiff	0.50 – 1.00
8 - 23	10 - 30	Medium Dense	6 - 12	8 - 15	Stiff	1.00 – 2.00
23 - 38	30 - 50	Dense	12 - 23	15 - 30	Very Stiff	2.00 – 4.00
> 38	> 50	Very Dense	> 23	> 30	Hard	> 4.00

Table 2: Soil Consistency and Relative Density (based on Terzaghi, Peck & Mesri, 1996)

* - Modified based on 80% hammer efficiency

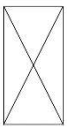
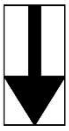
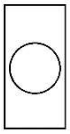
	Standard Penetration Test ASTM D1586 or AASHTO T-206		Dynamic Cone Penetrometer (Sower DCP) ASTM STP-399
	Shelby Tube Sampler ASTM D1587		No Sample Recovery
	Rock Core Sample ASTM D2113		Groundwater at Time of Drilling
	Auger Cuttings		Groundwater as Indicated

Table 1: Symbol Legend

Soil	Particle Size	U.S. Standard
Boulders	Larger than 300 mm	N.A.
Cobbles	300 mm to 75 mm	N.A.
Gravel	75 mm to 4.75 mm	3-inch to #4 sieve
Coarse	75 mm to 19 mm	3-inch to ¾-inch sieve
Fine	19 mm to 4.75 mm	¾-inch to #4 sieve
Sand	4.75 mm to 0.075 mm	#4 to #200 Sieve
Coarse	4.75 mm to 2 mm	#4 to #10 Sieve
Medium	2 mm to 0.425 mm	#10 to #40 Sieve
Fine	0.425 mm to 0.075 mm	#40 to #200 Sieve
Fines	Less than 0.075 mm	Passing #200 Sieve
Silt	0.075 mm to 2 µm	N.A.
Clay	Less than 2 µm	N.A.

Table 2: Standard Sieve Sizes

N-Value 	Standard Penetration Test Resistance calculated using ASTM D1586 or AASHTO T-206. Calculated as sum of original, field recorded values.	Atterberg Limits  PL LL	A measure of a soil's plasticity characteristics in general accordance with ASTM D4318. The soil Plasticity Index (PI) is representative of this characteristic and is bracketed by the Liquid Limit (LL) and the Plastic Limit (PL).
Qu	Unconfined compressive strength, typically estimated from a pocket penetrometer. Results are presented in tons per square foot (tsf).	% Moisture	Percent natural moisture content in general accordance with ASTM D2216.

Table 3: Soil Data

Hollow Stem Auger	Flights on the outside of the shaft advance soil cuttings to the surface. The hollow stem allows sampling through the middle of the auger flights.
Mud Rotary / Wash Bore	A cutting head advances the boring and discharges a drilling fluid to support the borehole and circulate cuttings to the surface.
Solid Flight Auger	Flights on the outside bring soil cuttings to the surface. Solid stem requires removal from borehole during sampling.
Hand Auger	Cylindrical bucket (typically 3-inch diameter and 8 inches long) attached to a metal rod and turned by human force.

Table 4: Soil Drilling Methods

Descriptor	Meaning
Trace	Likely less than 5%
Few	5 to 10%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

Table 5: Descriptors

Manual Hammer	The operator tightens and loosens the rope around a rotating drum assembly to lift and drop a sliding, 140-pound hammer falling 30 inches.
Automatic Trip Hammer	An automatic mechanism is used to lift and drop a sliding, 140-pound hammer falling 30 inches.
Dynamic Cone Penetrometer (Sower DCP) ASTM STP-399	Uses a 15-pound steel mass falling 20 inches to strike an anvil and cause penetration of a 1.5-inch diameter cone seated in the bottom of a hand augered borehole. The blows required to drive the embedded cone a depth of 1-3/4 inches have been correlated by others to N-values derived from the Standard Penetration Test (SPT).

Table 6: Sampling Methods

Non-plastic	A 1/8-inch thread cannot be rolled at any water content.
Low	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be re-rolled after reaching the plastic limit. The lump crumbles when drier than the plastic limit.
High	It takes considerable time rolling and kneading to reach the plastic limit. The thread can be re-rolled several times after reaching the plastic limit. The lump can be formed without crumbling when drier than the plastic limit.

Table 7: Plasticity

Dry	Absence of moisture, dusty, dry to the touch.
Moist	Damp but no visible water.
Wet	Visible free water, usually soil is below water table.

Table 8: Moisture Condition

Stratified	Alternating layers of varying material or color with layers at least ½ inch thick.
Laminated	Alternating layers of varying material or color with layers less than ¼ inch thick.
Fissured	Breaks along definite planes of fracture with little resistance to fracturing.
Slickensides	Fracture planes appear polished or glossy, sometimes striated.
Blocky	Cohesive soil that can be broken down into small angular lumps which resist further breakdown.
Lensed	Inclusion of small pockets of different soils, such as small lenses of sand scattered through a mass of clay.
Homogeneous	Same color and appearance throughout.

Table 9: Structure

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Geotechnical, Environmental, and Materials Engineers

KEY TO HATCHES

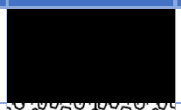
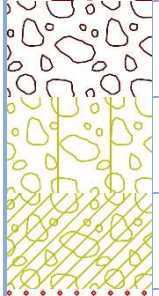
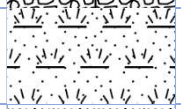
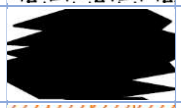
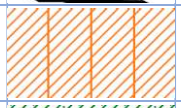
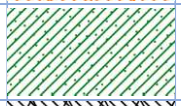
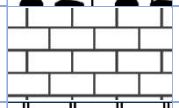
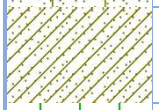
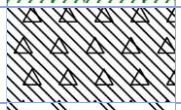
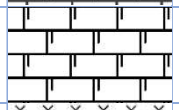
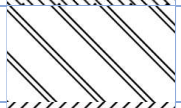
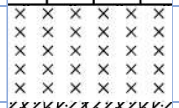
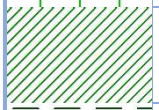
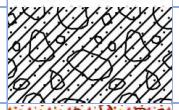
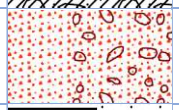
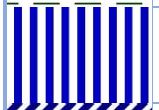
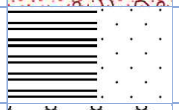
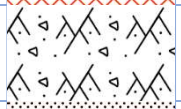
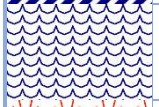
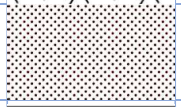
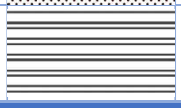
Hatch	Description	Hatch	Description	Hatch	Description
	***GW*** *- Well-graded gravels, gravel – sand mixtures, little or no fines*		*Asphalt*		*Clay with Gravel*
	***GP*** *- Poorly-graded gravels, gravel – sand mixtures, little or no fines*		*Aggregate Base*		*Sand with Gravel*
	GM *- Silty gravels, gravel – sand – silt mixtures*		*Topsoil*		*Silt with Gravel*
	GC *- Clayey gravels, gravel – sand – clay mixtures*		*Concrete*		*Gravel with Sand*
	***SW*** *- Well-graded sands, gravelly sands, little or no fines*		*Coal*		*Gravel with Clay*
	SP *- Poorly-graded sands, gravelly sands, little or no fines*		***CL-ML*** *- Silty Clay*		*Gravel with Silt*
	SM *- Silty sands, sand – silt mixtures*		*Sandy Clay*		*Limestone*
	***SC*** *- Clayey sands, sand – clay mixtures*		*Clayey Chert*		*Chalk*
	ML *- Inorganic silts and very find sands, rock flour, silty or clayey fine sands or clayey silt with slight plasticity*		*Low and High Plasticity Clay*		*Siltstone*
	***CL*** *- Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays*		*Low Plasticity Silt and Clay*		*Till*
	OL *- Organic silts and organic silty clays of low plasticity*		*High Plasticity Silt and Clay*		*Sandy Clay with Cobbles and Boulders*
	***MH*** *- Inorganic silts, micaceous or diatomaceous fine sand, or silty soils*		*Fill*		*Sandstone with Shale*
	CH *- Inorganic clays of high plasticity*		*Weathered Rock*		*Coral*
	***OH*** *- Organic clays of medium to high plasticity, organic silts*		*Sandstone*		*Boulders and Cobbles*
	***PT*** *- Peat, humus, swamp soils with high organic contents*		*Shale*		*Soil and Weathered Rock*

Table 1: Key to Hatches Used for Boring Logs and Soil Profiles

BORING LOCATION PLAN

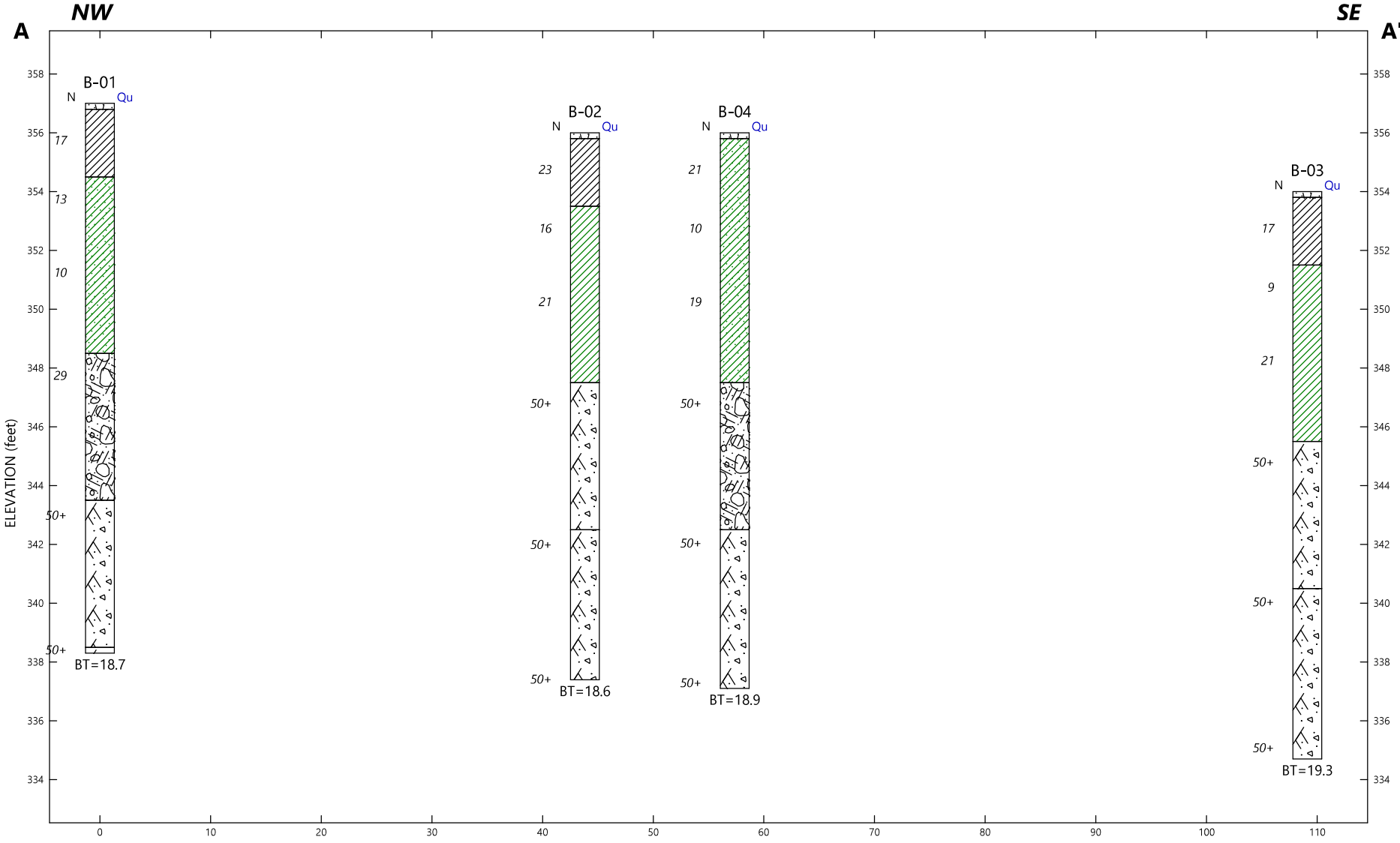


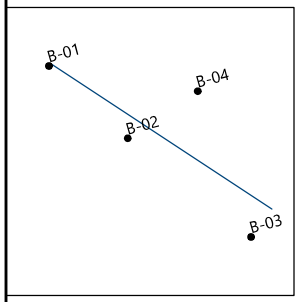
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Google Earth Satellite Imagery dated 12/6/2024 with overlay of the project schematic plan dated 07/09/2025	**PROJECT NO.**	**PROJECT NAME / LOCATION:**	**SCALE:**
	LR250093	Greenbrier High School Band Building Greenbrier, Arkansas	As Shown

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Geotechnical, Environmental, and Materials Engineers

SUBSURFACE PROFILES





Site Map Scale 1 inch equals 80 feet

Key to Hatches

- Topsoil
- Soil and Weathered Rock
- USCS Low Plasticity Silty Clay
- Weathered Rock
- USCS Low Plasticity Sandy Clay
- USCS Low Plasticity Clay

Legend

BT=Boring Termination, TPT=Test Pit Terminated
AR=Auger Refusal, ER=Excavation Refusal
N=Standard Penetration Test N-Value
Qu=Unconfined compressive strength estimate from pocket penetrometer test (tsf)
Water Level Reading at time of drilling.
Water Level Reading after drilling.

0 13

Horizontal Scale (feet)
Vertical Exaggeration: 2.5x

Building & Earth Sciences, Inc.
29 Collins Industrial Place, Bldg 1, Ste C, North Little Rock, Arkansas, 72113

Greenbrier High School Band Building
Greenbrier, Arkansas

A-A': Subsurface Profile

PROJECT NO: LR250093	PLATE NO: A'	DATE: 8/21/25

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BORING LOGS

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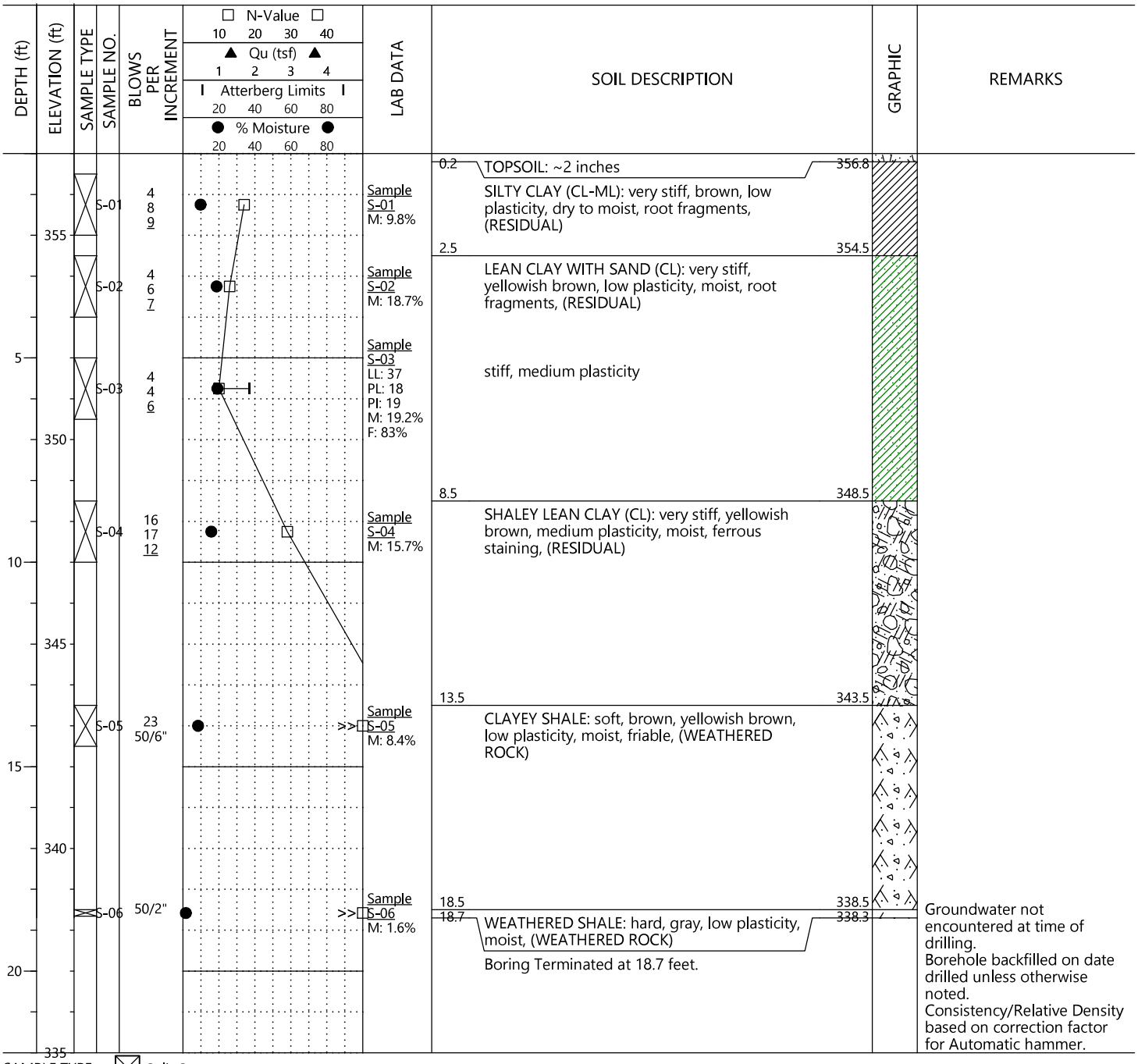
LOG OF BORING

Designation: B-01

Sheet 1 of 1

29 Collins Industrial Place, Bldg 1, Ste C
North Little Rock, Arkansas, 72113
Office: (501) 504-6929

PROJECT NAME:	Greenbrier High School Band Building	LOCATION:	Greenbrier, Arkansas
PROJECT NUMBER:	LR250093	DATE DRILLED:	8/8/25
DRILLING METHOD:	Hollow Stem Auger	WEATHER:	Clear
EQUIPMENT USED:	GeoProbe 7822DT	ELEVATION:	357
HAMMER TYPE:	Automatic	DRILL CREW:	Building & Earth
BORING LOCATION:	Northwest Building Corner	LOGGED BY:	T. Tollett



SAMPLE TYPE ☒ Split Spoon

N-VALUE STANDARD PENETRATION RESISTANCE (AASHTO T-206)
% MOISTURE PERCENT NATURAL MOISTURE CONTENT
▽ GROUNDWATER LEVEL IN THE BOREHOLE AT TIME OF DRILLING
▼ STABILIZED GROUNDWATER LEVEL

REC RECOVERY
RQD ROCK QUALITY DESIGNATION
UD UNDISTURBED
Qu POCKET PENETROMETER UNCONFINED COMPRESSIVE STRENGTH

LL: LIQUID LIMIT **M:** NATURAL MOISTURE CONTENT
PL: PLASTIC LIMIT **F:** PERCENT PASSING NO. 200 SIEVE
PI: PLASTICITY INDEX

BUILDING & EARTH
Geotechnical, Environmental, and Materials Engineers

LOG OF BORING

Designation: B-02

Sheet 1 of 1

29 Collins Industrial Place, Bldg 1, Ste C
North Little Rock, Arkansas, 72113
Office: (501) 504-6929

PROJECT NAME: Greenbrier High School Band Building
PROJECT NUMBER: LR250093
DRILLING METHOD: Hollow Stem Auger
EQUIPMENT USED: GeoProbe 7822DT
HAMMER TYPE: Automatic
BORING LOCATION: West Building Boundary

LOCATION: Greenbrier, Arkansas
DATE DRILLED: 8/8/25
WEATHER: Clear
ELEVATION: 356
DRILL CREW: Building & Earth
LOGGED BY: T. Tollett

DEPTH (ft)	ELEVATION (ft)	SAMPLE TYPE	SAMPLE NO.	BLOWS PER INCREMENT	LAB DATA	SOIL DESCRIPTION	GRAPHIC	REMARKS
						0.2 TOPSOIL: ~2 inches 355.8		
	355	⊠	S-01	5 9 14	Sample S-01 M: 4.8%	SILTY CLAY (CL-ML): very stiff, light brown, low plasticity, dry to moist, root fragments, (RESIDUAL)		
					Sample S-02 LL: 45 PL: 20 PI: 25 M: 19.4% F: 79.7%	2.5 353.5		
		⊠	S-02	5 8 8		LEAN CLAY WITH SAND (CL): very stiff, yellowish brown, medium plasticity, moist, root fragments, ferrous staining, (RESIDUAL)		
5	350	⊠	S-03	5 9 12	Sample S-03 M: 15.5%			
						8.5 347.5		
		⊠	S-04	10 38 50/5"	Sample S-04 M: 7.3%	CLAYEY SHALE: soft, brown, low plasticity, moist, friable, (WEATHERED ROCK)		
10	345							
						13.5 342.5		
		⊠	S-05	11 50/6"	Sample S-05 M: 9.3%	WEATHERED SHALE: soft, brown, low plasticity, moist, friable, (WEATHERED ROCK)		
15	340							
		⊠	S-06	50/2"		18.6 337.4 moderately hard Boring Terminated at 18.6 feet.		Groundwater not encountered at time of drilling. Borehole backfilled on date drilled unless otherwise noted. Consistency/Relative Density based on correction factor for Automatic hammer.
20	335							

SAMPLE TYPE ⊠ Split Spoon

N-VALUE STANDARD PENETRATION RESISTANCE (AASHTO T-206)
% MOISTURE PERCENT NATURAL MOISTURE CONTENT
▽ GROUNDWATER LEVEL IN THE BOREHOLE AT TIME OF DRILLING
▼ STABILIZED GROUNDWATER LEVEL

REC RECOVERY
RQD ROCK QUALITY DESIGNATION
UD UNDISTURBED
Qu POCKET PENETROMETER UNCONFINED COMPRESSIVE STRENGTH

LL: LIQUID LIMIT **M:** NATURAL MOISTURE CONTENT
PL: PLASTIC LIMIT **F:** PERCENT PASSING NO. 200 SIEVE
PI: PLASTICITY INDEX

BUILDING & EARTH
Geotechnical, Environmental, and Materials Engineers

LOG OF BORING

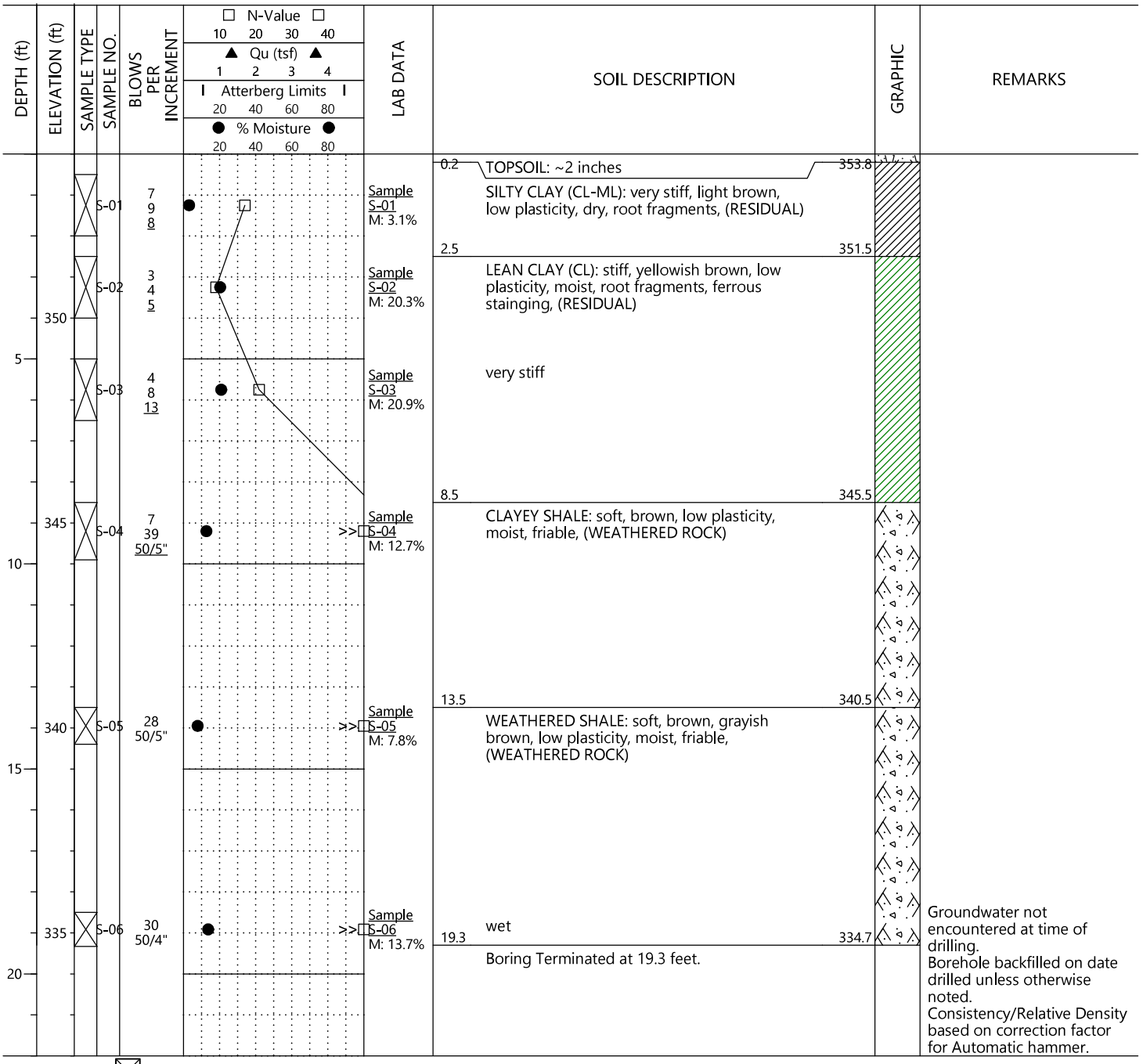
Designation: B-03

Sheet 1 of 1

29 Collins Industrial Place, Bldg 1, Ste C
North Little Rock, Arkansas, 72113
Office: (501) 504-6929

PROJECT NAME: Greenbrier High School Band Building
PROJECT NUMBER: LR250093
DRILLING METHOD: Hollow Stem Auger
EQUIPMENT USED: GeoProbe 7822DT
HAMMER TYPE: Automatic
BORING LOCATION: South Building Corner

LOCATION: Greenbrier, Arkansas
DATE DRILLED: 8/8/25
WEATHER: Clear
ELEVATION: 354
DRILL CREW: Building & Earth
LOGGED BY: T. Tollett



SAMPLE TYPE ☒ Split Spoon

N-VALUE STANDARD PENETRATION RESISTANCE (AASHTO T-206)
% MOISTURE PERCENT NATURAL MOISTURE CONTENT
▽ GROUNDWATER LEVEL IN THE BOREHOLE AT TIME OF DRILLING
▼ STABILIZED GROUNDWATER LEVEL

REC RECOVERY
RQD ROCK QUALITY DESIGNATION
UD UNDISTURBED
Qu POCKET PENETROMETER UNCONFINED COMPRESSIVE STRENGTH

LL: LIQUID LIMIT **M:** NATURAL MOISTURE CONTENT
PL: PLASTIC LIMIT **F:** PERCENT PASSING NO. 200 SIEVE
PI: PLASTICITY INDEX

BUILDING & EARTH
Geotechnical, Environmental, and Materials Engineers

LOG OF BORING

Designation: B-04

Sheet 1 of 1

29 Collins Industrial Place, Bldg 1, Ste C
North Little Rock, Arkansas, 72113
Office: (501) 504-6929

PROJECT NAME:	Greenbrier High School Band Building	LOCATION:	Greenbrier, Arkansas
PROJECT NUMBER:	LR250093	DATE DRILLED:	8/8/25
DRILLING METHOD:	Hollow Stem Auger	WEATHER:	Clear
EQUIPMENT USED:	GeoProbe 7822DT	ELEVATION:	356
HAMMER TYPE:	Automatic	DRILL CREW:	Building & Earth
BORING LOCATION:	Northeast Building Boundary	LOGGED BY:	T. Tollett

DEPTH (ft)	ELEVATION (ft)	SAMPLE TYPE	SAMPLE NO.	BLOWS PER INCREMENT	N-Value / Qu (tsf) / Atterberg Limits / % Moisture	LAB DATA	SOIL DESCRIPTION	GRAPHIC	REMARKS
0	355		S-01	4 10 11		Sample S-01 LL: 31 PL: 20 PI: 11 M: 3.9% F: 80.2%	0.2 TOPSOIL: ~2 inches 355.8 LEAN CLAY WITH SAND (CL): very stiff, light brown, low plasticity, dry, root fragments, (RESIDUAL)		
			S-02	4 4 6		Sample S-02 M: 17.0%	stiff, yellowish brown, moist, ferrous staining		
5	350		S-03	6 9 10		Sample S-03 M: 22.7%	very stiff		
			S-04	14 26 50/5"	>>	Sample S-04 M: 17.3%	8.5 347.5 SHALEY LEAN CLAY (CL): hard, brown, low plasticity, moist, (WEATHERED ROCK)		
10	345								
			S-05	38 50/5"	>>	Sample S-05 M: 7.4%	13.5 342.5 WEATHERED SHALE: soft, grayish brown, low plasticity, moist, (WEATHERED ROCK)		
15	340								
			S-06	50/5"	>>	Sample S-06 M: 6.8%	18.9 337.1 Boring Terminated at 18.9 feet.		Groundwater not encountered at time of drilling. Borehole backfilled on date drilled unless otherwise noted. Consistency/Relative Density based on correction factor for Automatic hammer.
20	335								

SAMPLE TYPE ☒ Split Spoon

N-VALUE STANDARD PENETRATION RESISTANCE (AASHTO T-206)
% MOISTURE PERCENT NATURAL MOISTURE CONTENT
▽ GROUNDWATER LEVEL IN THE BOREHOLE AT TIME OF DRILLING
▼ STABILIZED GROUNDWATER LEVEL

REC RECOVERY
RQD ROCK QUALITY DESIGNATION
UD UNDISTURBED
Qu POCKET PENETROMETER UNCONFINED COMPRESSIVE STRENGTH

LL: LIQUID LIMIT **M:** NATURAL MOISTURE CONTENT
PL: PLASTIC LIMIT **F:** PERCENT PASSING NO. 200 SIEVE
PI: PLASTICITY INDEX

LABORATORY TEST PROCEDURES

A brief description of the laboratory tests performed is provided in the following sections.

DESCRIPTION OF SOILS (VISUAL-MANUAL PROCEDURE) (ASTM D2488)

The soil samples were visually examined by our engineer and soil descriptions were provided. Representative samples were then selected and tested in accordance with the aforementioned laboratory-testing program to determine soil classifications and engineering properties. This data was used to correlate our visual descriptions with the Unified Soil Classification System (USCS).

NATURAL MOISTURE CONTENT (ASTM D2216)

Natural moisture contents (M%) were determined on selected samples. The natural moisture content is the ratio, expressed as a percentage, of the weight of water in a given amount of soil to the weight of solid particles.

ATTERBERG LIMITS (ASTM D4318)

The Atterberg Limits test was performed to evaluate the soil's plasticity characteristics. The soil Plasticity Index (PI) is representative of this characteristic and is bracketed by the Liquid Limit (LL) and the Plastic Limit (PL). The Liquid Limit is the moisture content at which the soil will flow as a heavy viscous fluid. The Plastic Limit is the moisture content at which the soil is between "plastic" and the semi-solid stage. The Plasticity Index (PI = LL - PL) is a frequently used indicator for a soil's potential for volume change. Typically, a soil's potential for volume change increases with higher plasticity indices.

MATERIAL FINER THAN NO. 200 SIEVE BY WASHING (ASTM D1140)

Grain-size tests were performed to determine the partial soil particle size distribution. The amount of material finer than the openings on the No. 200 sieve (0.075 mm) was determined by washing soil over the No. 200 sieve. The results of wash #200 tests are presented on the boring logs included in this report and in the table of laboratory test results.

LABORATORY TEST RESULTS

The results of the laboratory testing are presented in the following tables.

BORING NO.	DEPTH	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	% PASSING #200 SIEVE	CLASSIFICATION
B-01	0.5 - 2.0	9.8					
B-01	2.5 - 4.0	18.7					
B-01	5.0 - 6.5	19.2	37	18	19	83	CL
B-01	8.5 - 10.0	15.7					
B-01	13.5 - 14.5	8.4					
B-01	18.5 - 18.7	1.6					
B-02	0.5 - 2.0	4.8					
B-02	2.5 - 4.0	19.4	45	20	25	80	CL
B-02	5.0 - 6.5	15.5					
B-02	8.5 - 9.9	7.3					
B-02	13.5 - 14.5	9.3					
B-03	0.5 - 2.0	3.1					
B-03	2.5 - 4.0	20.3					
B-03	5.0 - 6.5	20.9					
B-03	8.5 - 9.9	12.7					
B-03	13.5 - 14.4	7.8					
B-03	18.5 - 19.3	13.7					
B-04	0.5 - 2.0	3.9	31	20	11	80	CL
B-04	2.5 - 4.0	17.0					
B-04	5.0 - 6.5	22.7					
B-04	8.5 - 9.9	17.3					
B-04	13.5 - 14.4	7.4					
B-04	18.5 - 18.9	6.8					

TABLE L-1: General Soil Classification Test Results

Soils with a Liquid Limit (LL) greater than 50 and Plasticity Index (PI) greater than 25 usually exhibit significant volume change with varying moisture content and are considered to be highly plastic

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a civil engineer may not fulfill the needs of a constructor — a construction contractor — or even another civil engineer. Because each geotechnical- engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. No one except you should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply this report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical-engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

Geotechnical Engineers Base Each Report on a Unique Set of Project-Specific Factors

Geotechnical engineers consider many unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk-management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical-engineering report that was:

- not prepared for you;
- not prepared for your project;
- not prepared for the specific site explored; or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical-engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical-engineering report is based on conditions that existed at the time the geotechnical engineer performed the study. *Do not rely on a geotechnical-engineering report whose adequacy may have been affected by*: the passage of time; man-made events, such as construction on or adjacent to the site; or natural events, such as floods, droughts, earthquakes, or groundwater fluctuations. *Contact the geotechnical engineer before applying this report to determine if it is still reliable.* A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ — sometimes significantly — from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide geotechnical-construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are Not Final

Do not overrely on the confirmation-dependent recommendations included in your report. *Confirmation-dependent recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations *only* by observing actual subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's confirmation-dependent recommendations if that engineer does not perform the geotechnical-construction observation required to confirm the recommendations' applicability.*

A Geotechnical-Engineering Report Is Subject to Misinterpretation

Other design-team members' misinterpretation of geotechnical-engineering reports has resulted in costly

problems. Confront that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Constructors can also misinterpret a geotechnical-engineering report. Confront that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing geotechnical construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical-engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make constructors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give constructors the complete geotechnical-engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise constructors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure constructors have sufficient time* to perform additional study. Only then might you be in a position to give constructors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and constructors fail to recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Environmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform an *environmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold-prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, many mold- prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical- engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; *none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.*

Rely, on Your GBC-Member Geotechnical Engineer for Additional Assistance

Membership in the Geotechnical Business Council of the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project. Confer with you GBC-Member geotechnical engineer for more information.

GEOTECHNICAL BUSINESS COUNCIL
of the Geoprofessional Business Association

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General Conditions of the Contract for Construction

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

High School Band Building

THE OWNER:
(Name, legal status and address)

Greenbrier School District
4 School Drive
Greenbrier, AR 72058

THE ARCHITECT:
(Name, legal status and address)

Jackson Brown Palculict Architects, Inc.
12921 Cantrell Road, Suite 201
Little Rock, AR 72223

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15 CLAIMS AND DISPUTES

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ARTICLE 1 GENERAL PROVISIONS

§ 1.1 Basic Definitions

§ 1.1.1 The Contract Documents

The Contract Documents are enumerated in the Agreement between the Owner and Contractor (hereinafter the Agreement) and consist of the Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement, and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive, or (4) a written order for a minor change in the Work issued by the Architect. Unless specifically enumerated in the Agreement, the Contract Documents do not include the advertisement or invitation to bid, Instructions to Bidders, sample forms, other information furnished by the Owner in anticipation of receiving bids or proposals, the Contractor's bid or proposal, or portions of Addenda relating to bidding or proposal requirements.

§ 1.1.2 The Contract

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Contractor and the Architect or the Architect's consultants, (2) between the Owner and a Subcontractor or a Sub-subcontractor, (3) between the Owner and the Architect or the Architect's consultants, or (4) between any persons or entities other than the Owner and the Contractor. The Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Architect's duties.

§ 1.1.3 The Work

The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment, and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

§ 1.1.4 The Project

The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner and by Separate Contractors.

§ 1.1.5 The Drawings

The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules, and diagrams.

§ 1.1.6 The Specifications

The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

§ 1.1.7 Instruments of Service

Instruments of Service are representations, in any medium of expression now known or later developed, of the tangible and intangible creative work performed by the Architect and the Architect's consultants under their respective professional services agreements. Instruments of Service may include, without limitation, studies, surveys, models, sketches, drawings, specifications, and other similar materials.

§ 1.1.8 Initial Decision Maker

The Initial Decision Maker is the person identified in the Agreement to render initial decisions on Claims in accordance with Section 15.2. The Initial Decision Maker shall not show partiality to the Owner or Contractor and shall not be liable for results of interpretations or decisions rendered in good faith.

§ 1.2 Correlation and Intent of the Contract Documents

§ 1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

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§ 1.2.1.1 The invalidity of any provision of the Contract Documents shall not invalidate the Contract or its remaining provisions. If it is determined that any provision of the Contract Documents violates any law, or is otherwise invalid or unenforceable, then that provision shall be revised to the extent necessary to make that provision legal and enforceable. In such case the Contract Documents shall be construed, to the fullest extent permitted by law, to give effect to the parties' intentions and purposes in executing the Contract.

§ 1.2.2 Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

§ 1.2.3 Unless otherwise stated in the Contract Documents, words that have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

§ 1.3 Capitalization

Terms capitalized in these General Conditions include those that are (1) specifically defined, (2) the titles of numbered articles, or (3) the titles of other documents published by the American Institute of Architects.

§ 1.4 Interpretation

In the interest of brevity the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

§ 1.5 Ownership and Use of Drawings, Specifications, and Other Instruments of Service

§ 1.5.1 The Architect and the Architect's consultants shall be deemed the authors and owners of their respective Instruments of Service, including the Drawings and Specifications, and retain all common law, statutory, and other reserved rights in their Instruments of Service, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and suppliers shall not own or claim a copyright in the Instruments of Service. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with the Project is not to be construed as publication in derogation of the Architect's or Architect's consultants' reserved rights.

§ 1.5.2 The Contractor, Subcontractors, Sub-subcontractors, and suppliers are authorized to use and reproduce the Instruments of Service provided to them, subject to any protocols established pursuant to Sections 1.7 and 1.8, solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and suppliers may not use the Instruments of Service on other projects or for additions to the Project outside the scope of the Work without the specific written consent of the Owner, Architect, and the Architect's consultants.

§ 1.6 Notice

§ 1.6.1 Except as otherwise provided in Section 1.6.2, where the Contract Documents require one party to notify or give notice to the other party, such notice shall be provided in writing to the designated representative of the party to whom the notice is addressed and shall be deemed to have been duly served if delivered in person, by mail, by courier, or by electronic transmission if a method for electronic transmission is set forth in the Agreement.

§ 1.6.2 Notice of Claims as provided in Section 15.1.3 shall be provided in writing and shall be deemed to have been duly served only if delivered to the designated representative of the party to whom the notice is addressed by certified or registered mail, or by courier providing proof of delivery.

§ 1.7 Digital Data Use and Transmission

The parties shall agree upon written protocols governing the transmission and use of, and reliance on, Instruments of Service or any other information or documentation in digital form.

§ 1.8 Building Information Models Use and Reliance

Any use of, or reliance on, all or a portion of a building information model without agreement to written protocols governing the use of, and reliance on, the information contained in the model shall be at the using or relying party's sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building information model, and each of their agents and employees.

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ARTICLE 2 OWNER

§ 2.1 General

§ 2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization. Except as otherwise provided in Section 4.2.1, the Architect does not have such authority. The term "Owner" means the Owner or the Owner's authorized representative.

§ 2.1.2 The Owner shall furnish to the Contractor, within fifteen days after receipt of a written request, information necessary and relevant for the Contractor to evaluate, give notice of, or enforce mechanic's lien rights. Such information shall include a correct statement of the record legal title to the property on which the Project is located, usually referred to as the site, and the Owner's interest therein.

§ 2.2 Evidence of the Owner's Financial Arrangements

§ 2.2.1 Prior to commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract. The Contractor shall have no obligation to commence the Work until the Owner provides such evidence. If commencement of the Work is delayed under this Section 2.2.1, the Contract Time shall be extended appropriately.

§ 2.2.2 Following commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract only if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) the Contractor identifies in writing a reasonable concern regarding the Owner's ability to make payment when due; or (3) a change in the Work materially changes the Contract Sum. If the Owner fails to provide such evidence, as required, within fourteen days of the Contractor's request, the Contractor may immediately stop the Work and, in that event, shall notify the Owner that the Work has stopped. However, if the request is made because a change in the Work materially changes the Contract Sum under (3) above, the Contractor may immediately stop only that portion of the Work affected by the change until reasonable evidence is provided. If the Work is stopped under this Section 2.2.2, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided in the Contract Documents.

§ 2.2.3 After the Owner furnishes evidence of financial arrangements under this Section 2.2, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.

§ 2.2.4 Where the Owner has designated information furnished under this Section 2.2 as "confidential," the Contractor shall keep the information confidential and shall not disclose it to any other person. However, the Contractor may disclose "confidential" information, after seven (7) days' notice to the Owner, where disclosure is required by law, including a subpoena or other form of compulsory legal process issued by a court or governmental entity, or by court or arbitrator(s) order. The Contractor may also disclose "confidential" information to its employees, consultants, sureties, Subcontractors and their employees, Sub-subcontractors, and others who need to know the content of such information solely and exclusively for the Project and who agree to maintain the confidentiality of such information.

§ 2.3 Information and Services Required of the Owner

§ 2.3.1 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

§ 2.3.2 The Owner shall retain an architect lawfully licensed to practice architecture, or an entity lawfully practicing architecture, in the jurisdiction where the Project is located. That person or entity is identified as the Architect in the Agreement and is referred to throughout the Contract Documents as if singular in number.

§ 2.3.3 If the employment of the Architect terminates, the Owner shall employ a successor to whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the Architect.

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§ 2.3.4 The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. The Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work.

§ 2.3.5 The Owner shall furnish information or services required of the Owner by the Contract Documents with reasonable promptness. The Owner shall also furnish any other information or services under the Owner's control and relevant to the Contractor's performance of the Work with reasonable promptness after receiving the Contractor's written request for such information or services.

§ 2.3.6 Unless otherwise provided in the Contract Documents, the Owner shall furnish to the Contractor one copy of the Contract Documents for purposes of making reproductions pursuant to Section 1.5.2.

§ 2.4 Owner's Right to Stop the Work

If the Contractor fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or repeatedly fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Section 6.1.3.

§ 2.5 Owner's Right to Carry Out the Work

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten-day period after receipt of notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such default or neglect. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect and the Architect may, pursuant to Section 9.5.1, withhold or nullify a Certificate for Payment in whole or in part, to the extent reasonably necessary to reimburse the Owner for the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect, or failure. If current and future payments are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner. If the Contractor disagrees with the actions of the Owner or the Architect, or the amounts claimed as costs to the Owner, the Contractor may file a Claim pursuant to Article 15.

ARTICLE 3 CONTRACTOR

§ 3.1 General

§ 3.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Contractor shall be lawfully licensed, if required in the jurisdiction where the Project is located. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term "Contractor" means the Contractor or the Contractor's authorized representative.

§ 3.1.2 The Contractor shall perform the Work in accordance with the Contract Documents.

§ 3.1.3 The Contractor shall not be relieved of its obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Architect in the Architect's administration of the Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor.

§ 3.2 Review of Contract Documents and Field Conditions by Contractor

§ 3.2.1 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed, and correlated personal observations with requirements of the Contract Documents.

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.3.4, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the

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purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

§ 3.2.3 The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, but the Contractor shall promptly report to the Architect any nonconformity discovered by or made known to the Contractor as a request for information in such form as the Architect may require.

§ 3.2.4 If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Architect issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall submit Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, the Contractor shall pay such costs and damages to the Owner, subject to Section 15.1.7, as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or Architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities.

§ 3.3 Supervision and Construction Procedures

§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences, and procedures, and for coordinating all portions of the Work under the Contract. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences, or procedures, the Contractor shall evaluate the jobsite safety thereof and shall be solely responsible for the jobsite safety of such means, methods, techniques, sequences, or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely notice to the Owner and Architect, and shall propose alternative means, methods, techniques, sequences, or procedures. The Architect shall evaluate the proposed alternative solely for conformance with the design intent for the completed construction. Unless the Architect objects to the Contractor's proposed alternative, the Contractor shall perform the Work using its alternative means, methods, techniques, sequences, or procedures.

§ 3.3.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of the Work for, or on behalf of, the Contractor or any of its Subcontractors.

§ 3.3.3 The Contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work.

§ 3.4 Labor and Materials

§ 3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

§ 3.4.2 Except in the case of minor changes in the Work approved by the Architect in accordance with Section 3.12.8 or ordered by the Architect in accordance with Section 7.4, the Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect and in accordance with a Change Order or Construction Change Directive.

§ 3.4.3 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not properly skilled in tasks assigned to them.

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§ 3.5 Warranty

§ 3.5.1 The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

§ 3.5.2 All material, equipment, or other special warranties required by the Contract Documents shall be issued in the name of the Owner, or shall be transferable to the Owner, and shall commence in accordance with Section 9.8.4.

§ 3.6 Taxes

The Contractor shall pay sales, consumer, use and similar taxes for the Work provided by the Contractor that are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.

§ 3.7 Permits, Fees, Notices and Compliance with Laws

§ 3.7.1 Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit as well as for other permits, fees, licenses, and inspections by government agencies necessary for proper execution and completion of the Work that are customarily secured after execution of the Contract and legally required at the time bids are received or negotiations concluded.

§ 3.7.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work.

§ 3.7.3 If the Contractor performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

§ 3.7.4 Concealed or Unknown Conditions

If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than 14 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if the Architect determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend that an equitable adjustment be made in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and Contractor, stating the reasons. If either party disputes the Architect's determination or recommendation, that party may submit a Claim as provided in Article 15.

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

§ 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,

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but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

§ 3.8.2 Unless otherwise provided in the Contract Documents,

.1 allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;

.2 Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit, and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and

.3 whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.

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

§ 3.9 Superintendent

§ 3.9.1 The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor.

§ 3.9.2 The Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the name and qualifications of a proposed superintendent. Within 14 days of receipt of the information, the Architect may notify the Contractor, stating whether the Owner or the Architect (1) has reasonable objection to the proposed superintendent or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 3.9.3 The Contractor shall not employ a proposed superintendent to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not change the superintendent without the Owner's consent, which shall not unreasonably be withheld or delayed.

§ 3.10 Contractor's Construction and Submittal Schedules

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall contain detail appropriate for the Project, including (1) the date of commencement of the Work, interim schedule milestone dates, and the date of Substantial Completion; (2) an apportionment of the Work by construction activity; and (3) the time required for completion of each portion of the Work. The schedule shall provide for the orderly progression of the Work to completion and shall not exceed time limits current under the Contract Documents. The schedule shall be revised at appropriate intervals as required by the conditions of the Work and Project.

§ 3.10.2 The Contractor, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, shall submit a submittal schedule for the Architect's approval. The Architect's approval shall not be unreasonably delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Architect reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, or fails to provide submittals in accordance with the approved submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

§ 3.10.3 The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner and Architect.

§ 3.11 Documents and Samples at the Site

The Contractor shall make available, at the Project site, the Contract Documents, including Change Orders, Construction Change Directives, and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and the approved Shop Drawings, Product Data, Samples, and similar required submittals. These shall be in electronic form or paper copy, available to the Architect and Owner, and delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as

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constructed.

§ 3.12 Shop Drawings, Product Data and Samples

§ 3.12.1 Shop Drawings are drawings, diagrams, schedules, and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier, or distributor to illustrate some portion of the Work.

§ 3.12.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams, and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

§ 3.12.3 Samples are physical examples that illustrate materials, equipment, or workmanship, and establish standards by which the Work will be judged.

§ 3.12.4 Shop Drawings, Product Data, Samples, and similar submittals are not Contract Documents. Their purpose is to demonstrate how the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect is subject to the limitations of Section 4.2.7. Informational submittals upon which the Architect is not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Architect without action.

§ 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve, and submit to the Architect, Shop Drawings, Product Data, Samples, and similar submittals required by the Contract Documents, in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of Separate Contractors.

§ 3.12.6 By submitting Shop Drawings, Product Data, Samples, and similar submittals, the Contractor represents to the Owner and Architect that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so, and (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

§ 3.12.7 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples, or similar submittals, until the respective submittal has been approved by the Architect.

§ 3.12.8 The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from the requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples, or similar submittals, unless the Contractor has specifically notified the Architect of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples, or similar submittals, by the Architect's approval thereof.

§ 3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples, or similar submittals, to revisions other than those requested by the Architect on previous submittals. In the absence of such notice, the Architect's approval of a resubmission shall not apply to such revisions.

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures. The Contractor shall not be required to provide professional services in violation of applicable law.

§ 3.12.10.1 If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall be entitled to rely upon the adequacy and accuracy of the performance and design criteria provided in the Contract Documents. The

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

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

§ 3.13 Use of Site

The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, lawful orders of public authorities, and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

§ 3.14 Cutting and Patching

§ 3.14.1 The Contractor shall be responsible for cutting, fitting, or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, fitting, or patching shall be restored to the condition existing prior to the cutting, fitting, or patching, unless otherwise required by the Contract Documents.

§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or Separate Contractors by cutting, patching, or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter construction by the Owner or a Separate Contractor except with written consent of the Owner and of the Separate Contractor. Consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold, from the Owner or a Separate Contractor, its consent to cutting or otherwise altering the Work.

§ 3.15 Cleaning Up

§ 3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials and rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery, and surplus materials from and about the Project.

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and the Owner shall be entitled to reimbursement from the Contractor.

§ 3.16 Access to Work

The Contractor shall provide the Owner and Architect with access to the Work in preparation and progress wherever located.

§ 3.17 Royalties, Patents and Copyrights

The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Architect harmless from loss on account thereof, but shall not be responsible for defense or loss when a particular design, process, or product of a particular manufacturer or manufacturers is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications, or other documents prepared by the Owner or Architect. However, if an infringement of a copyright or patent is discovered by, or made known to, the Contractor, the Contractor shall be responsible for the loss unless the information is promptly furnished to the Architect.

§ 3.18 Indemnification

§ 3.18.1 To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the

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Work, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss, or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Section 3.18.

§ 3.18.2 In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, the indemnification obligation under Section 3.18.1 shall not be limited by a limitation on amount or type of damages, compensation, or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts, or other employee benefit acts.

ARTICLE 4 ARCHITECT

§ 4.1 General

§ 4.1.1 The Architect is the person or entity retained by the Owner pursuant to Section 2.3.2 and identified as such in the Agreement.

§ 4.1.2 Duties, responsibilities, and limitations of authority of the Architect as set forth in the Contract Documents shall not be restricted, modified, or extended without written consent of the Owner, Contractor, and Architect. Consent shall not be unreasonably withheld.

§ 4.2 Administration of the Contract

§ 4.2.1 The Architect will provide administration of the Contract as described in the Contract Documents and will be an Owner's representative during construction until the date the Architect issues the final Certificate for Payment. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

§ 4.2.2 The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents.

§ 4.2.3 On the basis of the site visits, the Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and promptly report to the Owner (1) known deviations from the Contract Documents, (2) known deviations from the most recent construction schedule submitted by the Contractor, and (3) defects and deficiencies observed in the Work. The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of, and will not be responsible for acts or omissions of, the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

§ 4.2.4 Communications

The Owner and Contractor shall include the Architect in all communications that relate to or affect the Architect's services or professional responsibilities. The Owner shall promptly notify the Architect of the substance of any direct communications between the Owner and the Contractor otherwise relating to the Project. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and suppliers shall be through the Contractor. Communications by and with Separate Contractors shall be through the Owner. The Contract Documents may specify other communication protocols.

§ 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.

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§ 4.2.6 The Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require inspection or testing of the Work in accordance with Sections 13.4.2 and 13.4.3, whether or not the Work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, suppliers, their agents or employees, or other persons or entities performing portions of the Work.

§ 4.2.7 The Architect will review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data, and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5, and 3.12. The Architect's review shall not constitute approval of safety precautions or of any construction means, methods, techniques, sequences, or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

§ 4.2.8 The Architect will prepare Change Orders and Construction Change Directives, and may order minor changes in the Work as provided in Section 7.4. The Architect will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

§ 4.2.9 The Architect will conduct inspections to determine the date or dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion pursuant to Section 9.8; receive and forward to the Owner, for the Owner's review and records, written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10; and issue a final Certificate for Payment pursuant to Section 9.10.

§ 4.2.10 If the Owner and Architect agree, the Architect will provide one or more Project representatives to assist in carrying out the Architect's responsibilities at the site. The Owner shall notify the Contractor of any change in the duties, responsibilities and limitations of authority of the Project representatives.

§ 4.2.11 The Architect will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness.

§ 4.2.12 Interpretations and decisions of the Architect will be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and decisions, the Architect will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either, and will not be liable for results of interpretations or decisions rendered in good faith.

§ 4.2.13 The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

§ 4.2.14 The Architect will review and respond to requests for information about the Contract Documents. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

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.

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§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

§ 5.2 Award of Subcontracts and Other Contracts for Portions of the Work

§ 5.2.1 Unless otherwise stated in the Contract Documents, the Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the persons or entities proposed for each principal portion of the Work, including those who are to furnish materials or equipment fabricated to a special design. Within 14 days of receipt of the information, the Architect may notify the Contractor whether the Owner or the Architect (1) has reasonable objection to any such proposed person or entity or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.3 If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no reasonable objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

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

§ 5.3 Subcontractual Relations

By appropriate written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work that the Contractor, by these Contract Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies, and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

§ 5.4 Contingent Assignment of Subcontracts

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

- **.1** assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor; and
- **.2** assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract.

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§ 5.4.2 Upon such assignment, if the Work has been suspended for more than 30 days, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension.

§ 5.4.3 Upon assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity. If the Owner assigns the subcontract to a successor contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor contractor's obligations under the subcontract.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

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

§ 6.1.1 The term "Separate Contractor(s)" shall mean other contractors retained by the Owner under separate agreements. The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and with Separate Contractors retained under Conditions of the Contract substantially similar to those of this Contract, including those provisions of the Conditions of the Contract related to insurance and waiver of subrogation.

§ 6.1.2 When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

§ 6.1.3 The Owner shall provide for coordination of the activities of the Owner's own forces and of each Separate Contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with any Separate Contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to its construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, Separate Contractors, and the Owner until subsequently revised.

§ 6.1.4 Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces or with Separate Contractors, the Owner or its Separate Contractors shall have the same obligations and rights that the Contractor has under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6, and Articles 10, 11, and 12.

§ 6.2 Mutual Responsibility

§ 6.2.1 The Contractor shall afford the Owner and Separate Contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a Separate Contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly notify the Architect of apparent discrepancies or defects in the construction or operations by the Owner or Separate Contractor that would render it unsuitable for proper execution and results of the Contractor's Work. Failure of the Contractor to notify the Architect of apparent discrepancies or defects prior to proceeding with the Work shall constitute an acknowledgment that the Owner's or Separate Contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work. The Contractor shall not be responsible for discrepancies or defects in the construction or operations by the Owner or Separate Contractor that are not apparent.

§ 6.2.3 The Contractor shall reimburse the Owner for costs the Owner incurs that are payable to a Separate Contractor because of the Contractor's delays, improperly timed activities or defective construction. The Owner shall be responsible to the Contractor for costs the Contractor incurs because of a Separate Contractor's delays, improperly timed activities, damage to the Work or defective construction.

§ 6.2.4 The Contractor shall promptly remedy damage that the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or Separate Contractor as provided in Section 10.2.5.

§ 6.2.5 The Owner and each Separate Contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

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§ 6.3 Owner's Right to Clean Up

If a dispute arises among the Contractor, Separate Contractors, and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Architect will allocate the cost among those responsible.

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 General

§ 7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

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

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents. The Contractor shall proceed promptly with changes in the Work, unless otherwise provided in the Change Order, Construction Change Directive, or order for a minor change in the Work.

§ 7.2 Change Orders

§ 7.2.1 A Change Order is a written instrument prepared by the Architect and signed by the Owner, Contractor, and Architect stating their agreement upon all of the following:

.1 The change in the Work;

.2 The amount of the adjustment, if any, in the Contract Sum; and

.3 The extent of the adjustment, if any, in the Contract Time.

§ 7.3 Construction Change Directives

§ 7.3.1 A Construction Change Directive is a written order prepared by the Architect and signed by the Owner and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions, or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

§ 7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

§ 7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

.1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;

.2 Unit prices stated in the Contract Documents or subsequently agreed upon;

.3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or

.4 As provided in Section 7.3.4.

§ 7.3.4 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.4 shall be limited to the following:

.1 Costs of labor, including applicable payroll taxes, fringe benefits required by agreement or custom, workers' compensation insurance, and other employee costs approved by the Architect;

.2 Costs of materials, supplies, and equipment, including cost of transportation, whether incorporated or consumed;

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.3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;

.4 Costs of premiums for all bonds and insurance, permit fees, and sales, use, or similar taxes, directly related to the change; and

.5 Costs of supervision and field office personnel directly attributable to the change.

§ 7.3.5 If the Contractor disagrees with the adjustment in the Contract Time, the Contractor may make a Claim in accordance with applicable provisions of Article 15.

§ 7.3.6 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

§ 7.3.7 A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Architect. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for Work completed under the Construction Change Directive in Applications for Payment. The Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Architect determines, in the Architect's professional judgment, to be reasonably justified. The Architect's interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15.

§ 7.3.10 When the Owner and Contractor agree with a determination made by the Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and the Architect will prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

§ 7.4 Minor Changes in the Work

The Architect may order minor changes in the Work that are consistent with the intent of the Contract Documents and do not involve an adjustment in the Contract Sum or an extension of the Contract Time. The Architect's order for minor changes shall be in writing. If the Contractor believes that the proposed minor change in the Work will affect the Contract Sum or Contract Time, the Contractor shall notify the Architect and shall not proceed to implement the change in the Work. If the Contractor performs the Work set forth in the Architect's order for a minor change without prior notice to the Architect that such change will affect the Contract Sum or Contract Time, the Contractor waives any adjustment to the Contract Sum or extension of the Contract Time.

ARTICLE 8 TIME

§ 8.1 Definitions

§ 8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

§ 8.1.2 The date of commencement of the Work is the date established in the Agreement.

§ 8.1.3 The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8.

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

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§ 8.2 Progress and Completion

§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement, the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, commence the Work prior to the effective date of insurance required to be furnished by the Contractor and Owner.

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

§ 8.3 Delays and Extensions of Time

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by (1) an act or neglect of the Owner or Architect, of an employee of either, or of a Separate Contractor; (2) by changes ordered in the Work; (3) by labor disputes, fire, unusual delay in deliveries, unavoidable casualties, adverse weather conditions documented in accordance with Section 15.1.6.2, or other causes beyond the Contractor's control; (4) by delay authorized by the Owner pending mediation and binding dispute resolution; or (5) by other causes that the Contractor asserts, and the Architect determines, justify delay, then the Contract Time shall be extended for such reasonable time as the Architect may determine.

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

§ 8.3.3 This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 Contract Sum

§ 9.1.1 The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

§ 9.1.2 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed so that application of such unit prices to the actual quantities causes substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

§ 9.2 Schedule of Values

Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, the Contractor shall submit a schedule of values to the Architect before the first Application for Payment, allocating the entire Contract Sum to the various portions of the Work. The schedule of values shall be prepared in the form, and supported by the data to substantiate its accuracy, required by the Architect. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment. Any changes to the schedule of values shall be submitted to the Architect and supported by such data to substantiate its accuracy as the Architect may require, and unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's subsequent Applications for Payment.

§ 9.3 Applications for Payment

§ 9.3.1 At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 9.2, for completed portions of the Work. The application shall be notarized, if required, and supported by all data substantiating the Contractor's right to payment that the Owner or Architect require, such as copies of requisitions, and releases and waivers of liens from Subcontractors and suppliers, and shall reflect retainage if provided for in the Contract Documents.

§ 9.3.1.1 As provided in Section 7.3.9, such applications may include requests for payment on account of changes in the Work that have been properly authorized by Construction Change Directives, or by interim determinations of the Architect, but not yet included in Change Orders.

§ 9.3.1.2 Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or supplier, unless such Work has been performed by others

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whom the Contractor intends to pay.

§ 9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage, and transportation to the site, for such materials and equipment stored off the site.

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information, and belief, be free and clear of liens, claims, security interests, or encumbrances, in favor of the Contractor, Subcontractors, suppliers, or other persons or entities that provided labor, materials, and equipment relating to the Work.

§ 9.4 Certificates for Payment

§ 9.4.1 The Architect will, within seven days after receipt of the Contractor's Application for Payment, either (1) issue to the Owner a Certificate for Payment in the full amount of the Application for Payment, with a copy to the Contractor; or (2) issue to the Owner a Certificate for Payment for such amount as the Architect determines is properly due, and notify the Contractor and Owner of the Architect's reasons for withholding certification in part as provided in Section 9.5.1; or (3) withhold certification of the entire Application for Payment, and notify the Contractor and Owner of the Architect's reason for withholding certification in whole as provided in Section 9.5.1.

§ 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's evaluation of the Work and the data in the Application for Payment, that, to the best of the Architect's knowledge, information, and belief, the Work has progressed to the point indicated, the quality of the Work is in accordance with the Contract Documents, and that the Contractor is entitled to payment in the amount certified. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion, and to specific qualifications expressed by the Architect. However, the issuance of a Certificate for Payment will not be a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work; (2) reviewed construction means, methods, techniques, sequences, or procedures; (3) reviewed copies of requisitions received from Subcontractors and suppliers and other data requested by the Owner to substantiate the Contractor's right to payment; or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

§ 9.5 Decisions to Withhold Certification

§ 9.5.1 The Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of

- **.1** defective Work not remedied;
- **.2** third party claims filed or reasonable evidence indicating probable filing of such claims, unless security acceptable to the Owner is provided by the Contractor;
- **.3** failure of the Contractor to make payments properly to Subcontractors or suppliers for labor, materials or equipment;
- **.4** reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
- **.5** damage to the Owner or a Separate Contractor;
- **.6** reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay;

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or

.7 repeated failure to carry out the Work in accordance with the Contract Documents.

§ 9.5.2 When either party disputes the Architect's decision regarding a Certificate for Payment under Section 9.5.1, in whole or in part, that party may submit a Claim in accordance with Article 15.

§ 9.5.3 When the reasons for withholding certification are removed, certification will be made for amounts previously withheld.

§ 9.5.4 If the Architect withholds certification for payment under Section 9.5.1.3, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or supplier to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Contractor shall reflect such payment on its next Application for Payment.

§ 9.6 Progress Payments

§ 9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall so notify the Architect.

§ 9.6.2 The Contractor shall pay each Subcontractor, no later than seven days after receipt of payment from the Owner, the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

§ 9.6.3 The Architect will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect and Owner on account of portions of the Work done by such Subcontractor.

§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors and suppliers to ascertain whether they have been properly paid. Neither the Owner nor Architect shall have an obligation to pay, or to see to the payment of money to, a Subcontractor or supplier, except as may otherwise be required by law.

§ 9.6.5 The Contractor's payments to suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

§ 9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 9.6.7 Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors or provided by suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, create any fiduciary liability or tort liability on the part of the Contractor for breach of trust, or entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

§ 9.6.8 Provided the Owner has fulfilled its payment obligations under the Contract Documents, the Contractor shall defend and indemnify the Owner from all loss, liability, damage or expense, including reasonable attorney's fees and litigation expenses, arising out of any lien claim or other claim for payment by any Subcontractor or supplier of any tier. Upon receipt of notice of a lien claim or other claim for payment, the Owner shall notify the Contractor. If approved by the applicable court, when required, the Contractor may substitute a surety bond for the property against which the lien or other claim for payment has been asserted.

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§ 9.7 Failure of Payment

If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contract Documents, the amount certified by the Architect or awarded by binding dispute resolution, then the Contractor may, upon seven additional days' notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided for in the Contract Documents.

§ 9.8 Substantial Completion

§ 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use.

§ 9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

§ 9.8.3 Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion.

§ 9.8.4 When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion; establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance; and fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

§ 9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in the Certificate. Upon such acceptance, and consent of surety if any, the Owner shall make payment of retainage applying to the Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

§ 9.9 Partial Occupancy or Use

§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect.

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

§ 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.

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§ 9.10 Final Completion and Final Payment

§ 9.10.1 Upon receipt of the Contractor's notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection. When the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect, (3) a written statement that the Contractor knows of no reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment, (5) documentation of any special warranties, such as manufacturers' warranties or specific Subcontractor warranties, and (6) if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts and releases and waivers of liens, claims, security interests, or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien, claim, security interest, or encumbrance. If a lien, claim, security interest, or encumbrance remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging the lien, claim, security interest, or encumbrance, including all costs and reasonable attorneys' fees.

§ 9.10.3 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed, corrected, and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of the surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

§ 9.10.4 The making of final payment shall constitute a waiver of Claims by the Owner except those arising from

- **.1** liens, Claims, security interests, or encumbrances arising out of the Contract and unsettled;
- **.2** failure of the Work to comply with the requirements of the Contract Documents;
- **.3** terms of special warranties required by the Contract Documents; or
- **.4** audits performed by the Owner, if permitted by the Contract Documents, after final payment.

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor, or a supplier, shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 Safety Precautions and Programs

The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Contract.

§ 10.2 Safety of Persons and Property

§ 10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury, or loss to

- **.1** employees on the Work and other persons who may be affected thereby;

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.2 the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor, a Subcontractor, or a Sub-subcontractor; and

.3 other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction.

§ 10.2.2 The Contractor shall comply with, and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities, bearing on safety of persons or property or their protection from damage, injury, or loss.

§ 10.2.3 The Contractor shall implement, erect, and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards; promulgating safety regulations; and notifying the owners and users of adjacent sites and utilities of the safeguards.

§ 10.2.4 When use or storage of explosives or other hazardous materials or equipment, or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3. The Contractor may make a Claim for the cost to remedy the damage or loss to the extent such damage or loss is attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

§ 10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and Architect.

§ 10.2.7 The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition.

§ 10.2.8 Injury or Damage to Person or Property

If either party suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, notice of the injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

§ 10.3 Hazardous Materials and Substances

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials or substances. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and notify the Owner and Architect of the condition.

§ 10.3.2 Upon receipt of the Contractor's notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of the material or substance or who are to perform the task of removal or safe containment of the material or substance. The Contractor and the Architect will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed

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by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable additional costs of shutdown, delay, and start-up.

§ 10.3.3 To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), except to the extent that such damage, loss, or expense is due to the fault or negligence of the party seeking indemnity.

§ 10.3.4 The Owner shall not be responsible under this Section 10.3 for hazardous materials or substances the Contractor brings to the site unless such materials or substances are required by the Contract Documents. The Owner shall be responsible for hazardous materials or substances required by the Contract Documents, except to the extent of the Contractor's fault or negligence in the use and handling of such materials or substances.

§ 10.3.5 The Contractor shall reimburse the Owner for the cost and expense the Owner incurs (1) for remediation of hazardous materials or substances the Contractor brings to the site and negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner's fault or negligence.

§ 10.3.6 If, without negligence on the part of the Contractor, the Contractor is held liable by a government agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall reimburse the Contractor for all cost and expense thereby incurred.

§ 10.4 Emergencies

In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury, or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7.

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 Contractor's Insurance and Bonds

§ 11.1.1 The Contractor shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Contractor shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Owner, Architect, and Architect's consultants shall be named as additional insureds under the Contractor's commercial general liability policy or as otherwise described in the Contract Documents.

§ 11.1.2 The Contractor shall provide surety bonds of the types, for such penal sums, and subject to such terms and conditions as required by the Contract Documents. The Contractor shall purchase and maintain the required bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 11.1.3 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

§ 11.1.4 Notice of Cancellation or Expiration of Contractor's Required Insurance. Within three (3) business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by the Contract Documents, the Contractor shall provide notice to the Owner of such impending or actual cancellation or expiration. Upon receipt of notice from the Contractor, the Owner shall, unless the lapse in coverage arises from an act or omission of the Owner, have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by the Contractor. The furnishing of notice by the Contractor shall not relieve

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the Contractor of any contractual obligation to provide any required coverage.

§ 11.2 Owner's Insurance

§ 11.2.1 The Owner shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Owner shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located.

§ 11.2.2 Failure to Purchase Required Property Insurance. If the Owner fails to purchase and maintain the required property insurance, with all of the coverages and in the amounts described in the Agreement or elsewhere in the Contract Documents, the Owner shall inform the Contractor in writing prior to commencement of the Work. Upon receipt of notice from the Owner, the Contractor may delay commencement of the Work and may obtain insurance that will protect the interests of the Contractor, Subcontractors, and Sub-Subcontractors in the Work. When the failure to provide coverage has been cured or resolved, the Contract Sum and Contract Time shall be equitably adjusted. In the event the Owner fails to procure coverage, the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent the loss to the Owner would have been covered by the insurance to have been procured by the Owner. The cost of the insurance shall be charged to the Owner by a Change Order. If the Owner does not provide written notice, and the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain the required insurance, the Owner shall reimburse the Contractor for all reasonable costs and damages attributable thereto.

§ 11.2.3 Notice of Cancellation or Expiration of Owner's Required Property Insurance. Within three (3) business days of the date the Owner becomes aware of an impending or actual cancellation or expiration of any property insurance required by the Contract Documents, the Owner shall provide notice to the Contractor of such impending or actual cancellation or expiration. Unless the lapse in coverage arises from an act or omission of the Contractor: (1) the Contractor, upon receipt of notice from the Owner, shall have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by either the Owner or the Contractor; (2) the Contract Time and Contract Sum shall be equitably adjusted; and (3) the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent any loss to the Owner would have been covered by the insurance had it not expired or been cancelled. If the Contractor purchases replacement coverage, the cost of the insurance shall be charged to the Owner by an appropriate Change Order. The furnishing of notice by the Owner shall not relieve the Owner of any contractual obligation to provide required insurance.

§ 11.3 Waivers of Subrogation

§ 11.3.1 The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents, and employees, each of the other; (2) the Architect and Architect's consultants; and (3) Separate Contractors, if any, and any of their subcontractors, sub-subcontractors, agents, and employees, for damages caused by fire, or other causes of loss, to the extent those losses are covered by property insurance required by the Agreement or other property insurance applicable to the Project, except such rights as they have to proceeds of such insurance. The Owner or Contractor, as appropriate, shall require similar written waivers in favor of the individuals and entities identified above from the Architect, Architect's consultants, Separate Contractors, subcontractors, and sub-subcontractors. The policies of insurance purchased and maintained by each person or entity agreeing to waive claims pursuant to this section 11.3.1 shall not prohibit this waiver of subrogation. This waiver of subrogation shall be effective as to a person or entity (1) even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, (2) even though that person or entity did not pay the insurance premium directly or indirectly, or (3) whether or not the person or entity had an insurable interest in the damaged property.

§ 11.3.2 If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, to the extent permissible by such policies, the Owner waives all rights in accordance with the terms of Section 11.3.1 for damages caused by fire or other causes of loss covered by this separate property insurance.

§ 11.4 Loss of Use, Business Interruption, and Delay in Completion Insurance

The Owner, at the Owner's option, may purchase and maintain insurance that will protect the Owner against loss of use of the Owner's property, or the inability to conduct normal operations, due to fire or other causes of loss. The Owner waives all rights of action against the Contractor and Architect for loss of use of the Owner's property, due to

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fire or other hazards however caused.

§11.5 Adjustment and Settlement of Insured Loss

§ 11.5.1 A loss insured under the property insurance required by the Agreement shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.5.2. The Owner shall pay the Architect and Contractor their just shares of insurance proceeds received by the Owner, and by appropriate agreements the Architect and Contractor shall make payments to their consultants and Subcontractors in similar manner.

§ 11.5.2 Prior to settlement of an insured loss, the Owner shall notify the Contractor of the terms of the proposed settlement as well as the proposed allocation of the insurance proceeds. The Contractor shall have 14 days from receipt of notice to object to the proposed settlement or allocation of the proceeds. If the Contractor does not object, the Owner shall settle the loss and the Contractor shall be bound by the settlement and allocation. Upon receipt, the Owner shall deposit the insurance proceeds in a separate account and make the appropriate distributions. Thereafter, if no other agreement is made or the Owner does not terminate the Contract for convenience, the Owner and Contractor shall execute a Change Order for reconstruction of the damaged or destroyed Work in the amount allocated for that purpose. If the Contractor timely objects to either the terms of the proposed settlement or the allocation of the proceeds, the Owner may proceed to settle the insured loss, and any dispute between the Owner and Contractor arising out of the settlement or allocation of the proceeds shall be resolved pursuant to Article 15. Pending resolution of any dispute, the Owner may issue a Construction Change Directive for the reconstruction of the damaged or destroyed Work.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 Uncovering of Work

§ 12.1.1 If a portion of the Work is covered contrary to the Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Architect, be uncovered for the Architect's examination and be replaced at the Contractor's expense without change in the Contract Time.

§ 12.1.2 If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, the Contractor shall be entitled to an equitable adjustment to the Contract Sum and Contract Time as may be appropriate. If such Work is not in accordance with the Contract Documents, the costs of uncovering the Work, and the cost of correction, shall be at the Contractor's expense.

§ 12.2 Correction of Work

§ 12.2.1 Before Substantial Completion

The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, discovered before Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect's services and expenses made necessary thereby, shall be at the Contractor's expense.

§ 12.2.2 After Substantial Completion

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of any applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of notice from the Owner to do so, unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.5.

§ 12.2.2.2 The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

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§ 12.2.2.3 The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.

§ 12.2.3 The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

§ 12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction of the Owner or Separate Contractors, whether completed or partially completed, caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

§ 12.2.5 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

§ 12.3 Acceptance of Nonconforming Work

If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 Governing Law

The Contract shall be governed by the law of the place where the Project is located, excluding that jurisdiction's choice of law rules. If the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.

§ 13.2 Successors and Assigns

§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns, and legal representatives to covenants, agreements, and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project, if the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate the assignment.

§ 13.3 Rights and Remedies

§ 13.3.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights, and remedies otherwise imposed or available by law.

§ 13.3.2 No action or failure to act by the Owner, Architect, or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed upon in writing.

§ 13.4 Tests and Inspections

§ 13.4.1 Tests, inspections, and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules, and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections, and 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

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approvals where building codes or applicable laws or regulations so require.

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

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

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

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

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

§ 13.5 Interest

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

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor

§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, for any of the following reasons:

- **.1** Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;
- **.2** An act of government, such as a declaration of national emergency, that requires all Work to be stopped;
- **.3** Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or
- **.4** The Owner has failed to furnish to the Contractor reasonable evidence as required by Section 2.2.

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, repeated suspensions, delays, or interruptions of the entire Work by the Owner as described in Section 14.3, constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, as well as reasonable overhead and profit on Work not executed, and costs incurred by reason of such termination.

§ 14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, or their agents or employees or any other persons or entities performing portions of the Work because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in

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Section 14.1.3.

§ 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may terminate the Contract if the Contractor

.1 repeatedly refuses or fails to supply enough properly skilled workers or proper materials;

.2 fails to make payment to Subcontractors or suppliers in accordance with the respective agreements between the Contractor and the Subcontractors or suppliers;

.3 repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or

.4 otherwise is guilty of substantial breach of a provision of the Contract Documents.

§ 14.2.2 When any of the reasons described in Section 14.2.1 exist, and upon certification by the Architect that sufficient cause exists to justify such action, the Owner may, without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

.1 Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;

.2 Accept assignment of subcontracts pursuant to Section 5.4; and

.3 Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Initial Decision Maker, upon application, and this obligation for payment shall survive termination of the Contract.

§ 14.3 Suspension by the Owner for Convenience

§ 14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work, in whole or in part for such period of time as the Owner may determine.

§ 14.3.2 The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay, or interruption under Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent

.1 that performance is, was, or would have been, so suspended, delayed, or interrupted, by another cause for which the Contractor is responsible; or

.2 that an equitable adjustment is made or denied under another provision of the Contract.

§ 14.4 Termination by the Owner for Convenience

§ 14.4.1 The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

§ 14.4.2 Upon receipt of notice from the Owner of such termination for the Owner's convenience, the Contractor shall

.1 cease operations as directed by the Owner in the notice;

.2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and

.3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

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§ 14.4.3 In case of such termination for the Owner's convenience, the Owner shall pay the Contractor for Work properly executed; costs incurred by reason of the termination, including costs attributable to termination of Subcontracts; and the termination fee, if any, set forth in the Agreement.

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 Claims

§ 15.1.1 Definition

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, a change in the Contract Time, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim. This Section 15.1.1 does not require the Owner to file a Claim in order to impose liquidated damages in accordance with the Contract Documents.

§ 15.1.2 Time Limits on Claims

The Owner and Contractor shall commence all Claims and causes of action against the other and arising out of or related to the Contract, whether in contract, tort, breach of warranty or otherwise, in accordance with the requirements of the binding dispute resolution method selected in the Agreement and within the period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive all Claims and causes of action not commenced in accordance with this Section 15.1.2.

§ 15.1.3 Notice of Claims

§ 15.1.3.1 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered prior to expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party under this Section 15.1.3.1 shall be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

§ 15.1.3.2 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party. In such event, no decision by the Initial Decision Maker is required.

§ 15.1.4 Continuing Contract Performance

§ 15.1.4.1 Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

§ 15.1.4.2 The Contract Sum and Contract Time shall be adjusted in accordance with the Initial Decision Maker's decision, subject to the right of either party to proceed in accordance with this Article 15. The Architect will issue Certificates for Payment in accordance with the decision of the Initial Decision Maker.

§ 15.1.5 Claims for Additional Cost

If the Contractor wishes to make a Claim for an increase in the Contract Sum, notice as provided in Section 15.1.3 shall be given before proceeding to execute the portion of the Work that is the subject of the Claim. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

§ 15.1.6 Claims for Additional Time

§ 15.1.6.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, notice as provided in Section 15.1.3 shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary.

§ 15.1.6.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated, and had an adverse effect on the scheduled construction.

§ 15.1.7 Waiver of Claims for Consequential Damages

The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes

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.1 damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and

.2 damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit, except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this Section 15.1.7 shall be deemed to preclude assessment of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

§ 15.2 Initial Decision

§ 15.2.1 Claims, excluding those where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2 or arising under Sections 10.3, 10.4, and 11.5, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to mediation of any Claim. If an initial decision has not been rendered within 30 days after the Claim has been referred to the Initial Decision Maker, the party asserting the Claim may demand mediation and binding dispute resolution without a decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

§ 15.2.2 The Initial Decision Maker will review Claims and within ten days of the receipt of a Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Initial Decision Maker is unable to resolve the Claim if the Initial Decision Maker lacks sufficient information to evaluate the merits of the Claim or if the Initial Decision Maker concludes that, in the Initial Decision Maker's sole discretion, it would be inappropriate for the Initial Decision Maker to resolve the Claim.

§ 15.2.3 In evaluating Claims, the Initial Decision Maker may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Initial Decision Maker in rendering a decision. The Initial Decision Maker may request the Owner to authorize retention of such persons at the Owner's expense.

§ 15.2.4 If the Initial Decision Maker requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of the request, and shall either (1) provide a response on the requested supporting data, (2) advise the Initial Decision Maker when the response or supporting data will be furnished, or (3) advise the Initial Decision Maker that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Initial Decision Maker will either reject or approve the Claim in whole or in part.

§ 15.2.5 The Initial Decision Maker will render an initial decision approving or rejecting the Claim, or indicating that the Initial Decision Maker is unable to resolve the Claim. This initial decision shall (1) be in writing; (2) state the reasons therefor; and (3) notify the parties and the Architect, if the Architect is not serving as the Initial Decision Maker, of any change in the Contract Sum or Contract Time or both. The initial decision shall be final and binding on the parties but subject to mediation and, if the parties fail to resolve their dispute through mediation, to binding dispute resolution.

§ 15.2.6 Either party may file for mediation of an initial decision at any time, subject to the terms of Section 15.2.6.1.

§ 15.2.6.1 Either party may, within 30 days from the date of receipt of an initial decision, demand in writing that the other party file for mediation. If such a demand is made and the party receiving the demand fails to file for mediation within 30 days after receipt thereof, then both parties waive their rights to mediate or pursue binding dispute resolution proceedings with respect to the initial decision.

§ 15.2.7 In the event of a Claim against the Contractor, the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Owner

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may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

§ 15.2.8 If a Claim relates to or is the subject of a mechanic's lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines.

§ 15.3 Mediation

§ 15.3.1 Claims, disputes, or other matters in controversy arising out of or related to the Contract, except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.7, shall be subject to mediation as a condition precedent to binding dispute resolution.

§ 15.3.2 The parties shall endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement. A request for mediation shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the mediation. The request may be made concurrently with the filing of binding dispute resolution proceedings but, in such event, mediation shall proceed in advance of binding dispute resolution proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order. If an arbitration is stayed pursuant to this Section 15.3.2, the parties may nonetheless proceed to the selection of the arbitrator(s) and agree upon a schedule for later proceedings.

§ 15.3.3 Either party may, within 30 days from the date that mediation has been concluded without resolution of the dispute or 60 days after mediation has been demanded without resolution of the dispute, demand in writing that the other party file for binding dispute resolution. If such a demand is made and the party receiving the demand fails to file for binding dispute resolution within 60 days after receipt thereof, then both parties waive their rights to binding dispute resolution proceedings with respect to the initial decision.

§ 15.3.4 The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

§ 15.4 Arbitration

§ 15.4.1 If the parties have selected arbitration as the method for binding dispute resolution in the Agreement, any Claim subject to, but not resolved by, mediation shall be subject to arbitration which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules in effect on the date of the Agreement. The Arbitration shall be conducted in the place where the Project is located, unless another location is mutually agreed upon. A demand for arbitration shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the arbitration. The party filing a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded.

§ 15.4.1.1 A demand for arbitration shall be made no earlier than concurrently with the filing of a request for mediation, but in no event shall it be made after the date when the institution of legal or equitable proceedings based on the Claim would be barred by the applicable statute of limitations. For statute of limitations purposes, receipt of a written demand for arbitration by the person or entity administering the arbitration shall constitute the institution of legal or equitable proceedings based on the Claim.

§ 15.4.2 The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.

§ 15.4.3 The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly consented to by parties to the Agreement, shall be specifically enforceable under applicable law in any court having jurisdiction thereof.

§ 15.4.4 Consolidation or Joinder

§ 15.4.4.1 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may consolidate an arbitration conducted under this Agreement with any other arbitration to which it is a party provided that (1) the arbitration agreement governing the other arbitration permits consolidation, (2) the arbitrations to be consolidated substantially involve common questions of law or fact, and (3) the arbitrations employ materially

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similar procedural rules and methods for selecting arbitrator(s).

§ 15.4.4.2 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may include by joinder persons or entities substantially involved in a common question of law or fact whose presence is required if complete relief is to be accorded in arbitration, provided that the party sought to be joined consents in writing to such joinder. Consent to arbitration involving an additional person or entity shall not constitute consent to arbitration of any claim, dispute or other matter in question not described in the written consent.

§ 15.4.4.3 The Owner and Contractor grant to any person or entity made a party to an arbitration conducted under this Section 15.4, whether by joinder or consolidation, the same rights of joinder and consolidation as those of the Owner and Contractor under this Agreement.

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SECTION 00 73 00 - SUPPLEMENTAL GENERAL CONDITIONS

1. SUPPLEMENTAL GENERAL CONDITIONS: The following supplements modify the "General Conditions of the Contract for Construction", AIA Document A201 – 2017. Where a portion of the General conditions is modified or deleted by these Supplemental Conditions, the unaltered portions of the General Conditions shall remain in effect.

   A. 1.2.1 Add the following new paragraph:

      It is the further intent of these documents that the Contractor will construct, whether or not specified, noted or drawn, the entire building, site and amenities and all related equipment, systems and appurtenances complete, functional, compatible and complimentary in every respect. The Contractor shall assure this intent when substantial completion is achieved. This includes, but is not limited to, the completion of all interior and exterior finishes, structure and functioning utility systems. It is the further intent of these documents that the work shall comply with the current and accepted building codes including seismic requirements for Risk Category II, Seismic Design Category C and Site Class C.

   B. 2.2: Add the following:

      "2.2.5 The Contractor will be furnished ten (10) complete sets of drawings and Project Manuals as a part of this Contract. Additional sets which the Contractor may request will be supplied at the Contractor's expense."

   C. 3.4: Add the following:

      “3.4.2 After the award of the contract, substitutions of products will be considered only under the conditions and in the manner specified in Section 01 33 00, and…"

   D. 3.10: Add the following new subparagraph:

      "3.10.4 Submit construction schedules in accordance with Section 01 33 00."

   E. 3.11.: At end of subparagraph, add "Submit in accordance with Section 01 33 00."

   F. 3.12.5: At end of subparagraph, add "Submit in accordance with Section 01 33 00."

   G. 7.3 Delete in its entirety.

   H. 8.3: Add the following subparagraphs:

      "8.3.4 Include in construction time stated in Contract Documents an allowance for calendar days per month which, according to the following inclement weather table may not be available for construction out-of-doors (normal inclement weather).

January (6)	April (7)	July (5)	October (5)
February (5)	May (8)	August (5)	November (6)
March (7)	June (6)	September (5)	December (6)

8.3.4.1 Contract time will not be extended due to normal inclement weather unless the Contractor can substantiate, to satisfaction of Architect, that greater-than-normal inclement weather occurred, considering the full term of Contract Time, using a 5-year average of accumulated record mean values from climatological data compiled by the U.S. Department of Commerce National Oceanic and Atmospheric Administration for the project locale, and that alleged greater-than-normal inclement weather actually delayed work or portions of work. All inclement weather day extension submittals must be submitted to the Architect for review and approval by the 25th of the following month to be included with the Payment Request.

8.3.4.1.1 Rain days will not be allowed for weekend days and normal holidays unless contractor intends to work on those days on this specific project as a matter of routine.

8.3.4.1.2 The measure of extreme weather shall be the number of days in excess of those stated for each month, in which precipitation exceeded .10 inch, from area weather station for same period of time, which is same source of data used to determine normal weather losses.

8.3.4.1.3 If total accumulated number of calendar days lost to weather exceeds total accumulated number expected for same period from inclement weather table, time for completion will be extended by number of calendar days needed to include excess number of calendar days lost.

8.3.4.2 Contract time will not be extended due to weather occurring after building is enclosed. "Enclosed" is defined to mean when building is sufficiently sealed, either temporarily or permanently, to permit structure to be heated/cooled and roof completed in order to permit drywall trades to work. The Architect shall determine when structure in "enclosed", and shall issue a letter to Owner, with a copy to Contractor, stating date building became "enclosed".

8.3.4.3 No change in Contract Sum will be authorized because of Contract Time due to weather."

I. 9.2.: At end of subparagraph, add "Submit in accordance with Section 01 33 00."

J. 9.3.1:

1. At end of subparagraph, add "Submit in accordance with Section 01 33 00."

2. Add new clause as follows:

"9.3.1.3 Until Substantial Completion of the Work, 5% of each progress payment will be retained. Refer to Article 9.8.3 for adjustment in retainage upon Substantial Completion of Work.

K. 9.8.5: At end of subparagraph, add "The payment shall be sufficient to increase the total payments to 95% of the Contract Sum, less such amounts as the Architect shall determine for incomplete Work and unsettled claims."

L. 9.10.2: At end of first sentence, add "…and has provided contract close-out documents specified in Section 01 77 00."

At end of subparagraph, add "Submit affidavit of payment of debts and claims and affidavit of release of liens on AIA Forms G706 and G706A, respectively."

M. 11.1.1 Add the following new clauses:

"11.1.1.a The insurance required for subparagraph 11.1.1 shall be written for not less than the following limits, or greater if required by law:

(1)	Worker's Compensation & Employer's Liability	Statutory $500,000 Each Accident $500,000 Each Employee for Injury by Disease $500,000 Aggregate for Injury by Disease
(2)	Commercial General Liability (including Premises-Operations, Products and Completed Operations & Property Damage)	
	a. Bodily Injury and Property Damage Combined	$1,000,000 each occurrence $2,000,000 aggregate per Project
	b. Products and Completed Operations to be maintained For 3 years after final payment	$1,000,000 each occurrence $2,000,000 aggregate
	c. Personal and Advertising Injury	$1,000,000 occurrence
	d. Providing coverage for Explosion, Collapse & Underground (X C and U).	
	e. Contractual Liability	
	f. Additional Insured endorsement adding Owner & Architect	

(3) Business Auto Liability
(Including owned, non-owned and hired vehicles)

a. Bodily Injury and
Property Damage Combined $1,000,000 single limit per accident

(4) Umbrella Excess Liability $1,000,000 over primary insurance
$10,000 retention for self-insured hazards, each occurrence

(5) Builders Risk policy in the amount of the replacement cost of the completed structure or renovation, including materials not installed at time of loss.

N. 11.1.1 Add the following new clause as follows:

"11.1.1.b The Contractor shall furnish 3 copies of each Certificate of Insurance herein required which shall specifically set forth evidence of all coverage required. If this insurance is written on the Comprehensive General Liability policy form, the Certificates shall be AIA Document G715, Supplemental Attachment for ACORD Certificate of Insurance.

O. 11.1.2 Add the following new clauses:

"11.1.2.1 A successful bidder shall furnish a Performance and Payment bond within 10 days after receipt of the Intent to Award notice. Failure to furnish the required bonds may cause forfeiture of bid guarantee to the owner as liquidated damages.

11.1.2.2 The bond shall be written in favor of the Owner and executed. An original and two (2) copies of the bond must be furnished, with power of attorney attached to each. The contractor shall file (not record) the original with the Clerk in the Circuit Court of the County in which the work is to be performed is located. The contractor is to pay all expenses incidental to the filing of the bond. The remaining two copies should be certified by the Clerk to evidence the filing of the original and one copy submitted to the Owner.

11.1.2.3 The Contractor shall deliver the required bonds to the Owner not later than 3 days following the date the Agreement is entered into, or if the work is to be commenced prior thereto in response to a letter of intent, the Contractor shall, prior to the commencement of the work, submit evidence satisfactory to the Owner that such bonds will be furnished.

11.1.2.4 The Contractor shall require the attorney-in-fact who executes the required bonds on behalf of the surety to affix thereto a certified and current copy of the power of attorney."

P. 12.2.2 Add the following subparagraph:

12.2.2.1.1 Provide for and arrange a one-year inspection of facilities before warranties expire by Contractor, Architect/Engineer and Owner.

END OF SECTION

SECTION 01 11 00 - SUMMARY OF WORK

PART 1 - GENERAL

1.01 WORK UNDER THIS CONTRACT: Construction and completion of the High School Band Building as defined by each Bid Package for Greenbrier School District, under single lump sum contract.

1.02 COORDINATION: Provide administrative and supervisory requirements necessary for coordination of work, including meetings, administrative and supervisory personnel, survey, records, reports, limitations for use of site, installation provisions, cutting and patching, cleaning, protection, and conservation.

A. It is the responsibility of the Construction Manager to notify the Owner and the Architect of any and all deviations from the contract documents.

B. Contractor is responsible for contacting the Arkansas State Fire Marshal to coordinate an above ceiling inspection and final inspection.

1.03 BOUNDARIES AND BENCHMARKS: Employ a professional Civil Engineer or Land Surveyor registered in the State of Arkansas, and approved by the Architect, to confirm or define site boundaries and/or building lines. Erect substantial benchmarks and preserve them throughout the work.

1.04 SITE CONDITIONS AND CONTRACTOR USE OF PREMISES: Refer to drawings for site conditions. During entire construction period, Contractor shall have exclusive use of premises for construction operation, including full use of site.

1.05 CODES, ORDINANCES, AND REGULATORY AGENCY COMPLIANCE: Provide all materials and work in strict and full conformance with all applicable and latest editions of rules and regulations. The following is a partial list, for purposes of example, and is not to be considered all-inclusive.

A. ANSI

B. Standard Building Code

C. ADA Standards

D. Arkansas State Fire Prevention Code

E. Arkansas Mechanical Code

F. Arkansas Plumbing Code

G. Arkansas State Energy Code

H. Arkansas State Health Code

I. Other State and Local codes, ordinances and laws

J. Architectural Barriers Act of 1968: Public Law 90-480

K. Standard Gas Code

L. National Fire Protection Association 101, Life Safety Code

M. ASTM

1.06 INDUSTRY STANDARDS:

A. Applicability of Standards: Except where more explicit or stringent requirements are written into the contract documents, applicable construction industry standards have the same force and effect as if bound into or copied directly into the contract documents. Such industry standards are made a part of the contract documents by reference. Individual specification sections indicate which codes and standards the Contractor must keep available at project site for reference.

B. Publication Dates: Except as otherwise indicated, where compliance with an industry standard is required, comply with standard in effect as of date of contract documents.

C. Conflicting Requirements: Where compliance with two or more standards is specified, and where these standards establish different or conflicting requirements for minimum quantities or quality levels, the most stringent requirement will be enforced, unless the contract documents specifically indicate otherwise. Refer requirements that are different, but apparently equal, and uncertainties as to which quality level is more stringent to the Architect for a decision before proceeding.

D. Copies of Standards: The contract documents require that each entity performing work be experienced in that part of the work being performed. Each entity is also required to be familiar with industry standards applicable to that part of the work. Copies of applicable standards are not bound with the contact documents. Where copies of standards are needed for proper performance of the work, the Contractor is required to obtain such copies directly from the publication source.

E. Abbreviations and Names: Trade association names and titles of general standards are frequently abbreviated. Where acronyms or abbreviations are used in the specifications or other contract documents, they are defined to mean the recognized name of the trade association, standards generating organization, governing authority, or other entity applicable to the context of the text provisions.

1.07 PROJECT MEETINGS:

A. Pre-Construction Meeting: Within 15 days after execution of Agreement, the Architect and Construction Manager will prepare an agenda and schedule a pre-construction meeting. Written notice of meeting, date, time and place, and agenda items will be sent to the Owner and Contractor. The Construction Manager shall be responsible for notifying major sub-contractors of the meeting.

B. Progress Meetings: The Construction Manager shall schedule and hold regular progress meetings to coordinate, expedite and schedule work of all contracts. Hold additional meetings as progress of work dictates or when requested by Architect. Send written notice of meeting date, time and place, and agenda of meeting to the Owner, Architect/Engineer, sub-contractors and others as pertinent to agenda. Record results of meetings and distribute copies to everyone in attendance and to others affected by the decisions or actions resulting from each meeting.

C. School Board Meetings: A representative of the General Contractor is required to attend all scheduled monthly School Board Meetings. General Contractor will provide an updated project schedule and construction report.

1.08 HARASSMENT REGULATION: Monitor work to assure that workmen do not use profanity or harass students, faculty, employees or visitors. Workers are strictly prohibited from speaking to students.

1.09 PROHIBITED ITEMS: The use of tobacco products is strictly prohibited on property. Firearms, either on person or in a vehicle, are prohibited on property.

1.10 WORKER DRESS: Workers are to dress in an appropriate manner and to remain fully clothed on the job site.

PART 2 – BID PACKAGES:

2.01 Bid packages will be established and provided by the Construction Manager.

END OF SECTION

BLANK

SECTION 01 21 00 – ALLOWANCES

PART 1 – GENERAL

1.1 SCOPE:

A. This section includes administrative and procedural requirements governing Allowances.

1.2 RELATED DOCUMENTS:

A. Applicable provisions of the General Conditions, Supplementary Conditions, and Division 1 General Requirements apply to the work under this section.

1.3 ALLOWANCES:

A. Types of allowances include the following:

1. Unit Cost Allowances

2. Discretionary Fund Allowance

B. Selection and Purchases:

1. At the earliest practical date after award of the Contract, advise the Architect of the date when the final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.

2. At the Architect's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.

3. Purchase products and systems selected by the Architect from the designated supplier.

C. Submittals:

1. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.

2. Submit invoices or delivery slips to show the actual quantities of materials delivered to the site for use in fulfillment of each allowance.

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

D. Discretionary Fund Allowance:

1. Use the discretionary fund only as directed by the Architect for the Owner's purposes and only by Field Orders which indicate amounts to be charged to the allowance.

2. The Contractor's related costs for products and equipment ordered by the Owner under the discretionary fund are not part of the Contract Sum. These costs include delivery, installation, taxes, insurance, equipment rental, and similar costs.

3. Change Orders authorizing use of funds from the discretionary fund will include Contractor's related costs and reasonable overhead and profit margins.

4. At Project closeout, credit unused amounts remaining in the discretionary fund to the Owner by Change Order.

E. Unused Materials: Return unused materials to the manufacturer or supplier for credit to the Owner, after installation has been completed and accepted.

1. When requested by the Architect, prepare unused material for storage by Owner where it is not economically practical to return the material for credit. When directed by the Architect, deliver unused material to the Owner's storage space. Otherwise, disposal of unused material is the Contractor's responsibility.

PART 2 – PRODUCTS

NOT USED

PART 3 – EXECUTION

3.1 SCHEDULE OF ALLOWANCES:

A. Allowance No. 1: Interior Signage - $5,000 (Aluminum dimensional characters are to be included in Base Bid)

END OF SECTION

SECTION 01 22 00 – UNIT PRICES

PART 1 – GENERAL

1.01 SUMMARY

A. This Section includes administrative and procedural requirements for unit prices.

1.02 DEFINITIONS

A. Unit price is stated on the Bid Form, as a price per unit of measurement for materials or services added to or deducted from the Contract Sum by appropriate modification, if estimated quantities of Work required by the Contract Documents are increased or decreased.

1.03 PROCEDURES

A. The Unit Price shall include the furnishing by the Contractor of all labor, tools, materials, machinery, appliances, plant and equipment appurtenant to and necessary for, the construction in every detail and the completion of all work to which the Unit Price pertains.

B. Unit Price shall also include all profit, overhead expenses, bond, insurance, patent fees, royalties, risk due to the elements, delay, profit, injuries, damages, claims, and all other items not specifically mentioned that may be required to construct fully each item of the Work, complete in place.

C. No other charges or mark-ups will be allowed to be applied to the Unit Price when the appropriate Contract Document modification is written.

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

E. 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.

F. List of Unit Prices: A list of unit prices is included at the end of this Section. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 GENERAL

A. Refer to individual Sections of Specifications for the definitions of units of work where the establishment of unit prices is required; the methods of measurement and pricing are specified therein.

B. It is recognized that Unit Price items are listed in the Bid Form, and that the Owner-Contractor Agreement records acceptance or rejection of each Unit Price, either as bid or as otherwise agreed upon by the date of the Agreement.

C. Utilization of Unit Prices shall be solely by means of Change Orders as specified in the General and Supplementary Conditions.

D. Each Unit Price shall be the total cost or credit to the Owner.

E. Unit Prices stated shall apply to both additive and deductive variations in quantities.

F. Unit Prices stated on the Bid Form, and subsequently included in the Agreement, shall remain in effect until date of Final Completion of the entire Work.

3.02 IMPLEMENTATION

A. The initial listing of unit prices to be quoted with bids in included at the end of this Section as “Unit Price Schedule.”

B. Materials and methods for units of work covered by Unit Prices shall be in accordance with applicable product Specifications included in the Project Manual.

3.03 UNIT PRICE SCHEDULE

A. Unit Price No. 1: Undercut, fill and compaction

1. Provide cost per cubic yard of undercut, approved fill material, and proper compaction as directed by the geotechnical engineer. Construction Manager will hold an allowance for this work.

END OF SECTION

SECTION 01 29 00 – MEASUREMENT AND PAYMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES:

A. Measurement and payment criteria applicable to portions of the Work performed under a unit price payment method.

B. Defect assessment and non-payment for rejected work.

1.02 AUTHORITY:

A. Measurement methods delineated in the individual specification sections complement the criteria of this section. In the event of conflict, the requirements of the individual specification section govern.

B. Take all measurements and compute quantities. The Architect/Engineer will verify measurements and quantities.

1.03 UNIT QUANTITIES SPECIFIED:

A. Quantities indicated in the Bid Form are for bidding and contract purposes only. Quantities and measurements supplied or placed in the Work and verified by the Architect/Engineer determine payment.

B. If the actual Work requires more or fewer quantities than those quantities indicated, provide the required quantities at the unit sum/prices contracted.

C. If the actual Work requires a 25% or greater change in quantity than those quantities indicated, the Owner or Contractor may claim for a Contract Price adjustment.

1.04 MEASUREMENT OF QUANTITIES:

A. Linear Measurement: Measured by linear dimension, at the item centerline or mean chord.

B. Stipulated Sum/Price Measurement: Items measured as a completed item or unit of the Work.

1.05 PAYMENT:

A. Payment Includes: Full compensation for all required labor, Products, tools, equipment, plant, transportation, services and incidentals; erection, application or installation of an item of the Work; overhead and profit.

B. Final payment for Work governed by unit prices will be made on the basis of the actual measurements and quantities accepted by the Architect/Engineer multiplied by the unit sum/price for Work which is incorporated in or made necessary by the Work.

1.06 DEFECT ASSESSMENT:

A. Replace the Work, or portions of the Work, not conforming to specified requirements.

B. If, in the opinion of the Architect/Engineer, it is not practical to remove and replace the Work, the Architect/Engineer will direct one of the following remedies:

1. The defective Work may remain, but the unit sum/price will be adjusted to a new sum/price at the discretion of the Architect/Engineer.

2. The defective Work will be partially repaired to the instructions of the Architect/Engineer, and the unit sum/price will be adjusted to a new sum/price at the discretion of the Architect/Engineer.

C. The individual specification sections may modify these options or may identify a specific formula or percentage sum/price reduction.

D. The authority of the Architect/Engineer to assess the defect and identify payment adjustment, is final.

1.07 NON-PAYMENT FOR REJECTED PRODUCTS: Payment will not be made for any of the following:

A. Products wasted or disposed of in a manner that is not acceptable.

B. Products determined as unacceptable before or after placement.

C. Products not completely unloaded from the transporting vehicle.

D. Products placed beyond the lines and levels of the required Work.

E. Products remaining on hand after completion of the Work.

F. Loading, hauling and disposing of rejected Products.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 01 31 00 - COORDINATION

PART 1 - GENERAL

1.01 PROTECTION OF EXISTING FACILITIES: The Contractor shall conduct and schedule his work in a manner to cause as little disruption as possible to the existing facilities and operation.

1.02 SITE VISITATION: The Contractor is responsible to visit the project site prior to, and during, the course of construction to verify existing conditions, actual sizes, and other requirements outlined in the other sections of the specifications.

END OF SECTION

BLANK

SECTION 01 33 00 – SUBMITTALS AND SUBSTITUTIONS

PART 1 - GENERAL

1.01 SCOPE: Provide all submittals, including shop drawings, product data, samples, schedules, reports, and requests for substitutions, as required by the bidding and contract documents in strict accordance with the provisions of this section.

1.02 RELATED WORK SPECIFIED IN OTHER SECTIONS:

A. Contractual Requirements for Submittals: General Conditions and Supplementary General Conditions.

B. Individual Submittals Required: Pertinent sections of these specifications.

C. Section 01 77 00 – Contract Closeout

PART 2 - PRODUCTS

2.01 SUBSTITUTIONS:

A. The naming of specified items on the drawings or in the specifications means that such named items are specifically desired by the Architect and/or Owner. If the words "or acceptable equal" or "or approved equal" follows such named items, substitution requests may be submitted.

B. Complete data must be submitted on proposed substitutions. Submit samples for comparison and tests.

C. The Architect is the sole judge as to the equality and acceptability of proposed substitutions. ONLY WRITTEN ACCEPTANCES BY THE ARCHITECT WILL BE HELD VALID.

D. If any substitution will affect a correlated function, adjacent construction, or the work of other trades or contractors, the necessary changes and modifications to the affected work will be considered as part of the substitution, to be accomplished without additional cost to the Owner, if and when accepted.

E. Under no circumstances shall the Architect's acceptance of any such substitution relieve the Contractor from timely, full and proper performance of the work.

F. No substitutions will be accepted without submittal of the substitution request form included at the end of this Section filled out completely.

2.02 SHOP DRAWINGS:

A. Submit required shop drawings drawn to a scale sufficiently large to show pertinent features of item and its method of connection to work. Submit related shop drawings together; partial submittals will not be accepted. Reproduction of contract documents in any form for use as shop drawings will not be permitted. Provide manufacturer's name and model number of prefabricated items and indicate methods of attachment and clearances required relative to other trades affecting all elements of work. Identify deviations from contract documents (if any), check dimensions, check that trades have been coordinated and that no conflict will develop in this installation. After reviewing shop drawings, indicate Contractor's approval by signing and dating on Contractor's stamp. Failure to follow these procedures will result in rejection of submission and no additional contract time will be allowed for delay from this cause.

B. Submit a digital copy or one print of Contractor's stamped and approved shop drawings for Architect's review. The Architect will review the reproducible and stamp it with indication of action as appropriate. The Architect will retain the print for his record and will return the reproducible to the Contractor. For reproducibles returned "Not Approved" or "Revise and Resubmit", correct the original drawings, make a new reproducible and print, and resubmit. For reproducibles returned "Approved" or "Approved as Corrected", provide such number of prints of the reproducible as may be needed for field distribution.

2.03 PRODUCT DATA AND SAMPLES: Digital submittals are preferred. If contractor elects to submit hard copies, submit 5 copies of product data for Architect's review for items specified in the various specification sections (copies for mechanical and electrical data is specified in Divisions 21, 22, 23, 26, 27 and 28). Submit samples, where specified, along with product data. All color samples and charts must be physical copies. Make all submissions affecting color selection within 30 days after signing the contract. Mark data clearly to indicate exact items submitted and note deviations from contract documents (if any). After reviewing the submittals, indicate approval by signing and dating on Contractor's stamp, and submit to the Architect for review.

2.04 PROGRESS SCHEDULE:

A. Within 7 days after "Notice to Proceed", submit to the Architect a bar-chart type progress schedule indicating a time bar for each trade or operation of work to be performed at the site. Time bar shall demonstrate planned work, properly sequenced and intermeshed, for expeditious completion of work.

B. Submit with bar-chart a tabulation (by date) of all submittals required either by date period relation in contract documents or as necessitated by lead time related to individual time bar shown on progress schedule for the associated work. At Contractor's option, submittal dates may be shown on bar-chart schedule, in lieu of being tabulated.

C. Submit monthly updates of bar-chart accurately depicting actual progress to the first day of month. Indicate percentage of completion on time bars at 10% increments.

D. Submit progress schedule on transparency or other reproducible stock.

E. Distribute progress schedule including all updates to Architect, Owner, subcontractor, suppliers, fabricators, and others with a need-to-know schedule compliance requirement. Post copy in field office.

2.05 SCHEDULE OF VALUES: Submit schedule of values on AIA Document G703 (Continuation Sheet for G702). Itemize separate line cost for each major item of work and each sub-contracted item of work (use Sections under Division 2 through 33 in Table of Contents as a basis for listing).

2.06 APPLICATION AND CERTIFICATE FOR PAYMENT: Submit Application and Certificate for Payment on AIA Document G702 and G703.

PART 3 - EXECUTION

3.01 IDENTIFICATION OF SUBMITTALS: Completely identify each submittal and re-submittal by showing at least the following information:

A. Name and address of submitter, plus name and telephone number of the individual who may be contacted for further information.

B. Name of project as it appears on each page of these specifications.

C. Drawing number and specifications section number to which the submittal applies.

D. Whether this is an original submittal or re-submittal.

3.02 TIMING OF SUBMITTALS:

A. General: Make all submittals far enough in advance of scheduled dates of installation to provide all required time for reviews, for securing necessary approvals, for possible revision and re-submittal, and for placing orders and securing delivery.

B. Delays: Costs of delays due to late submittals may be back-charged as necessary and shall not be borne by the Owner.

END OF SECTION

SUBSTITUTION REQUEST FORM

Mail to: Jackson Brown Palculict Architects
12921 Cantrell Road, Suite 201
Little Rock, AR 72223
Phone: (501) 664-8700
Fax: (501) 664-5189

Email: randy@jbparchitects.com

SECTION: _____ PARAGRAPH: _____

SPECIFIED ITEM: _____

PROPOSED SUBSTITUTE: _____

Attach complete description, designation, catalog or model number, SpecData sheet, and other technical data, including laboratory tests if applicable. All required pre-bid substitutions must be submitted 10 days prior to bid.

Please answer the following questions:

1. Will substitution affect dimensions indicated on drawings? If so, explain.

2. Will substitution affect wiring, piping, ductwork, etc., indicated on drawings? If so, explain.

3. What affect will substitution have on other trades?

4. Differences between proposed and specified item?

5. If necessary, will the undersigned pay for Architect's costs required to revise working drawings, caused by substitution?

6. Manufacturer's warranties of specified items and proposed items are:

_____ Same _____ Different (explain)

Submitted by:

Firm: _____

Address: _____

_____

Signature: _____

Date: _____

Telephone: _____

Fax: _____

Review Comments:

_____ Approved

_____ Approved as Noted

_____ Not Approved

_____ Received Too Late

By: _____ Date: _____

Remarks: _____

_____

SECTION 01 45 00 – QUALITY CONTROL

PART 1 - GENERAL

1.01 CODE CONFORMANCE: All materials, equipment and the installation shall be in accordance with all local and state building, mechanical, electrical and plumbing codes and testing agencies. This includes, but is not limited to, IBC, Life Safety, UL, and ASTM. It is the contractor's responsibility, and his subcontractors, to comply with and conform to all governing authorities.

1.02 WORKMANSHIP: All materials and equipment shall be installed in a manner accepted by Standard Trade Practice. The installation will be accomplished by workmen skilled in the type of work required.

1.03 TRAFFIC SAFETY: Special efforts will be made not to interfere with traffic flow or create safety hazards to traffic. Contractor is to provide a mud-free path along major paths accessing the building once slab(s) have been placed. Major paths are to include, but not limited to, from job trailer(s) to building, from points of material delivery to building, and/or worker access points. The path is intended to minimize the pollution of dirt and particulates from being tracked in at high volume access points. The path is to be safe and stable for walking and equipment entering the facility. Options may include gravel base or placing concrete walks (once heavy equipment is complete).

1.04 DEBRIS DISPOSAL:

A. Debris shall be removed from the site promptly, and as feasible, all equipment and materials shall be removed or secured at the end of each day. The Contractor is responsible for daily cleanup of all construction areas and construction debris that has escaped from the construction site.

B. The Contractor shall exercise caution in not disturbing adjacent facilities, finishes, materials, grounds and other items not a part of this project. The Contractor shall clean, daily, all areas outside the project area of dirt, dust and debris generated by this contract.

C. All debris generated by the Contractor shall be properly disposed of by the Contractor. Removal of debris and other material shall be handled, transported, stored and disposed of by the Contractor and his subcontractors in accordance with all applicable federal, state or local laws, ordinances, regulations, court orders or other types of rules or rulings having the effect of laws.

D. The Contractor is required to take all precautions to prevent spillage of materials from Contractor vehicles. The Contractor shall provide adequate labor and equipment to keep paved areas free of debris and to contain loose materials at all times.

1.05 FINAL INSPECTION AND ACCEPTANCE OF WORK: As construction nears completion, the Superintendent will thoroughly inspect the work and generate a deficiency (punch) list. When all deficiencies are corrected, the Contractor shall request a final inspection.

END OF SECTION

SECTION 01 50 00 - CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 - GENERAL

1.01 SCOPE: Provide temporary utilities and miscellaneous facilities required during construction, complete, including maintenance and removal.

PART 2 - UTILITIES:

A. Temporary Utilities: Provide and pay for costs for gas, water, and electricity required for performance of this work. Make necessary arrangements with utility companies for temporary service. Contractor to contact utility company for final reading prior to turning building over to Owner.

1. Gas and Water: Provide necessary temporary piping and fittings.

2. Electricity: Provide necessary temporary electric wiring. Provide area distribution boxes so located that individual trades may use their own construction type extension cords to obtain adequate power and lighting for construction operations.

B. Telephone: Provide telephone, facsimile (fax), and/or email with printing capability, and answering machine, voice mail or pager in the field office. Pay costs for temporary service.

2.02 TEMPORARY SANITARY FACILITIES: Provide on-site temporary toilet facilities for use of construction personnel; maintain in a sanitary condition. Comply with applicable codes and regulations of authorities having jurisdiction.

2.03 FIELD OFFICE AND SHEDS: Provide field office and storage facilities adequate in size and accommodation for Contractor's offices, superintendent's office, and supply and tool rooms. Make the field office available to Architect throughout entire construction period.

2.04 PROJECT IDENTIFICATION:

A. Provide project sign, to be located as directed by Architect. Exact text lettering, and paint color selection will be provided by Architect at a later date.

1. Sign to be not less than 32 sq. ft., with painted graphic content to include title of authorities, name and title of Architect and Engineer, prime contractor, and major sub-contractors.

2. Sign Materials: New or used wood or metal structure and framing and exterior grade softwood plywood with medium density overlay for sign surface. Use standard large sizes to minimize joints.

3. Paint exposed surfaces of supports, framing, and surface material with coat of primer and one coat of exterior paint as specified in Section 09 91 00.

C. Remove sign, framing, and supports at completion of project.

2.05 PARKING AND STAGING AREAS: Available on site.

2.06 CONSTRUCTION AIDS: Provide and maintain for the duration of construction temporary equipment and apparatus including scaffolds, elevators and hoists, canopies, tarpaulins, barricades, warning signs, steps, ladders, platforms, ramps, chutes and other temporary construction aids and miscellaneous facilities as necessary for proper completion of the work; comply with pertinent safety regulations.

2.07 TEMPORARY HEAT: Provide temporary heat where indicated and where needed for the proper performance of work, for curing or drying of work recently installed, and protection of work in place from adverse effects of low temperatures.

2.08 DEWATERING AND SNOW AND ICE REMOVAL: Maintain site, excavations, and construction free of water, snow and ice, as necessary for protection and execution of the work. Comply with dewatering requirements specified in Section 31 30 00; where feasible, utilize same facilities.

2.09 TEMPORARY FIRE PROTECTION: During construction period and until fire protection needs are fulfilled by permanent facilities, provide and maintain types and forms of temporary fire protection needed to protect facilities against fire losses. Store combustible materials in recognized fire-safe locations and containers.

2.10 SECURITY: Provide sufficient control to prevent illegal entry or damage during nights, holidays, or other periods when work is not being executed, and such other controls as required during working hours.

PART 3 - EXECUTION

3.01 REMOVAL: Maintain construction facilities and temporary controls as long as needed for safe and proper completion of work. Remove temporary facilities and controls as rapidly as progress of work will permit or as directed by Architect.

END OF SECTION

SECTION 01 56 16 – DUST CONTROL

PART 1 - GENERAL

1.01 SCOPE: Provide dust control surfactant as required, complete, including application for dust control.

1.02 RELATED WORK SPECIFIED IN OTHER SECTIONS: Earthwork; Section 31 30 00.

1.03 PROJECT CONDITIONS: Protect structures, sidewalks, pavements, and other facilities from damage caused by application of dust control surfactant.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. SURFTREAT CA-101: A biodegradable liquid specially formulated for surface tension reduction, as manufactured by the ChemMark Corporation, 3140-K South Peoria Street, Suite 115, Aurora, CO 80014, (303) 752-3380. It is a water-soluble blend of modified non-ionic surfactant and divalent salts. SURFTREAT CA-101 is developed for use as a wetting agent and surface tension reducer for dust control applications and soil stabilization.

B. Physical Properties:

Color:	Opaque Liquid
Odor:	Mild
Density, lbs./gal.:	10.5 - 10.7
Specific gravity:	1.26 - 1.28
pH:	5.9 - 7.0

Freezing Point: Not flammable

PART 3 - EXECUTION

3.01 APPLICATION: Apply dust control surfactant in strict accordance with manufacturers written instructions.

END OF SECTION

BLANK

SECTION 01 57 13 – STORM WATER POLLUTION CONTROL

PART 1 - GENERAL

1.01 SCOPE: Under regulation of the Arkansas Department of Environmental Quality.

A. The Contractor shall be responsible for implementing pollution control methods for controlling storm water run-off from the construction site.

B. The Contractor shall submit a "Notice of Intent" to the Arkansas Department of Environmental Quality at least 48 hours prior to commencement of construction at this site.

1.02 METHODOLOGY

A. A plan of construction activity and pollution control methods is to be implemented during construction.

PART 2 - (NOT APPLICABLE)

PART 3 - (NOT APPLICABLE)

END OF SECTION

BLANK

SECTION 01 71 23 – FIELD ENGINEERING

PART 1 – GENERAL

1.01 SECTION INCLUDES:

A. Survey and field engineering

B. Quality control

C. Submittals

D. Project record documents

1.02 RELATED SECTIONS:

A. Section 00 31 00 – Information Available to Bidders

B. Section 00 72 00 – General Conditions

C. Section 01 77 00 – Contract Closeout: Project Record Documents

1.03 QUALITY ASSURANCE

A. Employ a Land Surveyor registered in the State of Arkansas and acceptable to Architect/Engineer, to perform survey work of this section.

B. Submit evidence of Surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate.

C. Employ a Professional Engineer of the discipline required for specific service on Project, licensed in the State of Arkansas.

1.04 SUBMITTALS FOR REVIEW

A. Submit name, address and telephone number of Surveyor before starting survey work.

B. On request, submit documentation verifying accuracy of survey work.

C. Submit a copy of certificate signed by the Land Surveyor that the elevations and locations of the Work are in conformance with Contract Documents.

1.05 PROJECT RECORD DOCUMENTS

A. Maintain a complete and accurate log of control and survey work as it progresses.

B. Submit Record Documents under provisions of Section 01 77 00.

1.06 EXAMINATION

A. Verify locations of survey control points prior to starting work.

B. Promptly notify Architect/Engineer of any discrepancies discovered.

1.07 SURVEY REFERENCE POINTS

A. Contractor to locate and protect survey control and reference points.

B. Control datum for survey is that indicated on drawings.

C. Protect survey control points prior to starting site work; preserve permanent reference points during construction.

D. Promptly report to Architect/Engineer the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.

E. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect/Engineer.

1.08 SURVEY REQUIREMENTS

A. Provide field engineering services. Utilize recognized engineering survey practices.

B. Establish a minimum of one permanent benchmark on site, referenced to established control points. Record locations, with horizontal and vertical data, on project record documents.

C. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:

1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.

2. Grid or axis for structures.

3. Building foundation, column locations and ground floor elevations.

D. Periodically verify layouts by same means.

1.09 SURVEYS FOR MEASUREMENT AND PAYMENT

A. Perform surveys to determine quantities of cost-plus work, including control surveys to establish measurement reference lines. Notify Architect/Engineer prior to starting work.

PART 2 – PRODUCTS

NOT APPLICABLE

PART 3 – EXECUTION

NOT APPLICABLE

END OF SECTION

BLANK

SECTION 01 77 00 – CONTRACT CLOSEOUT

PART 1 - GENERAL

1.01 SECTION INCLUDES:

A. Closeout procedures.

B. Final cleaning.

C. Project record documents.

D. Final walk-through inspection before final acceptance.

1.02 CLOSEOUT PROCEDURES:

A. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Architect's review.

B. Provide submittals to architect that are required by governing or other authorities.

C. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due.

1.03 FINAL CLEANING: Remove waste and surplus materials, rubbish, and construction facilities from the site.

1.04 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.

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 utilized.

3. Changes made by Addenda and modifications.

F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:

1. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.

2. Field changes of dimension and detail.

3. Details not on original Contract drawings.

G. Submit documents to Architect with claim for final Application for Payment.

PART 2 - PRODUCTS

2.01 MANUAL: Upon completion of the work and prior to final payment, submit to the Architect a loose-leaf, hard cover binder with the project name printed on it, containing five indexed sections as follows:

A. Sub-contractors: A listing of all sub-contractors for the project, including portions of work done, address and telephone number of the firm, and contact at the firm familiar with the project.

B. Guarantees and Warranties: One fully executed copy of each guarantee and warranty specified.

C. Certificates: One fully executed copy of each certificate specified.

D. Instructions: One operating, service, and maintenance manual or instruction sheet for each item specified.

E. List of As-Built Drawings, Record Drawings, Shop Drawings, Product Data and Samples.

F. Materials and Tools: List of spare parts, extra and overrun stock, maintenance tools and devices, keys and similar physical units submitted as specified.

G. Complete list of all exterior and interior materials colors used for entire project (i.e. paint, metal building, roofing, flooring, devices, etc.).

2.02 DRAWINGS AND SUBMITTALS PACKAGE: Upon completion of the work and prior to final payment, submit to the Architect a package labeled with the project name and containing one set of reproducible final record drawings and specifications, one copy of final shop drawings, product data, and samples (see AIA A201 paragraph 4.11.1). This package and the manual will be presented by the Architect to the Owner upon completion of the project. In addition, submit one set of record drawings to be retained by the Architect.

2.03 SUBSTANTIAL COMPLETION:

A. Preliminary Procedures: Before requesting inspection for determining date of substantial completion, complete the following. List items below that are incomplete in request.

1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the work is not complete.

2. Advise Owner of pending insurance changeover requirements.

3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.

4. Obtain and submit releases permitting Owner unrestricted use of the work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.

5. Prepare and submit Project Record Documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.

6. Deliver all “attic stock” items to a location designated by Owner. Label with manufacturer’s name and model number where applicable.

7. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner’s personnel of changeover in security provisions.

8. Complete startup testing of systems.

9. Submit test/adjust/balance records.

10. Terminate and remove temporary facilities from project site, along with mockups, construction tools, and similar elements.

11. Advise Owner of changeover in heat and other utilities.

12. Submit changeover information related to Owner's occupancy, use, operation and maintenance.

13. Complete final cleaning requirements, including touchup painting.

14. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

15. Instruct Owner's personnel in operation, adjustment and maintenance of products, equipment and systems.

B. Inspection: Submit a written request for inspection for substantial completion. On receipt of request, Architect will either proceed with inspection or notify contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify contractor of items, either on contractor's list or additional items identified by Architect that must be completed or corrected before certificate will be issued.

1. Re-inspection: Request re-inspection when the work identified in previous inspections as incomplete, is completed or corrected.

2. Results of completed inspection will form the basis of requirements for final completion.

2.04 LIST OF INCOMPLETE ITEMS (PUNCH LIST): Submit one copy 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.

A. Organize list of spaces in sequential order.

B. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment and building systems.

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 02 41 13 – SELECTIVE DEMOLITION

PART 1 - GENERAL

1.01 SCOPE: Provide selective demolition work, complete, as indicated, specified, and required for new work, including removal and disposal of demolished materials and capping of existing utilities as/if required.

1.02 SUBMITTALS: Comply with Section 01 33 00.

A. Before commencing selective demolition work, submit for review and approval of the Architect, a schedule showing the commencement, order, and completion dates for the various parts of this work. Include coordination for shut-off, capping, and continuation of utility services as required, together with details for dust, noise and weathertight protection.

B. Before starting any work relating to existing utilities that will temporarily discontinue service to adjacent buildings, notify the Architect 72 hours in advance and obtain approval before proceeding with work. Do not disconnect or disrupt service without Architect's prior approval.

1.03 PROJECT CONDITIONS:

A. Occupancy: Owner will be occupying buildings immediately adjacent to work. Conduct selective demolition work in a manner that will minimize need for disruption of Owner's normal operations.

B. Condition of Structure: Owner assumes no responsibility for actual condition of items or portions of structure to be demolished.

C. Hazardous Materials: The Owner does not anticipate that hazardous materials will be encountered. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by the Owner under a separate contract.

D. Protections:

1. Provide protective measures as required to protect personnel and general public from injury due to selective demolition work.

2. Provide interior and exterior shoring, bracing, and support to prevent movement, settlement, and collapse of structure or element to be demolished, and adjacent facilities and work to remain.

E. Damages: Promptly repair, to the satisfaction of the Architect, damages caused to existing structure or contents by demolition work or due to insufficiency of protection provided, at no cost to Owner. Replace damaged work, as directed by the Architect, if repair is not satisfactory.

F. Traffic: Conduct selective demolition operations and debris removal in a manner to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities.

G. Explosives: Use of explosives will not be permitted.

H. Environmental Controls: Use water sprinkling, temporary enclosures, and other suitable methods to limit dust and dirt rising and scattering in air to lowest practicable level. Comply with governing regulations pertaining to environmental protection.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.01 DEMOLITION: Refer to demolition plans and other drawings and provide selective demolition as indicated and as required for new work.

A. Proceed in a systematic manner. Use such methods as required to complete work in accordance with demolition schedule and governing regulations.

B. Demolish concrete and masonry in small sections. Cut concrete and masonry at junctures with construction to remain using power driven masonry saw or hand tools; do not use power driven impact tools.

3.02 DISPOSAL OF DEMOLISHED MATERIALS: Remove debris, rubbish, and other materials resulting from demolition operations as the work progresses. Transport and legally dispose of materials off site. Burning of debris will not be permitted on site.

3.03 CLEAN UP AND REPAIR:

A. Upon completion of selective demolition work, remove tools, equipment and demolished materials from site. Remove protections and leave interior areas broom clean.

B. Repair demolition performed in excess of that required. Return structures and surfaces to remain to condition existing prior to commencement of selective demolition work. Repair construction or surfaces soiled or damaged by selective demolition work.

END OF SECTION

SECTION 03 30 00 – CONCRETE WORK

PART 1 - GENERAL

1.01 SCOPE: Provide concrete work, complete. Provide all reinforcing steel, dowels, chairs, and accessories as specified for concrete work. Furnish reinforcing steel bars for masonry work and tie bars after they are in place.

1.02 RELATED WORK SPECIFIED IN OTHER SECTIONS:

A. Excavation and filling, including base course and cushion fill; Section 31 30 00.

B. Soil treatment for termite control; Section 31 31 00.

C. Placing of steel reinforcing bars in masonry walls; Section 04 20 00.

D. Furnishing of structural steel base-plates, anchor bolts and other metal accessories for insertion in concrete; Section 05 50 00.

E. Joint sealants; Section 07 92 00.

1.03 CODES AND STANDARDS:

A. Reference Standards and Specifications: Comply with the provisions of the following specifications and standards, except as otherwise noted or specified, or as accepted or directed by Architect during unusual climatic conditions.

1. ACI 301, "Specifications for Structural Concrete for Buildings."

2. ACI 318, "Building Code Requirements for Reinforced Concrete."

3. Concrete Reinforcing Steel Institute, "Manual of Standard Practice."

B. Local Codes and Ordinances: Wherever provisions of the International Building Code or the local current ordinances are more stringent than the above specifications and standards, the local codes and ordinances shall govern.

1.04 TESTS: Tests shall be paid for by the Contractor. Testing requirements are specified in FIELD SAMPLING AND TESTING paragraph.

A. Testing of concrete cylinders to determine compression strengths of concrete delivered to the job site, shall be performed by an independent testing laboratory that meets ASTM C1077 and is approved by Architect.

B. Testing for slab flatness (FF) and slab levelness (FL) shall be performed by an independent testing lab that meets ASTM E1155 and is approved by the Architect. Tests shall be performed within 72 hours of placement of slab.

1.05 QUALITY ASSURANCE: Concrete flatwork shall be performed utilizing high quality techniques conforming to the American Concrete Institute (ACI) standards provided for by ACI Publication CP-10; Concrete Flatwork Technician and Flatwork Finisher; ACI Publication CCS-1; Concrete Craftsman Series, Slabs on Grade.

A. All concrete installation shall be under the direct supervision of at least one ACI flatwork finisher currently certified with ACI.

B. Provide ACI flatwork finisher certification documentation prior to beginning any concrete operations.

1.06 SUBMITTALS: Comply with Section 01 33 00.

A. Shop Drawings: Submit to Architect for review prior to installation, shop drawings of all reinforcing steel, including bar cutting lists, construction of forms including jointing, reveals, location and pattern of form tie placement, and construction joint schedule with details.

B. Prior to placement of concrete, submit concrete mix designs proposed by the concrete supplier, for class of concrete, including recent test results substantiating the quality of concrete produced by each mix.

C. Weekly reports of all compression, slump, and air content tests from the testing laboratory.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Form Materials:

1. For Exposed Finish Concrete: Plywood, metal, or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces.

2. For Unexposed Finish Concrete: Use plywood, lumber, metal, or other acceptable material. If lumber is used, it must be dressed on at least 2 edges and 2 sides for a tight fit.

B. Form Coatings: Commercial formulation form coating compound that will not bond with, stain, nor adversely affect concrete surfaces, will not impair subsequent

treatments or finishes requiring bond or adhesion, nor impede wetting of concrete surfaces by water or curing compound.

C. Steel Reinforcement:

1. Reinforcing Bars: ASTM A615 (S1), Grade 60, deformed billet steel bars of grades as indicated on the structural drawings, free from loose rust, scale and other coatings that may reduce bond.

2. Mesh or Fabric Reinforcement: ASTM A1064, welded wire fabric, of sizes and types as indicated on the drawings. Supply mesh in flat sheets.

3. Accessories: Include spacers, chairs, ties, and other devices necessary for properly spacing and fastening reinforcement in place. Use plastic protected reinforcing bar supports conforming with CRSI Class 1 specification for exposed finish concrete. Support reinforcing steel in footing with concrete brick or plastic protected reinforcing bar supports.

4. Tie Wires: Soft annealed iron wire not smaller than 18 gauge.

D. Concrete Materials:

1. Portland Cement: ASTM C150, Type I.

2. Concrete Aggregates: ASTM C33, and the following:

a. Fine Aggregate: Clean, sharp, natural or manufactured sand, free from loam, clay, lumps, or other deleterious substances.

b. Coarse Aggregate: Clean, uncoated, processed, locally available aggregate, containing no clay, mud, loam or foreign matter; maximum size of 1-1/2".

3. Mixing Water: Clean, free from oil, acid, salt, injurious amounts of vegetable matter, alkalis, and other impurities; potable.

4. Admixtures:

a. Air Entrained Admixture: ASTM C260, 5%.

b. Other Admixtures: Do not use other admixtures unless accepted by Architect.

E. Miscellaneous Materials:

1. Connectors: Provide all metal connectors required for placement in cast-in-place concrete, for the attachment of structural and non-structural members.

2. Expansion Joint Filler: ASTM D1751, non-extruding pre-molded material, 1/2" thick, unless otherwise noted, composed of fiberboard impregnated with asphalt.

3. Liquid Membrane-forming Curing Compound: ASTM C309, Type I, Class B. Moisture loss not more than 0.055 gr./sq. cm. When applied at 200 sq. ft./gal. Dayton-Superior "Day-Chem Rez Cure (J-11-W)"; or approved equal. At stained concrete area, Conspec "RX Cure-30%" dissipating curing compound is specified; or approved equal.

4. Vapor Barrier: Stego Wrap 15-mil vapor barrier by Stego Industries. ASTM E1745, Class A, with a permeance less than 0.01 perms after mandatory conditioning tests per ASTM E1745 (7.1.1-7.1.5). Joints are to be lapped 6" and taped with Stego Tape. All penetrations are to be sealed with Stego Tape and/or Stego Mastic per manufacturer's recommendations.

5. Semi-hardboard Vapor Barrier: W.R. Meadows Pre-moulded Vapor Seal with plasmatic core, 65 lbs. per 100 square feet. "Dutch Lap", use Sealtight Catalytic Bonding Asphalt and PM-5X at slab edges. At polished concrete refer to Section 03 35 36.

6. Concrete Sealer: Conspec "Spec-Seal"; or approved equal.

7. Non-Shrink Grout: CRD-C 621, factory pre-mixed grout.

   a. Metallic: Master Builders "Embeco 885", Sonneborn "Ferrolith GDS", Euclid "Hi-Mod Grout", or L & M "Ferrogrout".

   b. Non-Metallic: Master Builders "Set Grout", Sonneborn "Sonogrout", Euclid "Euco-NS", or L & M "Crystex".

8. Bonding Agent: Polyvinyl acetate, re-wettable type; Sonneborn "Sonocrete", Euclid "Eucoweld", or L & M "Everbond".

9. Retro Plate 99

2.02 PROPORTIONING OF MIXES:

A. Strength: Concrete minimum ultimate strength at 28 days as noted on structural drawings, and as specified.

B. Mix Design:

1. Prepare design mixes for concrete, in accordance with ACI 301 and ACI 318, except as otherwise specified.

2. Proportion design mixes by weight for class of concrete required, complying with ACI 211, except as otherwise specified.

C. Provide test results from the concrete supplier for proposed design mix, to establish the following:

1. Gross weight and yield per cu. yd of trial mixtures.

2. Measured slump.

3. Measured air content.

4. Compressive strength developed at 7 days and 28 days, from not less than 3 test cylinders cast for each 7-day and 28-days test, and for each design mix.

D. Submit written reports to Architect for design mix at least 15 calendar days prior to the start of work.

E. Use air-entrained admixture in strict compliance with manufacturer's directions. No air-entrained concrete is to be used in mix scheduled to receive polish.

F. Slump Limits: As specified on structural drawings

2.03 BATCHING AND MIXING: Concrete may be ready-mixed or job-mixed at the Contractor's option, in accordance with the governing building code and with the referenced ACI 318. No hand mixing allowed.

PART 3 - EXECUTION

3.01 FORM WORK:

A. Design, erect, support, brace, and maintain form work to support vertical and lateral loads, and static and dynamic loads that might be applied until such loads can be supported by the concrete structure. Construct formwork so concrete members and structures are of correct size, shape, alignment elevations, and position.

B. Construct forms in accordance with ACI 347, to sizes, shapes, lines and dimensions indicated, and to obtain accurate alignment, location, grades, level and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, molding, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages

and inserts, and other features required in work. Solidly butt joint and provide back-up at joints to prevent leakage of cement paste.

C. Fabricate forms for easy removal without hammering or prying against the concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces.

D. Chamfer exposed corners and edges 3/4" unless otherwise indicated, using wood, metal, PVC or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

E. Form Ties: Factory-fabricated, adjustable-length, removable or snap-off metal form ties, designed to prevent form deflection, and to prevent spalling concrete surfaces upon removal.

F. Preparation of Form Surfaces: Coat the contact surfaces of forms with a form-coating compound where applicable before reinforcement is placed.

G. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such ties. Accurately place and securely support items built into form.

H. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt or other debris just before concrete is placed. Retighten forms after concrete placement, if required, to eliminate mortar leaks.

3.02 PLACING REINFORCEMENT: Comply with the Concrete Reinforcing Steel Institute (CRSI) "Recommended Practice for Placing Reinforcing Bars", and as herein specified.

A. Clean reinforcement of loose rust, mill scale, dirt, and other materials or coatings which reduce or destroy bond with concrete.

B. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcing by chairs and hangers as required. Set wire ties so ends are pointed into concrete. Do not support reinforcing for slabs on grade on brick of any type.

C. Provide minimum of three (3) inches of concrete protection over bar where concrete cast against earth. Provide a minimum of two (2) inches of concrete over bar where forms are used. See structural drawings for other cover requirements.

D. Do not place bars more than 2" beyond the last leg of continuous support. Do not use supports to hold runways for conveying equipment.

E. Install mesh welded wire fabric reinforcement in as long lengths as practicable, lapping pieces at least one mesh plus 2" but in no case less than 8". Lace splices with wire. Offset end laps to prevent continuous laps in either direction. Lift mesh to middle third of slab by use of chairs.

F. Securely tie all anchor bolts to reinforcement.

3.03 JOINTS AND INSERTS:

A. Construction Joints: Provide control and expansion joints. Locate and install joints, which are not shown on the drawings, so as not to impair the strength and appearance of structure. Submit joint schedule and details to Architect.

B. Inserts: Set and build into the work anchorage devices and other embedded items required for other work that is attached to, or supported by, concrete. Properly locate embedded items in cooperation with other trades, and secure in position before concrete is poured. Use setting drawings, diagrams, instructions, and directions provided by suppliers of the items to be attached thereto.

3.04 CONCRETE PLACEMENT: Comply with ACI 304, and as herein specified.

A. Pre-Placement Inspection: Before placing concrete, clean and inspect formwork, reinforcing steel, and items to be embedded or cast-in. Notify other crafts in ample time to permit the installation of their work, and cooperate with them in setting such work, as required. Make sure soil treatment for termite control has been applied to cushion fill before vapor barrier and concrete are installed. Coordinate the installation of joint materials and vapor barriers with placement of forms and reinforcing steel.

B. Vapor Barrier: Apply directly over fill. Lay dry with 6" wide side laps taped and end laps. Lay film just before reinforcement is placed and concrete is poured, and protect against punctures. Repair punctures with adhesive-applied extra sheet before proceeding.

C. Notify Architect 72 hours before placing any concrete.

D. Conveying: Convey concrete from the mixer to the place of final deposit by methods which will prevent the separation or loss of materials. Provide equipment for chuting, pumping, and pneumatically conveying concrete of proper size and design as to insure a practically continuous flow of concrete at the point of delivery and without segregation of the materials. Keep open troughs and chutes clean and free from coating of hardened concrete. Do not allow concrete to drop freely more than 5 feet. All equipment and methods used for conveying are subject to the approval of Architect.

E. Depositing: Deposit concrete continuously or in layers of such thickness that no concrete will be placed on hardened concrete so as to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete near or in its final location to avoid segregation due to rehandling or flowing, and displacement of the reinforcement.

F. Cold Weather Placing: Comply with the requirements of ACI 306.

G. Hot Weather Placing: Comply with the requirements of ACI 305.

H. Compaction: Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corner.

3.05 FIELD SAMPLING AND TESTING: The following samples and tests will be performed by an independent testing laboratory approved by Architect. Refer to paragraph 1.04 TESTS, for responsibility for payment of tests.

A. Samples:

1. Field samples shall be made and cured in accordance with ASTM C31, for each concrete strength, at the rate of 4 test cylinders and one slump test for each 50 cu. yds. of concrete from each day's pour.

2. Test cylinders as follows: One at 7 days, two at 28 days, and reserve the remaining for testing after a longer period as required by the Architect, if the 28 days tests do not meet the required strength. In accordance with ASTM C173 Volumetric Method, or ASTM C231 Pressure Method, make air content check for each set of test cylinders. It is the responsibility of the testing laboratory to provide the results to the Architect and Contractor within five (5) days of performing the tests.

3. The taking of samples from small pours of 10 cubic yards or less may be omitted at the discretion of Architect.

4. Additionally, test slump every 25 cu. yds., recording location for report.

5. When early form removal is requested, field cure cylinders tested at 7 or less days to determine sufficient strength.

B. Testing:

1. Where strength of any group of 3 cylinders or if any individual cylinder falls below minimum compressive strength specified, the Architect shall have the right to require that test specimens be cut from the structure. Specimens shall be selected by Architect from location in structure represented by test specimen or specimens which failed.

2. Specimens shall be secured, prepared, and tested in accordance with ASTM C42, within a period of 60 days after placing concrete.

3. Concrete shall be considered to meet the strength requirement of this specification if it meets the strength requirements of paragraph 5.6.4. of ACI 318.

4. Should laboratory analysis indicate that the proper concrete mix has not been used by the Contractor, all such concrete poured using the improper mix shall be subject to rejection.

5. The cost of cutting specimens from the structure, patching the resulting holes, and making the laboratory analysis shall be borne by the Contractor.

6. The holes from which the cored samples are taken shall be packed solid with no slump concrete proportioned in accordance with the ACI 211 "Recommended Practice for Selecting Proportions of No-Slump Concrete". The patching concrete shall have the same design strength as the specified concrete.

7. If any of the specimens cut from the structure fail to meet the requirements outlined in paragraph 5.6.4 of ACI 318, the Architect shall have the right to require any and all defective concrete to be replaced, and all costs resulting therefrom shall be borne by the Contractor.

C. Contractor Sampling: In addition to the slump tests specified above, the contractor shall keep a cone (mold) and rod apparatus on the job site for random testing of batches. When concrete does not meet the specified slump requirements, and when directed by Architect, immediately perform a slump test in accordance with ASTM C 143. Concrete not meeting the slump requirements shall be removed from the job site.

3.06 FINISH OF FORMED SURFACES:

A. Rough Form Finish: For formed concrete surfaces not exposed-to-view in the finish work or by other construction, unless otherwise indicated. This is the concrete surface having texture imparted by form facing material used, with tie holes and defective areas repaired and patched and fins and other projections exceeding 1/4" in height rubbed down or chipped off.

B. Smooth Form Finish: For formed concrete surfaces exposed-to-view, or that are to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, dampproofing, painting or other similar system. This is as-cast concrete surface obtained with selected form facing material, arranged orderly and symmetrically with a minimum of seams. Repair and

patch defective areas with fins or other projections completely removed and smoothed.

3.07 SLAB FINISHES:

A. Exposed Plain Concrete Finish: Finish concrete by forcing aggregate away from surface and screeding at proper level. Finish to a flatness rating of a minimum of 40 and a floor levelness rating of a minimum of 30. Float surface and lightly trowel. When concrete has set sufficiently to ring under trowel, give a second troweling to product a smooth, dense surface free from trowel marks and sweeps, air bubbles or other imperfections of troweling.

B. Slabs to Receive Floor Covering: Finish as in A. above, trowel to remove trowel marks and to a smooth, even finish, except omit second troweling.

C. Slabs to Receive Polished Finish: Finish to a flatness rating of a minimum of 40 and a floor levelness rating of a minimum of 30. Finish is to be achieved either with pans or laser screeds. Wet cures are most suitable, dissipating cure and seals may be acceptable if approved by Architect and floor polishing subcontractor. Coordinate with polished floor subcontractor prior to placement of slab.

D. Non-Slip Broom Finish: At exterior ramps, walks, steps. Finish as in A. above except that after first troweling, give surface a light broom finish, brushing at right angles to direction of travel. No exposed tool marks will be permitted. Score as indicated or directed with small radius edging tool, to minimum 1/2" depth.

E. Concrete Sealer: Apply two coats in accordance with manufacturer's instructions.

F. Saw Cutting: Saw cuts are to be a minimum of 1/4 the slab thickness and lo less than 1”, and 1/3 the slab thickness for fiber-reinforced slabs. Saw cuts are to be performed before the slab cools, as soon as the concrete surface if firm enough not to be torn or damaged by the blade, and before random drying/shrinkage cracks can form in the slab. The cuts are to be done within the same day of placement, not the next morning. Placement/pour schedule is to be established accordingly

3.08 CONCRETE CURING AND PROTECTION:

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days. Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least 7 days in accordance with ACI 301 procedures. Avoid rapid drying at end of final curing period.

B. Curing Methods: Perform curing of concrete by moist curing, by moisture-retaining cover curing, by curing and sealing compound, and by combinations thereof, as specified.

1. Provide moisture curing by keeping concrete surface continuously wet by covering with water, by water-fog spray, or by covering concrete surface with specified absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4" lap over adjacent absorptive covers.

2. Provide moisture-cover curing by covering concrete surface with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3" and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

3. Provide curing and sealing compound on interior slabs to receive resilient flooring, or left exposed; and to exterior slabs and walks as follows:

a. Apply specified curing and sealing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours). Apply uniformly in continuous operations by power-spray or roller in accordance with manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.

b. Do not use membrane curing compounds on surfaces which are to be covered with coating material applied directly to concrete, flooring (glue-down carpets) painting, and other coatings and finish materials, unless otherwise acceptable to Architect.

C. Curing Formed Surfaces: Cure formed concrete surfaces by moist curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

D. Curing Unformed Surfaces: Cure unformed surfaces, such as slabs and other flat surfaces by application of appropriate curing compound. Final cure concrete surfaces by moisture-retaining cover, unless otherwise directed.

3.09 PROTECTION:

A. No wheeling, working or walking on finished surfaces will be allowed for 16 hours after the concrete is placed.

B. Provide plywood or other acceptable protective cover at all traffic areas throughout the job.

C. Protect exposed concrete floors, steps, and walks from paint and other materials or equipment which may mar or damage these surfaces.

3.10 REMOVAL OF FORMS: Do not remove forms until the concrete has attained 67% of 28-day strength or a minimum of 4 days. Use a method of form removal which will not cause over-stressing of the concrete.

3.11 MISCELLANEOUS ITEMS: Fill in holes and openings left in concrete for the passage of work by other trades after their work is in place. Mix, place, and cure concrete to blend with in-place construction. Provide all other miscellaneous concrete filling required to complete work.

3.12 CONCRETE SURFACE REPAIRS: Repair and patch defective areas with cement mortar of the same type and class as the original concrete, immediately after removal of forms. Cut out honeycomb, rock pockets, voids over 1/2" diameter, and holes left by tie rods and bolts, down to solid concrete but in no case to a depth of less than 1". Make edges of cuts perpendicular to the concrete surface, before placing cement mortar in the same manner as adjacent concrete. Proprietary patching compounds may be used when acceptable to Architect.

3.13 CLEAN-UP: Do not allow debris to accumulate. Clean up all concrete and cement materials, equipment and debris upon completion of any portion of the concrete work, and upon completion of the entire cast-in-place concrete work.

END OF SECTION

SECTION 05 40 00 – LIGHT GAUGE METAL FRAMING

PART 1 – GENERAL

1.01 SCOPE: Provide all light gauge metal framing, complete.

1.02 RELATED WORK SPECIFIED IN OTHER SECTIONS: Structural steel is specified in Section 05 12 00.

1.03 SUBMITTALS: Comply with Section 01 33 00.

A. Product Data: Submit copy of installation instructions for each item of light gauge framing and accessories.

B. Shop Drawings: Submit shop drawings including placing drawings for framing members showing size and gage designations, number, type, location and spacing. Include design for attachment to structure. Indicate supplemental bracing, accessories and details as may be required for proper installation.

1.04 QUALITY ASSURANCE:

A. Design Components: Calculate structural properties of studs in accordance with AISC "Specification for Design of Cold-Formed Steel Structural Members".

B. Welding: Use qualified welders and comply with AWS D1.3 "Structural Welding Code - Sheet Steel".

1.05 PRODUCT DELIVERY AND STORAGE: Protect metal framing units from rusting and damage. Deliver to the project site in manufacturer's unopened containers or bundles, fully identified with name, brand, type, locations and spacing. Indicate supplemental bracing, accessories, and details as may be required for proper installation.

1.06 REFERENCES:

A. ASTM A 123 – Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

B. ASTM A 525 – Standard Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.

C. ASTM A 525M – Standard Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process (Metric).

D. ASTM A 591/A 591M – Standard Specification for Steel Sheet, Electrolytic Zinc-Coated, for Light Coating Mass Applications.

E. ASTM C 645 – Standard Specification for Non-Load (Axial) Bearing Steel Studs, Runners (Track), and Rigid Furring Channels for Screw Application of Gypsum Board.

F. ASTM C 754 – Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Board.

G. ASTM C 1002 – Standard Specification for Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases.

H. ML/SFA 540 (Metal Lathe/Steel Framing Association, Division of National Association of Architectural Metal Manufacturers) – Lightweight Steel Framing Manual.

I. SSMA (Steel Stud Manufacturers Association)

J. SSPC Paint 20 (Steel Structures Painting Council) – Zinc Rich Primers.

PART 2 - PRODUCTS

2.01 MANUFACTURERS: Bostwick, Superior, U. S. Gypsum, or approved equal.

2.02 METAL FRAMING:

A. System Components: With each type of metal framing required, provide manufacturer's standard steel runners (tracks), blocking, lintels, clip angles, shoes, reinforcements, fasteners, and accessories as recommended by manufacturer for the applications indicate, as needed to provide a complete metal framing system.

B. Materials and Finishes:

1. Refer to chart below for gauge thickness for all interior and exterior walls, unless noted otherwise. For ADE projects: Minimum of 20-gauge stud. Size as indicated on drawings. Fabricate metal framing components of commercial quality steel sheet with a minimum yield point of 33,000 psi; ASTM A446, A570, or A611. Contractor has an option of submitting engineered shop drawing for review in lieu of using the sizing chart listed below. Contractor shall submit engineered shop drawing for a complete system showing member sizes, spacing and connections to the structure for exterior studs.

Non-Loadbearing Interior Studs (L/240 deflection limit)

Stud Size	Limiting Wall Height
362S125-30 (33 ksi) (minimum size)	11'-11"
362S125-43 (33 ksi)	13'-6"
362S125-54 (50 ksi)	14'-4"
362S125-68 (50 ksi)	15'-4"

Notes:

1. Studs spaced at 16" on center maximum
2. Flanges continuously supported on each face
3. Based on 10 psf lateral load

Non-Loadbearing Interior Studs (L/240 deflection limit)

Stud Size	Limiting Wall Height
362S162-33 (33 ksi) (minimum size)	17'-7"
362S162-43 (33 ksi)	19'-1"
362S162-54 (33 ksi)	20'-6"
362S162-68 (33 ksi)	21'-11"
600S162-43 (33 ksi)	28'-4"
600S162-54 (33 ksi)	30'-5"

Notes:

1. Studs spaced at 16" on center maximum
2. Flanges continuously supported on each face
3. Based on 5 psf lateral load

Non-Loadbearing Exterior Studs w/o Masonry Veneer (L/240 deflection limit)

Stud Size	Limiting Wall Height
600S162-43 (33 ksi) (minimum size)	17'-10"
600S162-54 (33 ksi)	19'-1"
600S162-68 (33 ksi)	20'-6"
600S162-97 (33 ksi)	22'-0"

Notes:

1. Studs spaced at 16" on center maximum
2. Flanges continuously supported on each face
3. Based on 20 psf lateral load

Non-Loadbearing Exterior Studs with Masonry Veneer (L/600 deflection limit)

Stud Size	Limiting Wall Height
600S162-43 (33 ksi) (minimum size)	13'-1"
600S162-54 (33 ksi)	14'-1"
600S162-68 (33 ksi)	15'-1"
600S162-97 (33 ksi)	16'-9"

Notes:

1. Studs spaced at 16" on center maximum
2. Flanges continuously supported on each face
3. Based on 20 psf lateral load

2. Provide galvanized finish to metal framing components complying with ASTM A525 for minimum G60 coating.
3. "C"-Shape Studs: Manufacturer's standard load-bearing steel studs of size, shape and gage indicated and specified, with 1.625" flange and flange return lip.

4. Galvanizing Repair Paint: High zinc dust content paint for repair of galvanized surfaces damaged by welding, complying with MIL-P-21035.

STEEL VALUES

Gauge No.	Design Thickness (inches)	Minimum Thickness (mils)	Color Reference
25	.0179	18	Natural
22	.0269	27	Black
20 Drywall	.0312	30	Pink
20 Structural	.0329	35	White
18	.0428	43	Yellow
16	.0538	54	Green
14	.0677	68	Orange
12	.0966	97	Red

2.02 FABRICATION:

A. General: Framing components may be prefabricated into panels prior to erection. Fabricate panels plumb, square, true to line and braced against racking with joints welded. Perform lifting of prefabricated panels in a manner to prevent damage or distortion in any members in the assembly.

B. Fastenings: Attach similar components by welding. Attach dissimilar components by welding, bolting, or screw fasteners, as standard with the manufacturer. Wire typing of framing components is not permitted.

PART 3 - EXECUTION

3.01 INSTALLATION: Install metal framing systems in accordance with manufacturer's printed or written instructions and recommendations, and final shop drawings.

A. General:

1. Runner Tracks: Install continuous tracks sized to match studs. Align tracks accurately to the layout at base and top of studs. Secure tracks as recommended by the stud manufacturer for the type of construction involved, except do not exceed 24" o.c. spacing for nail or power-driven fasteners, not 16" o.c. for other types of attachment. Provide fasteners at corners and ends of tracks.

2. Set studs plumb, except as needed for diagonal bracing or required for non-plumb walls or warped surfaces and similar requirements.

3. Where stud system abuts structural columns or walls anchor ends of stiffeners to supporting structure.

4. Install supplementary framing, blocking and bracing in the metal framing system wherever walls or partitions are indicated to support fixtures, equipment, services, casework, heavy trim and furnishings, and similar work requiring attachment to the wall or partition. Where type of supplementary support is not otherwise indicated, comply with the stud manufacturer's recommendations and industry standards in each case, considering the weight or loading resulting from the items supported.

B. Installation of Wall Stud System: Space studs 16" o.c.

1. Secure studs to top and bottom runner tracks by either welding or screw fastening at both inside and outside flanges. At load bearing walls, studs are to fit “tightly” to capture track and running track. No gaps allowed.

2. Frame wall openings larger than 2'-0" square with double stud at each jamb of frame except where more than 2 are either shown or indicated in manufacturer's instructions. Install runner tracks and jamb studs with stud shoes or by welding, and space jack studs same as full-height studs of the wall. Secure stud system all around to wall opening frame in the manner indicated.

3. Frame both sides of expansion and control joints, as shown for the wall system, with a separate stud and do not bridge the joint with components of the stud system. Install horizontal stiffeners in stud system, spaced (vertical distance) at not more than 5 ft. o.c. weld at each intersection.

C. Bridging: Provide and install bridging at all stud walls per SSMA and manufacturer’s recommendations.

3.02 FIELD PAINTING: Touch up shop-applied protective coatings damaged during handling and installation. Use galvanizing repair paint for galvanized surfaces.

END OF SECTION

SECTION 05 50 00 – METAL FABRICATIONS AND MISCELLANEOUS METAL WORK

PART 1 - GENERAL

1.01 SCOPE: Provide metal fabrications and miscellaneous metal work, complete, including:

A. Steel supports for work of other trades.

B. Miscellaneous metal steel attachments, anchors, plates, angles, etc.

C. Include all anchors, angles, bolts, expansion shields for items in this Section only, and other accessories shown in detail and or required for the complete installation of all work.

1.02 RELATED WORK SPECIFIED IN OTHER SECTIONS: Cast-in-place Concrete; Section 03 30 00.

1.03 SUBMITTALS: Comply with Section 01 33 00.

A. Product Data: Submit for products used in miscellaneous metal fabrications, including paint products and grout.

B. Shop Drawings: Submit shop drawings for the fabrication and erection of all assemblies of metal fabrications and miscellaneous metal work. Include plans, elevations, sections and details of fabrications and their connections. Show anchorage and accessory items. Provide templates for anchors and bolts specified for installation under other sections.

1.03 PROJECT CONDITIONS:

A. Field Measurements:

1. Check actual locations of walls and other construction to which metal fabrications must fit, by accurate field measurements before fabrication; show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of work.

2. Where field measurements cannot be made without delaying work, guarantee dimensions and proceed with fabrication of products without field measurements. Coordinate construction to ensure that actual opening dimensions correspond to guaranteed dimensions. Allow for trimming and fitting.

1.04 REFERENCES:

A. AISI (American Iron and Steel Institute) – Cold-Formed Steel Design Manual.

B. ASTM A 123 – Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

C. ASTM A 446/A 446M – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality.

D. ASTM A 525 – Standard Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.

E. ASTM A 525M – Standard Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process (Metric).

F. ASTM A 570/A 570M – Standard Specification for Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality.

G. ASTM A 611 – Standard Specification for Steel, Sheet, Carbon, Cold-Rolled, Structural Quality.

H. ASTM A 645/A 645M – Standard Specification for Pressure Vessel Plates, Five Percent Nickel Alloy Steel, Specially Heat Treated.

I. ASTM C 955 – Standard Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging, for Screw Application of Gypsum Board and Metal Plaster Bases.

J. AWS D1.1 – Structural Welding Code – Steel.

K. AWS D 1.3 – Structural Welding Code – Sheet Steel.

L. MFMA (Metal Framing Manufacturers Association) – Guidelines for the Use of Metal Framing.

M. ML/SFA 540 – (Metal Lathe/Steel Framing Association, Division of National Association of Architectural Metal Manufacturers; NAAMM) – Lightweight Steel Framing Systems Manual.

N. SSPC – Paint 15 (Steel Structures Painting Council) – Steel Joist Shop Paint.

O. SSPC – Paint 20 (Steel Structures Painting Council) – Zinc Rich Primers.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Miscellaneous Steel Bars, Rods and Shapes: ASTM A36, A283, A108, A663, A501 and A575, as applicable.

B. Bolts and Nuts: ASTM A307, Grade A. High strength bolts; ASTM A325. Hot-dip galvanize all items in accordance with ASTM A153.

C. Expansion Bolts: Hilti "Kwik Bolt".

D. Expansion Shields: F.S. FF-S-325.

E. Anchor Bolts: Furnish and deliver to site, anchor bolts and other items to be embedded in concrete. Provide necessary shop details and diagrams for concrete forms and, if required, provide templates to insure proper and accurate locations and setting of anchor bolts.

F. Toggle Bolts: Tumble-wing type F.S. FF-B-588 type, class and style as required.

G. Lock Washers: F.S. FF-W-84, helical spring type carbon steel.

H. Miscellaneous Items: Furnish bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels and other miscellaneous steel shapes as required for framing and supporting work and for anchoring or securing work to concrete or other structures. Straight bolts and other stock rough hardware items are specified in Section 06 10 00.

I. Shop Paint: Lead free, alkyd primer; Tnemec 10-99, Southern Coatings Enviro-Guard 1-2900, or approved equal, meeting performance requirements of F.S. TT-P-86, and passing ASTM B117 after 500 hours. Primer selected must be compatible with finish coats of paints. Coordinate selection of metal primer with finish paint requirements specified in Section 09 91 00.

J. Galvanizing Repair Paint: High zinc dust content paint for re-galvanizing welds in galvanized steel work, complying with SSPC - Paint 20.

2.02 FABRICATION:

A. Workmanship: Use materials of size and thickness shown or, if not shown, or required size and thickness to produce strength and durability in finished product. Work to dimensions shown or accepted on shop drawings, using proven details of fabrication and support. Use type of materials shown or specified for various components of work.

B. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges. Ease exposed edges to a radius of approximately 1/32" unless otherwise shown. Form bent metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

C. Weld corners and seams continuously, complying with AWS recommendations. At exposed connections, grind exposed welds smooth and flush to match and blend with adjoining surfaces.

D. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type shown or, if not shown, Phillips flat-head (countersunk) screws or bolts. Provide for anchorage of type shown, coordinated with supporting structure. Fabricate and space anchoring devices to provide adequate support for intended use. Cut, reinforce, drill and tap miscellaneous metal work as indicated to receive finish hardware and similar items.

E. Shop Painting:

1. Shop paint miscellaneous metal work, except concealed metal work, members or portion of members to be embedded in concrete or masonry, surfaces and edges to be field welded, and galvanized surfaces, unless otherwise specified.

2. Remove scale, rust and other deleterious materials before applying shop coat. Clean off heavy rust and loose mill scale in accordance with SSPC SP-2 or SSPC SP-3.

3. Remove oil, grease and similar contaminants in accordance with SSPC SP-1.

4. Immediately after surface preparation, brush or spray on primer in accordance with manufacturer's instructions, and at rate to provide uniform dry film thickness of 2.0 mils for each coat. Use painting methods which will result in full coverage of joints, corners, edges, and exposed surfaces.

2.03 STEEL SUPPORTS: Provide structural steel lintels, channels, braces, angles, etc., as indicated and assemble as detailed. Secure all connections to provide rigid supports for all items required including support not specifically specified in other sections.

PART 3 - EXECUTION

3.01 PREPARATION: Furnish setting drawings, diagrams, templates, instructions and directions for installation or anchorages. Coordinate delivery of such items to site.

3.02 INSTALLATION: Perform cutting, drilling and fitting required for installation; set work accurately in locations, alignment and elevation, measured from established lines and levels. Provide anchorage devices and fasteners where necessary for installation to other work.

3.03 TOUCH-UP SHOP PAINTING: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting. Use galvanizing repair paint on damaged galvanized surfaces.

END OF SECTION

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SECTION 06 10 00 – ROUGH CARPENTRY

PART 1 - GENERAL

1.01 SCOPE: Provide carpentry work, and installation of items specified in other sections which are normally installed by the carpenters. In general, this work includes the following:

A. Wood structure.

B. Concealed framing, studs, etc.

C. Plywood roof sheathing.

D. Braces, stripping, grounds, and nailers indicated or necessary to install casework, toilet room accessories, and to receive or back work of other trades.

1.02 QUALITY ASSURANCE:

A. Grading Marks: Factory-mark each piece of lumber and plywood with type, grade, mill and grading agency identification; and submit mill certificate that material has been inspected and graded in accordance with requirements if it cannot be marked on a concealed surface.

B. Wood Preservative Treatment: Label each piece of pressure treated lumber and plywood with the Quality Control mark of the American Wood Preservers Bureau showing compliance with the appropriate standard.

1.03 PRODUCT HANDLING: Keep carpentry materials dry during delivery, storage and handling. Store lumber and plywood in stacks for air circulation within stacks. Protect bottom of stacks against contact with damp surface. Protect exposed materials against weather. Do not store dressed or treated lumber or plywood outdoors.

PART 2 - PRODUCTS

2.01 SOFTWOOD: Comply with the standards of SPIB "Standard Grading Rules for Southern Pine Lumber".

A. For structural lumber 2" to 4" thick, 6" and wider, use KD, S4S, Southern Pine No. 2.

B. For structural light framing 2" to 4" thick, 2" to 4" wide, use KD, S4S, Southern Pine No. 2.

C. For light framing 2" to 4" thick, 2" to 4" wide, and studs, use KD, S4S, Southern Pine No. 2.

D. For finish lumber, use KD, S4S, Southern Pine C & BTR, vertical grain.

2.02 SOFTWOOD PLYWOOD: Comply with PS-1, Exposure 1 (exterior glue), Group 1, Southern Pine; APA CD grade, with exterior glue, span index 32/16 at roof sheathing.

2.03 ROUGH HARDWARE: Nails, metal connectors, bolts, nuts, screws, washers, staples, and other fasteners (except as specified or noted otherwise); hot-dip galvanized steel.

2.04 PLYWOOD SHEATHING CLIPS: Simpson PSC, 18 gauge steel, galvanized.

2.05 WOOD PRESERVATIVE TREATMENTS:

A. Pressure treat above-ground items with water-borne preservatives to comply with AWPB LP-2. After treatment, kiln-dry lumber to a maximum moisture content of 19%. Treat indicated items and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, and vapor barriers.

2. Wood blocking, furring, stripping and similar concealed members in contact with masonry and concrete.

3. Wood framing members less than 18" above grade.

4. Wood floor plates installed over concrete slabs directly in contact with earth.

B. Complete fabrication of treated items prior to treatment, where possible. If cut after treatment, coat cut surfaces with heavy brush coat of same chemical used for treatment and to comply with AWPB M4.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL:

A. Discard units of material with defects which might impair quality of work, and units which are too small to use in fabricating work with minimum joints or optimum joint arrangement.

B. Set carpentry work to required levels and lines, with members plumb and true to line and cut and fitted.

C. Securely attach carpentry work to substrate by anchoring and fastening as indicated and as required by recognized standards. Countersink nail heads on exposed carpentry work and fill holes.

D. Use common wire nails, except as otherwise indicated or specified. Use finishing nails for finish work. Select fasteners of size that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting of wood; pre-drill as required.

E. Anchor carpentry work to anchorage devices or blocking built-in or directly attached to substrates. Secure to grounds, strips, backing and blocking, of thickness and shape required to secure work and equipment in place, as indicated on the drawings or required by conditions. Fasten wood grounds, furring and other engaging woodwork to various types of walls with approved types and sizes of nails, ties, and inserts, spaced to provide rigid secure supports.

3.02 ROOF STRUCTURE: Splice rafters directly over structural supports. Set crown edge up and solid block over bearings; cross bridge.

3.03 ROOF SHEATHING: Install with face grain across supports; locate and stagger joints over supports. Nail 6" o.c. at panel ends (supported plywood edges) and 12" o.c. at intermediate supports (unsupported plywood edges) using 8d common nails. At unsupported edges use plywood sheathing clips, one between supports.

3.04 TRIM: Miter corners, ease edges. (NOTE: Prefinished metal for cladding is specified in Section 07 62 00.)

3.05 ROUGH CARPENTRY: Provide wood grounds, strips, bucks, plates, backing, and blocking of thickness and shape required to secure work and equipment in place, as indicated on drawings or required by conditions. Fasten with approved types and sizes of nails, ties, and inserts, spaced to provide rigid secure supports.

3.06 ROUGH HARDWARE: Provide rough hardware necessary or required for installation of work specified. Use sufficient size and number of spikes, nails, screws, bolts, etc., to insure rigidity, security and permanence.

3.07 CLEAN-UP: Remove from the premises all rubbish, debris, and unused materials which may be accumulated during the progress of the work.

END OF SECTION

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SECTION 06 40 00 – ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.01 SCOPE: Provide architectural woodwork, complete. Work includes, but is not limited to, the following:

A. Cabinetwork, millwork, hardware and accessories.

B. Plastic laminate countertops, backsplashes, skirts, trash container cutouts and braces.

C. Solid surfacing countertops and backsplashes.

D. Shelving.

E. Standing and running trim.

1.02 RELATED WORK SPECIFIED IN OTHER SECTIONS:

A. Finishing; Section 09 91 00.

B. Plumbing Fixtures; Division 22.

C. Miscellaneous Metals; Section 05 50 00.

1.03 SUBMITTALS:

A. Product Data: Submit manufacturer's product data for each product and process specified as work of this section and incorporated into items of architectural woodwork during fabrication, finishing and installation.

B. Shop Drawings: Prior to fabrication, submit shop drawings indicating location, material quality and species, fabrication and assembly details. Verify and indicate requirements for cutouts in countertops for plumbing fixtures. Layouts indicate color, pattern and finish selections. Provide seaming diagram.

C. Samples: Submit samples, in full color and pattern ranges for Architect's selection, for plastic laminate, chemical-resistant plastic laminate and solid surfacing.

1.04 QUALITY ASSURANCE:

A. Cabinet Material and Fabrication Standards: Custom grade for opaque finish, laminated plastic, chemical-resistant plastic laminate, and solid surfacing countertops, in accordance with the latest edition of the Architectural Woodwork

Institute Quality Standards and Guide Specifications, conforming to the following sections except where modified elsewhere in this section.

1. Section 100 - Lumber

2. Section 200 - Panel Products

3. Section 400 - Architectural Cabinets

4. Section 1700 - Installation

B. Fabrication of architectural woodwork to be by a single firm.

1.05 DELIVERY, STORAGE, AND HANDLING: Deliver, store and handle architectural woodwork in a manner to prevent damage and deterioration. Protect all surfaces of items subject to damage during transit.

1.06 WARRANTY: Provide a five (5) year fabricator/installer warranty on all casework.

PART 2 - PRODUCTS

2.01 MATERIALS: Conform to Sections 100 and 200 of reference standard, except as modified below:

A. Exposed Solid Wood for Transparent Finish: Red Oak, plain sawn.

B. Solid Wood for Semi-exposed Members: Same as exposed members.

C. Solid Wood for Concealed Members: Southern Pine or Douglas Fir.

D. Exposed Plywood for Transparent Finish: Red Oak; plain sliced.

E. Semi-exposed Plywood: Same as exposed plywood.

F. Concealed Plywood: Southern Pine or Douglas Fir.

G. Exposed Plywood for Laminated Plastic: Hardwood, any species, bonded with exterior glue.

H. Plastic Laminate: High-pressure Laminated Plastic and Chemical-resistant Laminated Plastic: NEMA LD-3, GP-50 (0.050”) and NEMA LD-3, Grade HGP; Nevamar, Formica, Wilsonart or Laminart, in pattern, texture and color as selected by Architect.

I. Solid Surfacing: Homogeneous solid sheets of filled plastic resin complying with material and performance requirements of ANSI Z124.3, Type 5 or Type 6, without a pre-coated finish, 1/2" thick; Wilsonart is specified; or approved equal. Pattern and color from Groups A-F as selected by Architect.

J. Adhesive: Complying with CS 35, Type I.

K. Fasteners and Anchors: Screws (F.S. FF-S-111), nails (F.S. FF-N-105), and anchors and expansion bolts of material, type, and finish required for each use and for secure anchorage.

L. Exposed Plywood for Opaque Finishes: Paint grade Birch.

M. Low pressure laminate: TFL panels by Wilsonart; or approved equal.

1. Laminate Composition: Melamine saturated decorative layers thermally fused to both core face surfaces with heat and pressure. Stain resistant surface with wear and scratch resistance.

2. Panel Core Material: Composite panel product composed primarily of cellulosic materials and a bonding system, resulting in a durable and dimensionally stable substrate suitable for decorative laminate overlays."

2.02 FABRICATION AND MANUFACTURE: Comply with specified sections of referenced standard, except do not use staples in exposed millwork construction.

A. Cabinets: As detailed.

B. Countertops:

1. Solid Surfacing Countertops and Integral Bowls: Fabricate tops in one piece with shop-applied backsplashes and edges. Comply with solid surfacing material manufacturer's recommendations for adhesives, sealers, fabrication and finishing. Install integral sink bowls in countertops installed at shop. Drill holes in countertops for plumbing fittings and soap dispensers in shop.

2. Coordinate and verify requirements for cutouts for plumbing fixtures.

C. Shelving: Sizes as indicated on drawings.

PART 3 - EXECUTION

3.01 PREPARATION:

A. Condition woodwork to average prevailing humidity conditions in installation areas prior to installing.

B. Prior to installation, examine shop-fabricated work for completion, and complete work as required, including back priming and removal of packing.

3.02 INSTALLATION: Comply with ASI referenced section and as specified.

A. Prior to installation, ensure proper acclimation of product.

B. Install woodwork plumb, level, and true and straight with no distortions. Shim as required using concealed shims. Install to a tolerance of 1/8" in 8'-0" for plumb and level (including countertops); and with no variations in flushness or adjoining surfaces.

C. Scribe and cutwork to fit adjoining work and refinish cut surfaces or repair damaged finish at cuts.

D. Anchor woodwork to anchors or blocking built-in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation. Use fine finishing nails for exposed nailing, countersunk and filled flush with woodwork.

E. Cabinets: Install without distortion so that doors and drawers will fit openings properly and be accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete the installation of hardware and accessory items.

F. Laminated Plastic and Chemical-resistant Laminated Plastic Countertops, Backsplashes, Skirts and Trash Container Cutouts: Anchor securely to base units, walls and other support systems.

G. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to the greatest extent possible. Stagger joints in adjacent and related members. Cope at returns, miter at corners, and comply with referenced standards for joinery. All exposed plywood edges are to have hardwood trim. No taped edges will be accepted.

3.03 ADJUSTMENT, CLEANING, FINISHING AND PROTECTION:

A. Repair damaged and defective woodwork wherever possible to eliminate defects functionally and visually; where not possible to repair properly, replace woodwork. Adjust joinery for uniform appearance.

B. Clean hardware, lubricate, and make final adjustments for proper operation.

C. Clean woodwork on exposed and semi-exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

D. Protection: Provide final protection and maintain conditions necessary to ensure that the work will be without damage or deterioration at the time of acceptance.

END OF SECTION

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SECTION 07 10 00 – WATERPROOFING

PART 1 - GENERAL

1.01 SCOPE: Provide all waterproofing, complete, as indicated on drawings and in specifications. Refer to Section 03 30 00.

1.02 SUBMITTALS: Comply with Section 01 33 00.

A. Product Data: Submit product data and general recommendations from waterproofing materials manufacturer for types of materials required.

B. Samples: Submit samples of sheet waterproofing and auxiliary materials as requested by Architect.

C. Certificates: Include certificates substantiating that materials comply with specified requirements.

1.03 QUALITY ASSURANCE:

A. Manufacturer: Obtain primary materials from a single manufacturer, to greatest extent possible. Provide secondary materials only as recommended by manufacturer of primary materials.

B. Installer: Firm with not less than three years of successful experience in installations similar to requirements of this project and which is acceptable to manufacturer of primary waterproofing system manufacturers.

1.04 PROJECT CONDITIONS:

A. Substrate: Proceed with work after substrate construction, openings, and penetrating work have been completed.

B. Weather: Proceed with work only when existing and forecasted weather conditions will permit work to be performed in accordance with manufacturer's recommendations and warranty requirements.

1.05 WARRANTY:

A. Submit written warranty, executed by manufacturers, agreeing to repair and replace waterproofing system that fails in materials and workmanship.

B. Warranty period is 5 years.

PART 2 - PRODUCTS

2.01 NON-SHRINK GROUT: "Waterplug" by Thoro Systems, Inc.

2.02 BACKER ROD: Open cell polyethylene by Denver Foam

2.03 SEALANT: Sonneborn NP-1 urethane or Vulchem

2.04 EXTRUDED SILICONE BRIDGE: Spectrem® Simple Seal by Tremco

PART 3 - EXECUTION

3.01 PREPARATION:

A. Comply with manufacturer's instructions for surface preparation.

B. Chip off projections where necessary for proper placement and adhesion of waterproofing.

3.02 INSTALLATION:

A. Comply with manufacturer's instructions for handling and installation of sheet waterproofing materials.

B. Coordinate installation of waterproofing materials and associated work to provide complete system complying with combined recommendations of manufacturers and installers involved in work. Schedule installation to minimize period of exposure of waterproofing materials.

3.03 PROTECTION: Provide protection of all waterproofing materials, as specified by manufacturer during installation of other materials and throughout remainder of construction period.

END OF SECTION

SECTION 07 11 00 – ACRYLIC (TEXTURED) DAMPPROOFING

PART 1 - GENERAL

1.01 SCOPE: Provide textured acrylic dampproof coating over exterior split face concrete masonry units and pre-cast concrete.

1.02 RELATED WORK SPECIFIED IN OTHER SECTIONS: Joint sealants; Section 07 92 00.

1.03 SUBMITTALS:

A. Product Data: Submit manufacturer's product data and application instructions on coating system.

B. Prior to application, submit sample panel showing specified texture and specified color, for Architect's approval.

1.04 JOB CONDITIONS: Do not apply coating when temperatures are 40°F or due to fall below 40°F within 24 hours, or to frozen or frost-filled surfaces.

1.05 COORDINATION: Coordinate installation of dampproofing with joint sealant work. Install dampproofing prior to joint sealant installation.

PART 2 - PRODUCTS

2.01 ACRYLIC DAMPPROOFING COATING: Standard Drywall Systems "Thorolastic" or Western Waterproofing "Flexible Resto-Crete", acrylic base, ready-mix, textured coating, in color as selected by the Architect, minimum 1/8" thick., and minimum of two coats.

A. Base and Finish Coat: “Thorolastic-Fine”, water-based acrylic emulsion with high solids content; standard colors as selected by Architect.

B. Crack Fillers:

1. Hairline Cracks (no larger than 1/32”): “Thorolastic-Smooth”.

2. Large Static Cracks (larger than 1/32” up to 1/16” and non-moving): “Thorolastic Knife Grade”, water-based acrylic emulsion in a putty consistency.

3. Dynamic Cracks (subject to thermal or other movement): Sealant joint as specified in Section 07 92 00.

PART 3 - EXECUTION

3.01 PREPARATION: Clean surfaces free of all laitance, dirt, dust, grease, oil, efflorescence, paint, and foreign material, including form release agents and curing compounds.

3.02 APPLICATION:

A. Spray apply 2 coats in a heavy, unstretched, uniform manner in one direction, in strict accordance with manufacturer's instructions and recommendations.

B. Use brush at edges of concrete block and pre-cast at sealant joints to assure coating on all exposed surfaces.

C. Finish to even sand texture.

END OF SECTION

SECTION 07 21 00 – BUILDING INSULATION

PART 1 - GENERAL

1.01 SCOPE: Provide building insulation, complete.

1.02 SUBMITTALS: Comply with Section 01 33 00. Submit manufacturer's installation instructions for each type of insulation. Include data substantiating that materials comply with physical and thermal properties, and other requirements of specified insulation.

1.03 PRODUCT HANDLING: Do not allow insulation materials to become wet or soiled. Comply with manufacturer's instructions for handling, storage, and protection during installation.

1.04 JOB CONDITIONS: Do not proceed with the installation of insulation until the work which follows (and which conceals the insulation) is scheduled to follow immediately.

PART 2 - PRODUCTS

2.01 INSULATION: Batt Insulation: 3-5/8" (R=13), 6" (R=19), 8" (R=25) kraft-faced fiberglass batt insulation; Owens/Corning, Manville or Certainteed.

2.02 MISCELLANEOUS MATERIALS: Provide adhesive for bonding insulation, mechanical anchors, or other required items, as recommended by the insulation manufacturer.

2.03 RIGID PERIMETER INSULATION: Extruded polystyrene board insulation. 1" thick (R-5) and 2" thick (R-10); Dow Styrofoam SM is specified; equivalent products of AmocoFoam and Fomular are acceptable; or approved equal.

2.04 ROOF INSULATION: Refer to Section 07 22 16.

2.05 SOUND ATTENUATION BATTS: Ecotouch Sound Attenuation Batts by Owens/Corning, Manville or Certainteed.

2.06 "Z" FURRING: Provide 1-1/2", 20 ga. By Dietrich Metal Framing or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Comply with manufacturer's instructions.

B. Extend insulation full thickness over entire surface to be insulated. Cut and fit tightly around obstructions and fill voids with insulation.

END OF SECTION

SECTION 07 22 16 – ROOF AND DECK INSULATION

PART 1 – GENERAL

1.01 SCOPE: Provide roof and deck insulation, complete.

1.02 SECTION INCLUDES

A. HCFC FREE "Green" Polyiso Rigid board type roof insulation(s) for thermal protection as part of roofing assemblies.

B. Roofing crickets.

C. Recover board HCFC FREE "Green" Polyiso roof insulation.

1.03 RELATED SECTIONS

A. Section 06 10 00 - Rough Carpentry: Wood roof blocking and nailers.

1.04 REFERENCES

A. LTTR – Long Term Thermal Resistance, using techniques from CAN/ULC S770 based on ASTM C1303

B. UL 263 - Fire Tests of Building Construction and Materials.

C. UL 790 - Tests for Fire Resistance of Roof Covering Materials.

D. UL 1256 - Fire Test of Roof Deck Constructions.

E. ASTM E 2114-01 – Standard Terminology for Sustainability Relative to the Performance of Buildings

F. ASTM 2129 –01 – Standard Practice for Data Collection for Sustainability Assessment of Building Product

1.05 DEFINITIONS

A. HCFC FREE "Green" Polyiso Roof Board Insulation is defined as environmentally friendly, with Zero Global Warming, Zero Ozone Depletion (ODP) as in compliance with the US EPA requirements of January 1, 2003 to eliminate production of HCFC 141b.

B. LTTR (Long Term Thermal Resistance) is defined as using techniques from ASTM C1303, CAN/ULC S770 predicting a foam's R-Value that has been shown to be equivalent to the average performance of a permeably faced foam insulation

product over 15 years. In Canada this method is used as the Design R-Value. This applies to ALL foam insulation products with blowing agents other than air, such as Polyiso, “Green” Polyiso, extruded polystyrene and polyurethane. The new method is based on consensus standards in the US and Canada. PIMA has reported this method as providing a better understanding of the thermal performance of foam.

1.06 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Product Data:

1. Manufacturer´s HCFC FREE “Green” Polyiso specifications

2. Installation instructions for HCFC FREE “Green” Polyiso insulation board and fasteners

3. Product Data as per ASTM 2129 – 01 Standard for Data Collection for Sustainability Assessment of Building Products

C. Samples:

1. Submit 6” x 6” samples of each board type required.

2. Submit samples of each fastener type required.

D. Shop Drawings: Roof plan showing layout of boards, and fastening patterns, and ventilation and roof edge details.

E. Certificates: System Manufacturer´s or insulation manufacturer’s certification that HCFC FREE “Green” Polyiso materials meet Zero ODP (Ozone Depletion Potential) and Zero GWP (Global Warming Potential) specification requirements.

F. Thermal Warranty: Submit sample warranty indicating conditions and limitations.

1.07 QUALITY ASSURANCE

A. HCFC FREE “Green” Polyiso Manufacturer Qualifications:

1. Show evidence of ability to manufacturer products specified with sufficient manufacturing facilities.

a. List dates of HCFC FREE “Green” Polyiso plant conversion and/or full production operation

b. List HCFC chemistry alternative/replacement.

2. Provide past project HCFC FREE “Green” Polyiso installation performance histories

B. Regulatory Requirements:

1. American Society for Testing and Materials (ASTM).

2. Factory Mutual (FM).

3. Underwriters Laboratories Inc. (UL) Classification.

4. IBC, BOCA, ICBO and SBCCI Sections on Foam Insulation.

1.08 DELIVERY, STORAGE AND HANDLING

A. Deliver insulation in packages labeled with material name, thermal value and product code.

B. When stored outdoors, stack insulation on pallets above ground or roof deck and cover with tarpaulin or other suitable waterproof coverings. Slit or remove manufacturer´s packaging before covering with waterproof covering.

1.09 PROJECT CONDITIONS

A. Comply with insurance underwriter´s requirements applicable for products of this Section.

B. Do not install insulation on roof deck when water of any type is present. Do not apply roofing materials when substrate is damp or wet.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers: Atlas Roofing Corporation, 1775 The Exchange, Suite 160, Atlanta, GA 30339, Ph. (770) 952-1442 Fax (770) 952-3170; or approved equal.

B. Requests for substitutions will be considered in accordance with provisions of Section 01 33 00.

C. Provide all HCFC FREE “Green” Polyiso roof board insulation from a single manufacturer.

2.02 MATERIALS

A. HCFC FREE “Green” Polyiso Roof Board Insulation: Provide products that comply with the following:

1. ASTM standards specified.

2. Factory Mutual (FM) approvals specified.

3. Underwriters Laboratories Inc. (UL) classifications specified.

4. BOCA National Building Code Sections on Foam Insulation

5. ICBO Uniform Building Code Sections on Foam Insulation.

6. SBCCI Standard Building Code Sections on Foam Insulation.

B. ACFoam Nail Base: Closed-cell HCFC FREE “Green” polyisocyanurate foam board manufactured using ACUltra Hydrocarbon blowing agent and bonded to 7/16 inch thick APA/TECO rated OSB on the top side and a fiber-reinforced felt facer on the bottom; for use with single-ply wind rating; compressive strength - 20 psi.

1. ASTM C 1289, Type V

2. IBC, NBC, UBC and SBC Sections on Foam Insulation (Chapter 26)

3. ARMA insulated deck requirements

4. APA/TECO rated OSB nailable surface

FM Standard 4450/4470 Approval: ACFoam Nailbase Insulation is approved for Class 1 insulated roof deck construction. Refer to FM Approval Guide for details.

UL Standard 263 Fire Resistance Classification (ASTM E119): Some classifications for fire resistance are P225, P230, P259, P508, P510, P514, P701, P717, P719, P723, P728, P732, P734, P739, P801, P815, and P819. See UL Fire Resistance Directory.

C. LTTR – 4” Insulation "R" Value: 22.3. Long-term thermal resistance values of the foam were determined in accordance with CAN/ULC-S770. All test samples were third-party selected and tested by an accredited materials testing laboratory.

D. Related Materials:

1. Fasteners: Factory Mutual approved.

2. Base Ply: As recommended by membrane manufacturer.

3. Fasteners: For Nail Base and Vented-R: Atlas Nail Base Fasteners.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine roof deck for suitability to receive insulation. Verify that substrate is dry, clean and free of foreign material that will damage insulation or impede installation.

B. Verify that roof drains, scuppers, roof curbs, nailers, equipment supports, vents and other roof accessories are secured properly and installed in conformance with Contract Drawings and submittals.

C. Verify that deck is structurally sound to support installers, materials and equipment without damaging or deforming work.

1. Start of installation indicates installer accepts conditions of existing deck surfaces.

3.02 APPLICATION/INSTALLATION

A. Install specified insulation using approved mechanical fasteners in accordance with manufacturer´s latest written instructions and as required by governing codes and Owner´s insurance carrier.

B. Install with end joints staggered to avoid having insulation joints coinciding with joints in deck. In multi-layer installations, stagger joints in top and bottom layers.

3.03 CLEANING/PROTECTION

A. Remove trash and construction debris from insulation surface prior to application of roofing membrane.

B. Do not leave installed insulation exposed to weather. Cover and waterproof with completed roof system immediately after installation.

1. Temporarily seal exposed insulation edges at the end of each day.

2. Remove and replace installed insulation that has become wet or damaged with new insulation.

C. Protect installed insulation and roof cover from traffic by use of protective covering materials during and after installation

END OF SECTION

SECTION 07 24 00 - EXTERIOR INSULATION AND FINISH SYSTEM

PART 1 - GENERAL

1.01 SCOPE: Provide exterior insulation and finish system, complete, including insulation, reinforcing fabric, adhesives, fasteners, and base and finish coats.

1.02 RELATED WORK SPECIFIED IN OTHER SECTIONS:

A. Joint sealant requirements; Section 07 92 00.

B. Sheet metal flashing; Section 07 62 00.

C. Metal Framing; Section 05 40 00.

D. Gypsum Sheathing; Section 09 29 00.

1.03 SUBMITTALS: Comply with Section 01 33 00.

A. Samples: Submit for verification 2' x 2' sample of system showing textures and colors selected, using workmanship and tools typical of actual installation.

B. Product Data: Submit manufacturer's technical data and installation instructions for each component.

C. Shop Drawings: Submit shop drawings showing fabrication and installation of system including plans, elevations, sections, details of components, joint locations and configurations within system and between system and construction penetrating system, and attachments to construction behind system.

D. Installer Certificates: Submit certificates signed by manufacturer certifying that installers comply with requirements under "Quality Assurance" article.

E. Warranty: Submit executed warranty.

1.04 PERFORMANCE REQUIREMENTS:

A. Durability:

1. Abrasion Resistance: ASTM D-968; no deleterious effects after 500 liters.

2. Absorption-Freeze-Thaw: 60 cycles, soak at 68°F for four days, then 14°F for two hours; no checking, cracking or splitting.

3. Accelerated Weathering: ASTM G-23; 2,000 hours. No deterioration.

4. Mildew Resistance: MIL Std 810B; passes.

5. Moisture Resistance: ASTM D-2247; no deleterious effects after 14 days.

6. Salt Spray Resistance: ASTM B-117; 5% concentration for 300 hours. No deleterious effects.

7. Water Penetration: ASTM E-331; no water penetration to the innermost surface of the test specimen.

8. Water Vapor Transmission: ASTM E-96 Water Method Procedure B; Standard Lamina: 10 g/hr•m^2.

B. Structural Performance:

1. Bond Strength: ASTM C-297; minimum 19.1 psi; failure in the substrate or insulation board.

2. Full-scale Structural Tests: ASTM E-330; minimum failure load under positive or suction force of 90 psf substrate failure.

3. Impact Resistance: EIMA Standard 101.86 for standard mesh.

C. Fire Performance:

1. Flame Spread: ASTM E-84. When tested individually:

a. EPS Insulation Board: Not exceeding 25 for flame spread index and not exceeding 450 for smoke developed index.

b. Adhesives and Coatings: Not exceeding 20 for flame spread index and not exceeding 10 for smoke developed index.

1.05 QUALITY ASSURANCE:

A. Use only experienced applicators, approved or licensed by the manufacturer for system specified.

B. Use only materials furnished by manufacturer.

C. Insulation:

1. Packages and containers of foam plastic and foam plastic ingredients shall bear label of an approved agency showing either flame spread rating and smoke developed rating of product at thickness tested or the use for which product has been listed.

2. Foam plastics or foam plastic cores in manufactured assemblies used in building construction shall have flame spread rating of not more than 75 and shall have smoke developed rating of not more than 450 when tested in maximum thickness intended for use in accordance with ASTM E-84.

3. Potential heat of foam plastic in any portion of wall or panel shall not exceed 6,000 BTU/sq. ft. of project area as described by tests conducted in accordance with NFPA 259.

4. Foam plastic insulation, exterior coatings and facings tested separately shall each have a flame spread rating of 25 or less and a smoke developed rating of 450 or less as determined in accordance with ASTM E-84.

5. Submit results of diversified or full-scale fire tests reflecting an end use configuration demonstrating assembly in final form does not propagate flame over surface or through core when exposed on exterior face to fire source.

6. Packages, containers and edge or face of each piece of foam plastic insulation shall bear label of an approved agency. Label shall contain manufacturer's or distributor's identification, model number, serial number of definitive information describing the product or materials performance characteristics and approved agency's identification.

7. Provide thermal insulation containing recycled materials to the extent practicable, provided the material meets all other requirements of this section.

D. Comply with EIMA recommendations.

1.06 DELIVERY AND STORAGE:

A. Deliver materials in original, unopened packages and containers, clearly marked and identified with manufacturer's name and description of contents.

B. Store material inside and under cover; keep dry and protected from weather, direct sunlight, surface contamination, aging, corrosion, damaging temperatures, damage from construction traffic and other causes. Store insulation board flat and off the ground.

1.07 JOB CONDITIONS:

A. Install at ambient temperature above 40°F and rising and maintained above 40°F for 24 hours after each application of coatings.

B. Coordinate and sequence installation with work of other trades.

1.08 WARRANTY: Provide manufacturer's standard limited materials warranty.

PART 2 - PRODUCTS

2.01 MANUFACTURERS: Dryvit System is specified. Equivalent systems of Sto and Synergy, are acceptable; or approved equal. Parex "Cementitious System 3" is also acceptable.

A. Note: Differences between above listed systems have been reviewed and are considered acceptable; differences are not specified.

2.02 MATERIALS:

A. Adhesive: 100% acrylic-based.

B. Insulation Board: Thicknesses indicated, maximum 2’ x 4’, nominal 1.0 pcf, aged expanded polystyrene.

C. Reinforcing Mesh: Standard and high-impact strength grades, balanced, treated glass fiber mesh, reverse rolled.

1. Standard: Not less than 4 oz./sq. yd.

2. High Impact (at base and doors): Not less than 20 oz./sq. yd.

D. Finish 100% acrylic-based factory mixed coating, in standard integral color as selected by Architect; fine sand finish texture.

E. Cement: ASTM C-150, Type I.

F. Water: Clear, potable.

G. Sealants: Silicone as recommended by manufacturer; comply with requirements specified in Section 07 92 00.

2.03 ADHESIVE MIXTURE: Mix adhesive and cement, in accordance with manufacturer's instructions, in ratio of 1.1 by weight. Add small amounts of water to adjust workability.

PART 3 - EXECUTION

3.01 EXAMINATION: Examine substrate to which insulation will be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION: Comply with manufacturer's written instructions and final shop drawings.

A. Insulation Board:

1. Pre-cut to fit openings, corners and projections prior to application.

2. Apply with long edge horizontal, and with joints offset to substrate joints. Use running bond pattern. Stagger and interlock at corners.

3. Apply adhesive mixture to insulation board using notched trowel method.

4. Mount to substrate, tamping board for uniform contact and bond with true plane. Align edges of adjacent boards. Let dry 24 hours.

5. Rout reveals, grooves and other features into outside surface of insulation board.

6. Sand high areas to produce level surface.

B. Base Coat: Embed standard reinforcing mesh, concave surface facing wall, in minimum 1/16" thick layer of adhesive mixture applied to entire surface of insulation board. Lap mesh edges 2-1/2" on all sides. Smooth surface until mesh is not visible. Allow to dry 24 hours.

C. Finish: Trowel apply continuously over base coat in one operation for leveling and texturing, working toward joints and corners. Provide uniform appearance, matching approved sample for texture and colors.

3.03 CONTROL JOINTS: Provide control joints as indicated, and in compliance with manufacturer's details and final shop drawings.

3.04 PROTECTION:

A. Protect adjacent materials from damage during installation of exterior insulation and finish system.

B. Protect tops of walls during and after installation until application of final trim, to prevent water infiltration behind system.

3.05 CLEAN-UP: Clean adjacent materials and surfaces, and work area of foreign materials resulting from work of this section. Remove unused materials and dispose of off site.

END SECTION

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SECTION 07 27 19.13 – SHEET AIR INFILTRATION BARRIER

PART 1 – GENERAL

1.01 SCOPE

A. Provide and install complete air barrier system including, but not limited to, weather barrier membrane, seam tape, flashing, fasteners.

1.02 REFERENCES

A. ASTM International:

1. ASTM C920; Standard Specification for Elastomeric Joint Sealants

2. ASTM C1193; Standard Guide for Use of Joint Sealants

3. ASTM D882; Test Method for Tensile Properties of Thin Plastic Sheeting

4. ASTM D1117; Standard Guide for Evaluating Non-woven Fabrics

5. ASTM E84; Test Method for Surface Burning Characteristics of Building Materials

6. ASTM E96; Test Method for Water Vapor Transmission of Materials

7. ASTM E1677; Specification for Air Retarder Material or System for Framed Building Walls

8. ASTM E2178; Test Method for Air Permeance of Building Materials

B. AATCC – American Association of Textile Chemists and Colorists:

1. Test Method 127 Water Resistance: Hydrostatic Pressure Test

C. TAPPI

1. Test Method T-410; Grams of Paper and Paperboard (Weight Per Unit Area)

2. Test Method T-460; Air Resistance (Gurley Hill Method)

1.03 SUBMITTALS

A. Refer to Section 01 33 00.

B. Product Data: Submit manufacturer current technical literature for each component.

C. Samples: Weather barrier membrane, minimum 8-1/2” x 11”

D. Quality Assurance Submittals:

1. Manufacturer Instructions: Provide manufacturer’s written installation instructions.

E. Closeout Submittals:

1. Refer to Section 01 77 00

1.04 QUALITY ASSURANCE

A. Qualifications:

1. Installer shall have experience with installation of similar weather barrier assemblies under similar conditions.

2. Installation shall be in accordance with manufacturer’s installation guidelines and recommendations.

3. Source Limitations: Provide weather barrier and accessory materials produced by single manufacturer.

1.05 DELIVERY, STORAGE & HANDLING

A. Deliver weather barrier materials and components in manufacturer’s original, unopened, undamaged containers with identification labels intact.

B. Store weather barrier materials as recommended by system manufacturer.

1.06 SCHEDULING

A. Review requirements for sequencing of installation of weather barrier assembly with installation of windows, doors, louvers and flashings to provide a weather-tight barrier assembly.

PART 2 – PRODUCTS

2.01 MANUFACTURER

A. DuPont Building Innovations; 4417 Lancaster Pike, Chestnut Run Plaza 721, Wilmington, DE 19805; (800) 448-9835; www.tyvek.com; is specified, or approved equal.

2.02 MATERIALS

A. Textured, spunbonded polyolefin, non-woven, non-perforated, weather barrier; DuPont™ Tyvek® StuccoWrap® (use behind rigid insulation) and related assembly components.

B. Performance Characteristics:

1. Air Penetration: 0.004 cfm/ft^2 at 75 Pa, when tested in accordance with ASTM E2178. Type I per ASTM E1677

2. Water Vapor Transmission: 50 perms, when tested in accordance with ASTM E96, Method B

3. Water Penetration Resistance: 210 cm, when tested in accordance with AATCC Test Method 127

4. Basis Weight: 2.1 oz/yd^2, when tested in accordance with TAPPI Test Method T-410

5. Air Resistance: 300 seconds, when tested in accordance with TAPPI Test Method T-460

6. Tensile Strength: 30/30 lbs/in., when tested in accordance with ASTM D882, Method A

7. Tear Resistance: 7/9 lbs, when tested in accordance with ASTM D1117

8. Surface Burning Characteristics: Class A, when tested in accordance with ASTM E84. Flame Spread: 5, Smoke Developed: 25

2.03 ACCESSORIES

A. Seam Tape: 3” wide, DuPont™ Tyvek®

B. Fasteners:

1. DuPont™ Tyvek® Wrap Cap Screws, 1-5/8” rust resistant screw with 2” diameter plastic cap

C. Sealants: Refer to Section 07 92 00

1. Products:

a. DuPont Weatherization Sealant

b. Sealants recommended by the weather barrier manufacturer

D. Adhesive:

1. Provide adhesive recommended by weather barrier manufacturer

2. Products:

a. Liquid Nails® LN-109

b. Polyglaze® SM 5700

c. Denso Butyl Liquid

d. 3M High Strength 90

e. Adhesives recommended by the weather barrier manufacturer

E. Primer:

1. Provide flashing manufacturer recommended primer to assist in adhesion between substrate and flashing.

2. Products:

a. 3M High Strength 90

b. Denso Butyl Spray

c. Primers recommended by the flashing manufacturer

F. Flashing:

1. DuPont™ FlexWrap™, as manufactured by DuPont Building Innovations: flexible membrane flashing materials for window openings and penetrations.

2. DuPont™ StraightFlash™, as manufactured by DuPont Building Innovations: straight flashing membrane materials for flashing windows and doors and sealing penetrations and masonry ties, etc.

3. DuPont™ StraightFlash™ VF, as manufactured by DuPont Building Innovations: dual-sided, straight flashing membrane materials for brickmold and non-flanged windows and doors.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Verify substrate and surface conditions are in accordance with weather barrier manufacturer recommended tolerances prior to installation of weather barrier and accessories.

3.02 INSTALLATION

A. Install weather barrier over exterior face of exterior wall substrate in accordance with manufacturer recommendations.

B. Start weather barrier installation at a building corner, leaving 6”-12” of weather barrier extended beyond corner to overlap.

C. Apply wrap with grooved surface pattern in vertical direction.

D. Install weather barrier in a horizontal manner starting at the lower portion of the wall surface. Maintain weather barrier plumb and level.

E. Shingle weather barrier over back edge of weep screed. Seal weather barrier with sealant or tape to weep screed. Ensure weeps are not blocked.

F. Subsequent layers shall overlap lower layers a minimum of 6” horizontally in a shingling manner.

G. Window and Door Openings: Extend weather barrier completely over openings.

H. Weather Barrier Attachment:

1. Attach weather barrier to studs through exterior sheathing. Secure using weather barrier manufacturer recommended fasteners, space 12”-18” vertically on center along stud line, and 24” on center, maximum horizontally.

I. Apply 4” x 7” piece of DuPont™ StraightFlash™ to weather barrier membrane prior to the installation cladding anchors.

3.03 SEAMING

A. Seal seams of weather barrier with seam tape at all vertical and horizontal overlapping seams.

B. Seal any tears or cuts as recommended by weather barrier manufacturer.

3.04 OPENING PREPARATION

A. Flush cut weather barrier at edge of sheathing around full perimeter of opening.

B. Cut a head flap at 45° angle in the weather barrier at window head to expose 8” of sheathing. Temporarily secure weather barrier flap away from sheathing with tape.

3.05 FLASHING

A. Cut 9” wide DuPont™ FlexWrap™ a minimum of 12” longer than width of sill rough opening.

B. Cover horizontal sill by aligning DuPont™ FlexWrap™ edge with inside edge of sill. Adhere to rough opening across sill and up jambs a minimum of 6”. Secure flashing tightly into corners by working in along the sill before adhering up the jambs.

C. Fan DuPont™ FlexWrap™ at bottom corners onto face of wall. Firmly press in place. Mechanically fasten fanned edges.

D. Apply 9” wide strips of DuPont™ StraightFlash™ at jambs. Align flashing with interior edge of jamb framing. Start DuPont™ StraightFlash™ at head of opening and lap sill flashing down to the sill.

E. Spray-apply primer to top 6” of jambs and exposed sheathing.

F. Install DuPont™ FlexWrap™ at opening head using same installation procedures used at sill. Overlap jamb flashing a minimum of 2”.

G. Coordinate flashing with window installation.

H. On exterior, install backer rod in joint between window frame and flashed rough framing. Apply sealant at jambs and head, leaving sill unsealed. Apply sealants in accordance with sealant manufacturer's instructions and ASTM C1193.

I. Position weather barrier head flap across head flashing. Adhere using 4" wide DuPont™ StraightFlash™ over the 45° seams.

J. Tape head flap in accordance with manufacturer recommendations.

K. On interior, install backer rod in joint between frame of window and flashed rough framing. Apply sealant around entire window to create air seal. Apply sealants per sealant manufacturer's instructions and ASTM C1193.

3.06 PROTECTION

A. Protect installed weather barrier from damage.

END OF SECTION

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SECTION 07 54 23 – TPO MEMBRANE ROOFING SYSTEM

PART 1 – GENERAL

1.01 SCOPE

A. Furnish and install a complete TPO roofing system, including:

1. Roofing Manufacturer's requirements for the specified warranty

2. Preparation of roofing substrates

3. Wood nailers for roofing attachment

4. Insulation

5. Self-Adhered TPO membrane

6. Metal roof edging and copings

7. Flashings

8. Walkway pads

9. Other roofing-related items specified or indicated on the drawings or otherwise necessary to provide a complete weatherproof roofing system

B. Disposal of demolition debris and construction waste is the responsibility of Contractor. Perform disposal in manner complying with all applicable federal, state, and local regulations.

C. Comply with the published recommendations and instructions of the roofing membrane Manufacturer, at http://www.holcimelevate.com.

D. Commencement of work by the Contractor shall constitute acknowledgement by the Contractor that this specification can be satisfactorily executed, under the project conditions and with all necessary prerequisites for warranty acceptance by roofing membrane Manufacturer. Any modification of the Contract Sum will be made in accordance with the stipulations of the Contract Documents stated elsewhere.

1.02 RELATED SECTIONS

A. Section 06 10 00 – Rough Carpentry

B. Section 07 62 00 – Sheet Metal Flashing and Trim

C. Division 22 – Roof Drains

1.03 DEFINITIONS

A. Definitions in the current editions of ASTM D1079 and NRCA's "The NRCA Roofing Manual: Membrane Roof Systems" apply to work of this Section.

1.04 SUBMITTALS

A. Product Data:

1. Provide membrane Manufacturer's printed data sufficient to show that all components of roofing system, including insulation and fasteners, comply with the specified requirements and with the membrane Manufacturer's requirements and recommendations for the system type specified; include data for each product used in conjunction with roofing membrane.

2. Where UL or FM requirements are specified, provide documentation that shows that the roofing system to be installed is UL-Classified or FM-approved, as applicable. Include data itemizing the components of the classified or approved system.

B. Installation Instructions:

1. Provide Manufacturer's instructions to Installer, marked up to show exactly how all components will be installed.

2. Where instructions allow installation options, clearly indicate which option will be used.

C. Shop Drawings:

1. Provide roof plan indicating orientation of steel deck (if applicable), and fastener and/or adhesive layouts.

2. Provide the roof membrane Manufacturer's standard details customized for this project for all relevant conditions, including flashings, base tie-ins, roof edges, terminations, expansion joints, penetrations, and drains.

D. Provide copy of Pre-Installation Notice to show that Manufacturer's required Pre-Installation Notice (PIN) has been accepted and approved by the Manufacturer.

E. Submit samples of each product to be used.

F. Specimen Warranty

G. Closeout Submittals

H. Executed Warranty

1. Maintenance data

1.05 QUALITY ASSURANCE

A. Applicator Qualifications:

1. Current Elevate Master Contractor status

2. At least five years' experience in installing specified system

3. Capability to provide payment and performance bond to building Owner

B. Pre-Installation Conference:

1. Before start of roofing work, Contractor shall hold a meeting to discuss the proper installation of materials and requirements to achieve the warranty.

2. Require attendance with all parties directly influencing the quality of roofing work or affected by the performance of roofing work.

3. Review methods and procedures related to roofing installation, including Manufacturer's written instructions.

4. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

5. Examine deck substrate conditions and finishes, including flatness and fastening.

6. Review structural loading limitations of roof deck during and after roofing.

7. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.

8. Review governing regulations and requirements for insurance and certificates if applicable.

9. Review temporary protection requirements for roofing system during and after installation.

10. Review roof observation and repair procedures after roofing installation.

11. Notify Architect well in advance of meeting.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver products in Manufacturer's original containers, dry and undamaged, with seals and labels intact and legible.

B. Discard and legally dispose of material that cannot be applied within its stated shelf life.

C. Store materials clear of ground and moisture with weather protective covering.

D. Keep combustible materials away from ignition sources.

E. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck and/or structural overloading.

1.07 FIELD CONDITIONS

A. Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed in accordance with Manufacturer's written instructions and warranty requirements.

1.08 WARRANTY

A. Provide Elevate 20-year Red Shield™ Roofing System Limited Warranty; or approved equal, covering membrane, roof insulation, and system accessories. Comply with all warranty procedures required by Manufacturer, including notifications, scheduling, and inspections. Systems specified with a warranty duration of 20 years or greater or a wind speed coverage above 55 mph require additional attachment and detail considerations. Consult the Manufacturer’s design guidelines for further information. See Platinum TPO specification for 30-year systems.

B. Limit of Liability: No dollar limitation (NDL)

C. Scope of Coverage: Repair leaks in the roofing system caused by:

1. Ordinary wear and tear

2. Normal exposure to the elements

3. Manufacturing defect in Elevate materials

4. Defective workmanship used to install these materials

5. Damage due to winds up to 90 mph

6. Not Covered:

    a. Damage due to winds in excess of 90 mph

    b. Damage due to hurricanes or tornadoes

    c. Hail

    d. Intentional damage

    e. Unintentional damage due to normal rooftop inspections, maintenance, or service

PART 2 – PRODUCTS

2.01 MANUFACTURER

A. Acceptable Manufacturer – Roofing System: Elevate roofing, lining, and wall systems, Nashville, TN, http://www.holcimelevate.com; or approved equal.

1. Roofing systems manufactured by others may be acceptable provided the roofing system is equivalent in materials and warranty conditions and the Manufacturer meets the following qualifications:

    a. Specializing in manufacturing the roofing system to be provided

    b. Minimum ten years of experience manufacturing the roofing system to be provided

    c. Able to provide a no dollar limit, single source roof system warranty backed by corporate assets in excess of one billion dollars

    d. ISO 9001 certified

2. Substitution Procedures: Comply with Section 01 33 00.

    a. Submit evidence that the proposed substitution complies with the specified requirements.

2.02 ROOFING SYSTEM DESCRIPTION

A. Roofing System:

1. Membrane: Thermoplastic polyolefin (TPO)

a. Thickness: As specified elsewhere

b. Membrane Attachment: Self-Adhered

2. Slope: As indicated on drawings

3. Comply with applicable local building code requirements.

4. Provide assembly having Underwriters Laboratories, Inc. (UL) Class A Fire Hazard Classification

B. Insulation Assembly:

1. Insulation (composite):

a. Total System R-Value: 25 or greater

b. Maximum Board Thickness: 4″

1) Use as many layers as necessary to achieve required R-value

2) Stagger joints in adjacent layers

c. Base Layer: Polyisocyanurate foam board, non-composite

1) Attachment: Low-rise polyurethane adhesive

d. Top Layer: Polyisocyanurate foam board, composite

1) Attachment: Low-rise polyurethane adhesive

2.03 TPO MEMBRANE MATERIALS

A. Roofing and Flashing Membrane: Flexible, heat weldable sheet composed of thermoplastic polyolefin polymer and ethylene propylene rubber; complying with ASTM D 6878, with polyester weft inserted reinforcement and the following additional characteristics:

1. Thickness: 0.060″

2. Color: Grey

3. Reinforcement: Polyester, weft-inserted scrim

4. Sheet Width: Use widest sheet practical for jobsite conditions to minimize field seams.

5. Acceptable Product: UltraPly™ TPO SA (self-adhered) by Elevate

B. Membrane Fasteners: Type and size as required by roof membrane Manufacturer for roofing system and warranty to be provided; use only fasteners furnished by roof membrane Manufacturer.

C. Curb and Parapet Flashing: Same material as membrane, with encapsulated edge which eliminates need for seam sealing the flashing-to-roof splice; precut to 18″ wide; UltraPly™ TPO 18″ Curb Flashing.

D. Formable Flashing: Non-reinforced, flexible, heat weldable sheet, composed of thermoplastic polyolefin polymer and ethylene propylene rubber, color to match roof membrane; UltraPly™ TPO Unsupported Flashing by Elevate.

E. Factory-formed Weldable Flashing Accessories: UltraPly™ TPO Flashing by Elevate

F. Self-Adhering Flashing Membrane: Unsupported (non-reinforced) TPO membrane factory laminated to white seam tape; UltraPly™ TPO QuickSeam™ Flashing by Elevate

G. Factory-formed Self-Adhering Flashing Accessories: UltraPly™ TPO QuickSeam™ Flashing by Elevate

H. Bonding Adhesive: Formulated for compatibility with TPO membrane and wide variety of substrate materials; Single Ply LVOC Bonding Adhesive by Elevate.

I. Seam Edge Treatment: Clear polymer-based sealant, formulated for sealing exposed edges of membrane; UltraPly™ TPO Cut Edge Sealant LVOC by Elevate

J. Pourable Sealer: One part polyurethane; White One-Part Pourable Sealer by Elevate.

K. Water Block Seal: Butyl rubber sealant for use between two surfaces, not exposed; Water Block Seal S-20 by Elevate

L. Metal Plates and Strips used for Fastening Membrane and Insulation: Steel with Galvalume coating; corrosion-resistance meeting FM 4470 criteria

M. Termination Bars: Aluminum bars with integral caulk ledge; 1.3″ wide by 0.10″ thick; Termination Bar by Elevate

N. Roof Walkway Pads: TPO pad designed to provide protection from essential rooftop services and traffic and maintain the integrity of the existing roof surface; X-Tred™ Walkway Pad (Grey) by Elevate

2.04 ROOF INSULATION AND COVER BOARDS

A. Refer to Section 07 22 16.

2.05 METAL ACCESSORIES

A. Metal Roof Edging and Fascia: Continuous metal edge member serving as termination of roof membrane and retainer for metal fascia; watertight with no exposed fasteners; mounted to roof edge nailer

1. Wind Performance:

a. Membrane Pull-Off Resistance: 100 lbs./ft, minimum, when tested in accordance with ANSI/SPRI ES-1 Test Method RE-1, current edition

b. Fascia Pull-Off Resistance: At least the minimum required when tested in accordance with ANSI/SPRI ES-1 Test Method RE-2, current edition

c. Provide product listed in current Factory Mutual Research Corporation Approval Guide with at least FM 1-270 rating

2. Description: Two-piece, 45° sloped galvanized steel sheet edge member securing top and bottom edges of formed metal fascia

a. Fascia Face Height: 5″

b. Edge Member Height Above Nailer: 1-1/4″

c. Fascia Material and Finish: 24-gage, 0.024″ galvanized steel with Kynar 500 finish in Manufacturer's standard color; matching concealed joint splice plates; factory-installed protective plastic film

d. Length: minimum of 120″

e. Functional Characteristics: Fascia retainer supports while allowing for free thermal cycling of fascia

f. Acceptable Product: Appropriate Elevate pre-manufactured fascia system

B. Weldable Metal: Flexible non-reinforced thermoplastic polyolefin membrane factory laminated to hot-dipped galvanized steel, color to match roof membrane; UltraPly™ TPO Coated Metal

C. Aluminum Bar: Continuous 6063-T6 alloy aluminum extrusion with pre-punched slotted holes; miters welded; injection molded EPDM splices to allow thermal expansion

D. Anchor Bar Cleat: 20-gage, 0.036″ G90 coated commercial type galvanized steel with pre-punched holes

E. Fasteners: Factory-provided corrosion resistant fasteners, with drivers; no exposed fasteners permitted

F. Special Shaped Components: Provide factory-fabricated pieces necessary for complete installation, including miters, scuppers, and end caps; minimum 14″ long legs on corner pieces

2.06 ACCESSORY MATERIALS

A. Wood Nailers: PS 20-dimension lumber, Structural Grade No. 2 or better Southern Pine, Douglas Fir; or PS 1, APA Exterior Grade plywood; pressure preservative treated.

1. Width: 3-1/2″ inches, nominal minimum, or as wide as the nailing flange of the roof accessory to be attached to it

2. Thickness: Same as thickness of roof insulation

PART 3 – INSTALLATION

3.01 GENERAL

A. Install roofing, insulation, flashings, and accessories in accordance with roofing Manufacturer's published instructions and recommendations for the specified roofing system. Where Manufacturer provides no instructions or recommendations, follow good roofing practices and industry standards. Comply with federal, state, and local regulations.

B. Obtain all relevant instructions and maintain copies at project site for duration of installation period.

C. Do not start work until Pre-Installation Notice has been approved by Manufacturer as confirmation that this project qualifies for a Manufacturer's warranty.

D. Perform work using competent and properly equipped personnel.

E. Temporary closures, which ensure that moisture does not damage any completed section of the new roofing system, are the responsibility of the Applicator. Completion of flashings, terminations, and temporary closures shall be completed as required to provide a watertight condition.

F. Install roofing membrane only when surfaces are clean, dry, smooth, and free of snow or ice; do not apply roofing membrane during inclement weather or when ambient conditions will not allow proper application; consult Manufacturer for recommended procedures during cold weather. Do not work with sealants and adhesives when material temperature is outside the range of 60 to 80 °F.

G. Protect adjacent construction, property, vehicles, and persons from damage related to roofing work; repair or restore damage caused by roofing work.

H. Protect from spills and overspray from bitumen, adhesives, sealants, and coatings.

I. Particularly protect metal, glass, plastic, and painted surfaces from bitumen, adhesives, and sealants within the range of wind-borne overspray.

J. Protect finished areas of the roofing system from roofing related work traffic and traffic by other trades.

K. Until ready for use, keep materials in their original containers as labeled by the Manufacturer.

L. Consult membrane Manufacturer's instructions, container labels, and Safety Data Sheets (SDS) for specific safety instructions. Keep all adhesives, sealants, primers, and cleaning materials away from all sources of ignition.

3.02 EXAMINATION

A. Examine roof deck to determine that it is sufficiently rigid to support installers and their mechanical equipment, and that deflection will not strain or rupture roof components or deform deck.

B. Verify that surfaces and site conditions are ready to receive work. Correct defects in the substrate before commencing with roofing work. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.

C. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.

D. Examine roof substrate to verify that it is properly sloped to drains.

E. Verify that the specifications and drawing details are workable and not in conflict with the roofing Manufacturer's recommendations and instructions; start of work constitutes acceptance of project conditions and requirements.

3.03 PREPARATION

A. Prior to proceeding, prepare roof surface so that it is clean, dry, and smooth, and free of sharp edges, fins, roughened surfaces, loose or foreign materials, oil, grease, and other materials that may damage the membrane.

B. Fill all surface voids in the immediate substrate that are greater than 1/4″ wide with fill material acceptable to membrane Manufacturer.

C. Seal, grout, or tape deck joints, where needed, to prevent seepage into building.

3.04 VAPOR BARRIER INSTALLATION

A. All substrates (except metal decks) must be primed prior to application. Use only primer supplied by membrane Manufacturer.

B. Expanded Polystyrene, Extruded Polystyrene, Common Polyisocyanurate, Fiberglass, Wood Fiber, Perlite, and existing single-ply roofs are not acceptable substrates for SBS bitumen adhesive.

C. Application can be made at ambient temperatures as low as 25 °F as long as membrane has been stored in a heated area so that it will be between 50 °F and 100 °F at the time of application.

D. Install with minimum 3" side laps and 6" end laps.

E. Roll in with a 75 lb. roller to fully mate each roll to substrate, including all lap areas.

3.05 INSULATION AND COVER BOARD INSTALLATION

A. Install insulation in configuration and with attachment method(s) specified in PART 2, under Insulation.

B. Install only as much insulation as can be covered with the completed roofing system before the end of the day's work or before the onset of inclement weather.

C. Lay roof insulation in courses parallel to roof edges.

D. Neatly and tightly fit insulation to all penetrations, projections, and nailers, with gaps not greater than 1/4″. Fill gaps greater than 1/4″ with acceptable insulation. Do not leave the roofing membrane unsupported over a space greater than 1/4″.

E. Mechanical Fastening: Using specified fasteners and insulation plates engage fasteners through insulation into deck to depth and in pattern required by Factory Mutual for specified FM Class and membrane Manufacturer, whichever is more stringent (if applicable).

F. Adhesive Attachment: Apply in accordance with membrane Manufacturer's instructions and recommendations; "walk-in" individual roof insulation boards to obtain maximum adhesive contact (if applicable).

3.06 SINGLE-PLY MEMBRANE INSTALLATION

A. Beginning at low point of roof, place membrane without stretching over substrate and allow to relax at least 30 minutes before attachment or splicing; in colder weather allow for longer relax time.

B. Lay out the membrane pieces so that field and flashing splices are installed to shed water.

C. Install membrane without wrinkles and without gaps or fishmouths in seams, and bond and test seams and laps in accordance with membrane Manufacturer's instructions and details.

1. Self-Adhered Membrane: Place membrane over substrate and broom over using membrane Manufacturer's recommended procedures.

D. Edge Securement: Secure membrane at all locations where membrane terminates or goes through an angle change greater than 1:12 inches (8.3%) using mechanically fastened reinforced perimeter fastening strips, plates, or metal edging as indicated or as recommended by roofing Manufacturer. Exceptions: Round pipe penetrations less than 18″ in diameter and square penetrations less than 4″ square.

1. Metal edging is not merely decorative; ensure anchorage of membrane as intended by roofing Manufacturer and compliant with IBC.

3.07 FLASHING AND ACCESSORIES INSTALLATION

A. Install flashings, including laps, splices, joints, bonding, adhesion, and attachment, as required by membrane Manufacturer's recommendations and details.

B. Metal Accessories: Install metal edgings, gravel stops, and copings in locations indicated on the drawings, with horizontal leg of edge member over membrane and flashing over metal onto membrane.

1. Follow roofing Manufacturer's instructions.

2. Use weldable TPO-coated metal where membrane-to-metal connections occur.

3. Remove protective plastic surface film immediately before installation.

4. Install water block sealant under the membrane anchorage leg.

5. Flash with Manufacturer's recommended flashing sheet unless otherwise indicated.

6. Where single application of flashing will not completely cover the metal flange, install additional piece of flashing to cover the metal edge.

7. If the roof edge includes a gravel stop and sealant is not applied between the laps in the metal edging, install an additional piece of self-adhesive flashing membrane over the metal lap to the top of the gravel stop; apply seam edge treatment at the intersections of the two flashing sections.

8. When the roof slope is greater than 1:12 (8.3%), apply seam edge treatment along the back edge of the flashing.

C. Scuppers: Set TPO-coated metal scuppers in sealant and weld to membrane as recommended by Manufacturer.

D. Roofing Expansion Joints: Install as shown on drawings and as recommended by roofing Manufacturer.

E. Flashing at Walls, Curbs, and Other Vertical and Sloped Surfaces:

1. Install weathertight flashing at all walls, curbs, parapets, skylights, and other vertical and sloped surfaces that the roofing membrane abuts to; extend flashing at least 8″ above membrane surface.

2. Use the longest practical flashing pieces.

3. Evaluate the substrate and overlay and adjust installation procedure in accordance with membrane Manufacturer's recommendations.

4. Complete the splice between flashing and the main roof sheet with specified splice adhesive before adhering flashing to the vertical surface.

5. Provide termination directly to the vertical substrate as shown on roof drawings.

F. Flashing at Penetrations: Flash all penetrations passing through the membrane; make flashing seals directly to the penetration.

G. Pipes, Round Supports, and Similar Items: Flash with specified pre-molded pipe flashings wherever practical; otherwise use specified self-curing elastomeric flashing.

H. Pipe Clusters and Unusual Shaped Penetrations: Provide penetration pocket at least 2″ deep, with at least 1″ clearance from penetration, sloped to shed water.

I. Structural Steel Tubing: If corner radii are greater than 1/4″ and longest side of tube does not exceed 12″, flash as for pipes; otherwise, provide a standard curb with flashing.

J. Flexible and Moving Penetrations: Provide weathertight gooseneck set in sealant and secured to deck, flashed as recommended by Manufacturer.

3.08 WALKWAY INSTALLATION

A. Install walkways at access points to the roof, around rooftop equipment that may require maintenance, and where indicated on the drawings.

1. Use specified walkway pads unless otherwise indicated.

2. Walkway Pads: Adhere to the roofing membrane, spacing each pad at minimum of 1″ and maximum of 3″ from each other to allow for drainage.

3. If installation of walkway pads over field fabricated splices or within 6″ of a splice edge cannot be avoided, adhere another layer of flashing over the splice and extending beyond the walkway pad a minimum of 6″ on either side.

4. Prime the membrane, remove the release paper on the pad, press in place, and walk on pad to ensure proper adhesion.

3.09 FIELD QUALITY CONTROL

A. Inspection by Manufacturer: Provide final inspection of the roofing system by a Technical Representative employed by roofing system Manufacturer specifically to inspect installation for warranty purposes (e.g., not a sales representative).

B. Perform all corrections necessary for issuance of warranty.

3.10 CLEANING

A. Clean all contaminants generated by roofing work from building and surrounding areas, including bitumen, adhesives, sealants, and coatings.

B. Repair or replace building components and finished surfaces damaged or defaced due to the work of this section; comply with recommendations of Manufacturers of components and surfaces.

C. Remove leftover materials, trash, debris, equipment from project site and surrounding areas.

3.11 PROTECTION

A. Where construction traffic must continue over finished roof membrane, provide durable protection, and replace or repair damaged roofing to original condition.

END OF SECTION

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SECTION 07 62 00 – SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Coping, parapet, and cap flashings.

B. Counterflashings over bituminous base flashings.

C. Counterflashings at roof mounted equipment and vent stacks.

D. Gutters and downspouts.

1.02 REFERENCES

A. ASTM A525 - Steel Sheet, Zinc Coated, (Galvanized) by the Hot-Dip Process.

B. ASTM B209 - Aluminum and Alloy Sheet and Plate.

C. ASTM D226 - Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.

D. ASTM D4586 - Asphalt Roof Cement, Asbestos-Free.

E. NRCA (National Roofing Contractors Association) - Roofing Manual.

F. SMACNA - Architectural Sheet Metal Manual.

1.03 SUBMITTALS: Submit two samples illustrating metal finish color, to be selected by Architect.

1.04 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA and NRCA standard details and requirements and recognized industry practices.

B. Maintain one copy of each document on site.

1.05 QUALIFICATIONS: Fabricator and Installer: Company specializing in sheet metal flashing work with five (5) years documented experience.

1.06 PRE-INSTALLATION CONFERENCE: Convene one week prior to commencing work of this Section.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Stack preformed and prefinished material to prevent twisting, bending, or abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

B. Prevent contact with materials which may cause discoloration, staining or scratching.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Vincent Brass - "ColorKlad".

B. Peterson - "PacClad".

2.02 SHEET MATERIALS: Pre-Coated Steel: G90 commercial quality zinc coating; 24 gage core steel, primed and finished one side with Kynar base fluoropolymer coating 1.0 mil total dry film thickness, and with wash coat on reverse side.

2.03 ACCESSORIES

A. Fasteners: Cadmium plated (rust resistant); 1/4" x length required; Hex head screws with soft neoprene washers.

B. Sealant: Urethane type, Sonolastic NP-1 manufactured by Sonneborn.

C. Plastic Cement: ASTM D4586.

D. Mastic Sealant: Polyisobutylene; non-hardening, non-skinning, non-drying, and non-migrating.

E. Roofing Cement: ASTM D2822, asphaltic.

F. Concrete Splash Blocks.

G. Nails, Screws, and Rivets: Same metal as flashing/sheet metal or other noncorrosive metal as recommended by sheet metal manufacturer. Match finish of exposed heads with materials being fastened.

H. Solder: ASTM B32, 50% tin and 50% lead, used with rosin flux

I. Bitumastic Coating: SSPC - Paint 12, cold applied solvent type bitumastic coating for application in dry film thickness of 15 mils per coat

2.04 FABRICATION

A. Form sections true to shape, accurate in size, square, and free from distortion or defects.

B. Fabricate cleats of same material as sheet, minimum 1-1/2 inches wide, interlockable with sheet.

C. Form pieces in longest possible lengths.

D. Hem exposed edges on underside 1/2 inch (13 mm); miter and seam corners.

E. Form material with flat lock seams.

F. Fabricate corners from one piece with minimum 18 inch (450 mm) long legs; seam for rigidity, seal with sealant.

G. Fabricate vertical faces with bottom edge formed outward 1/4 inch (6 mm) and hemmed to form drip.

H. Form sheet metal pans (pitch pockets) 6 inch (150 mm) nominal size, with 3 inch (75 mm) upstand, and 4 inch (100 mm) flanges.

PART 3 - EXECUTION

3.01 EXAMINATION: Examine substrates and conditions under which metal flashing and trim will be installed. Do not proceed with installation until unsatisfactory conditions have been corrected.

A. Verify roof openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set, double booted, reglets in place, and nailing strips located.

B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.02 PREPARATION: Install starter and edge strips, and cleats before starting installation.

3.03 INSTALLATION

A. SMACNA Details: Except as otherwise indicated or specified, comply with applicable recommendations and details of "Architectural Sheet Metal Manual" by SMACNA.

B. Secure flashings in place using concealed fasteners. Use exposed fasteners only where permitted.

C. Apply plastic cement compound between metal flashings and felt flashings.

D. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.

E. Seal metal joints watertight.

F. Manufacturer's Recommendations: Except as otherwise indicated or specified, comply with recommendations and instructions of manufacturer of sheet metal being installed.

G. Anchor units of work securely in place by methods indicated, providing for thermal expansion of metal units; conceal fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints and seams which will be permanently watertight and weatherproof.

H. Bed flanges of work in a thick coat of bituminous roofing cement where required for waterproof performance.

I. Seal edges of metal flashing to substrates with roofing cement; install bed or bead of cement in manner which will maintain a watertight seal.

J. Remove strippable film from pre-painted work.

3.04 FIELD QUALITY CONTROL

A. Field inspection will be performed.

B. Inspection will involve surveillance of work during installation to ascertain compliance with specifications.

3.05 CLEAN-UP: After completion of work, clean roofing cement, sealant and bituminous paint from flashing, floors, and all surfaces so defaced. Remove all excess materials and scraps from the job and leave all surfaces neat and clean.

END OF SECTION

SECTION 07 92 00 – JOINT SEALANTS

PART 1 - GENERAL

1.01 SCOPE: Completely close all joints throughout the project, especially between dissimilar materials with sealant and backer rod or caulking compound. Including, but not limited to, are joints around frames of doors, windows and other openings in exterior walls, flooring joints, joints at wall intersections, change in direction of surfaces, intersections of surfaces, joints at penetration of walls, decks, and floors, by piping and other materials, and other services and equipment, joints between items of equipment and other construction, and other joints indicated or specified to be caulked or sealed.

1.02 RELATED WORK SPECIFIED IN OTHER SECTIONS: Sealing of fixed aluminum windows; Section 08 41 13.

1.03 SUBMITTALS: Comply with Section 01 33 00.

A. Product Data: Submit manufacturer's specifications, recommendations, and installation instructions for each type of sealant and miscellaneous materials. Include letter of certification or certified test laboratory reports indicating that each material complies with the requirements and is intended for the applications indicated.

B. Samples: Submit 12" long sample of each color required (except black) for each type of sealant exposed to view. Samples will be viewed for color only.

1.04 JOB CONDITIONS:

A. Examine joint surfaces, backing, and anchorage of units forming sealant rabbet. Do not proceed with work until unsatisfactory conditions have been corrected.

B. Do not proceed with installations of sealants under adverse weather conditions, or when temperatures are above or below manufacturer's recommended limitations for installation. Proceed with the work only when forecasted weather conditions are favorable for proper cure and development of high early bond strength.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Compatibility: Provide joint sealers, joint fillers and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by testing and field experience.

B. Provide in colors as selected by Architect from manufacturer's standard colors.

2.02 ELASTOMERIC JOINT SEALANTS: Provide manufacturer's standard chemically curing, elastomeric sealant of base polymer indicated which complies with ASTM C920 requirements, including those for Type, Grade Class, and Uses.

A. Two-Or-More Component Non-sag Urethane Sealant: Type M, Grade NS, Class 25. Tremco "Dymeric", Sonneborn "NP-2", Pecora "Dynatrol II" or Mameco "Vulkem 227".

B. One-Component Non-sag Urethane Sealant: Type M, Grade NS, Class 25. Sonneborn "Sonolastic NP-1", Tremco "Dymonic", Pecora "Dynatrol I", or Mameco "Vulkem 116".

C. One-Component Pourable Urethane Sealant: Type S, Grade P, Class 25. Sonneborn "Sonolastic Paving Joint Sealant", Pecora "NR-201 Urexpan", or Mameco "Vulkem 45".

D. One-Component Mildew-Resistant Silicone Sealant: Type S, Grade NS, Class 25. GE "SCS 1702", Dow Corning "786", or Tremco "Proglaze White", or Pecora "863 #345 White".

2.03 ACRYLIC EMULSION SEALANT: One component, non-sag, acrylic, paintable, mildew-resistant, complying with ASTM C834. Tremco "Acrylic Latex Caulk", Sonneborn "Sonolac", or Pecora "AC-20".

2.04 MISCELLANEOUS MATERIALS:

A. Joint Cleaner: Type of joint cleaning compound recommended by the sealant or caulking compound manufacturer for the joint surfaces to be cleaned.

B. Joint Primer/Sealer: Type recommended by the sealant manufacturer for the joint surfaces to be primed or sealed.

C. Bond Breaker Tape: Polyethylene tape or other plastic tape as recommended by sealant manufacturer, to be applied to sealant-contact surfaces where bond to the substrate or joint filler must be avoided for proper performance of sealant. Provide self-adhesive tape wherever applicable.

D. Sealant Backer Rod: Compressible rod stock open cell polyurethane foam. Provide size and shape of rod which will control the joint depth for sealant placement, break bond of sealant at bottom of joint, form optimum shape of sealant bead on back side, and provide a highly compressible backer to minimize the possibility of sealant extrusion when joint is compressed.

PART 3 - EXECUTION

3.01 JOINT TYPES AND USAGES: Caulking and sealant usage is specified below.

A. Caulking: All interior joints except joints with metal, aluminum, and wet work.

B. Sealants: Use multi-component or one-component non-sag polyurethane at all exterior joints and interior joints with aluminum or metal. Use mildew resistant silicone sealant at sinks and plumbing fixtures. Use minimum 35 Shore A hardness urethane sealant for horizontal joints subject to pedestrian and vehicular traffic.

3.02 JOINT SURFACE PREPARATION:

A. Clean joint surfaces immediately before installation of sealant. Remove dirt, insecure coatings, moisture, and other substances which would interfere with bond of sealant.

B. For elastomeric sealants, do not proceed with installation of sealant over joint surfaces which have been painted, lacquered, waterproofed or treated with water repellent or other treatment or coating. Remove coating or treatment from joint surfaces before installing sealant.

C. Etch cementitious joint surfaces to remove excess alkalinity. Etch with 5% solution of muriatic acid; neutralize with dilute ammonia solution, rinse thoroughly with water and allow to dry before sealant installation.

D. Roughen joint surfaces on non-porous materials, wherever sealant manufacturer's data indicates lower bond strength than for porous surfaces. Rub with fine abrasive cloth or wool to produce a dull sheen.

3.03 INSTALLATION:

A. Comply with sealant manufacturer's printed instructions, except where more stringent requirements are indicated or specified and except where manufacturer's technical representative directs otherwise.

B. Prime or seal the joint surfaces wherever shown or recommended by the sealant manufacturer. Do not allow primer/sealer to spill or migrate onto adjoining surfaces.

C. Install sealant backer rod for liquid elastomeric sealants, except where shown to be omitted or recommended to be omitted by sealant manufacturer for the application shown.

D. Install bond breaker tape wherever shown and wherever required by manufacturer's recommendations to ensure that elastomeric sealants will perform properly.

E. Employ only proven installation techniques, which will ensure that sealants will be deposited in uniform, continuous ribbons without gaps or air pockets, with complete "wetting" of the joint bond surfaces equally on opposite sides. Except as otherwise indicated, fill sealant rabbet to a slightly concave surface, slightly below adjoining surfaces. Where horizontal joints are between a horizontal surface and a vertical surface, fill joint to form a slight cove, so that joint will not trap moisture and dirt.

F. Install sealants to depths as shown or, if not shown, as recommended by the sealant manufacturer but within the following general limitations, measured at the center (thin) section of the bead.

1. For sidewalks and similar joints sealed with elastomeric sealants and subject to traffic and other abrasion and indentation exposures, fill joints to a depth equal to 75% of joint width, but neither more than 5/8" deep nor less than 3/8" deep.

2. For normal moving joints sealed with elastomeric sealants, but not subject to traffic, fill joints to a depth equal to 50% of joint width, but neither more than 1/2" deep nor less than 1/4" deep.

3. For joints sealed with non-elastomeric sealants, fill joints to a depth in the range of 75% to 125% of joint width.

G. Do not allow sealants to overflow or spill onto adjoining surfaces. Use masking tape or other precautionary devices to prevent staining of adjoining surfaces, by either the primer/sealer or the sealant.

H. Remove excess and spillage of sealants promptly as the work progresses. Clean the adjoining surfaces by whatever means may be necessary to eliminate evidence of spillage, without damage to adjoining surface finishes.

3.04 CURE AND PROTECTION: Cure sealants in compliance with manufacturer's instructions and recommendations, to obtain high early bond strength, internal cohesive strength, and surface durability. Cure and protect sealants in a manner which will minimize increases in modulus of elasticity and other accelerated aging effects. Replace or restore sealants which are damaged or deteriorated during construction period.

END OF SECTION

SECTION 08 12 13.13 - METAL DOORS AND FRAMES

PART 1 - GENERAL

1.01 SCOPE: Provide metal frames, hollow metal doors, and related items required to complete work. Doors and frames requiring labeled construction are indicated on Door Types and on Door Schedule.

1.02 RELATED WORK SPECIFIED IN OTHER SECTIONS:

A. Furnishing of finish hardware; Section 08 70 00.

B. Finish painting; Section 09 91 00.

C. Glass and glazing; Section 08 80 00.

1.03 SUBMITTALS: Comply with Section 01 33 00.

A. Product Data: Submit copy of manufacturer's technical data and installation instructions.

B. Shop Drawings: Prior to fabrication of work, submit shop drawings indicating gauge of metals, details of construction including reinforcement for hardware, profile of moldings, connections to other work, fastenings and anchors.

1.04 QUALITY ASSURANCE:

A. Provide doors and frames complying with Steel Door Institute "Recommended Specifications: Standard Steel Doors and Frames" (SDI-100), and as specified.

B. Provide metal doors and frames manufactured by a single firm.

C. Fire Rated Units: Provide fire rated units complying with NFPA 80 "Standard for Fire Doors and Windows", and units tested, listed, and labeled in accordance with ASTM E152 "Standard Methods of Fire Tests of Door Assemblies" by a nationally recognized independent testing and inspection agency acceptable to authorities having jurisdiction. Labels must be affixed to the frame; do not paint labels.

1.05 DELIVERY, STORAGE, AND HANDLING:

A. Deliver, handle, and store metal doors and frames in a manner to prevent damage and deterioration.

B. Provide packaging such as cardboard or other containers, separators, banding, spreaders, and paper wrappings as required to completely protect metal doors and frames during transportation and storage.

C. Store doors upright, in a protected dry area, at least 1" off ground and with at least 1/4" air space between individual pieces. Protect primed and hardware surfaces as required.

D. Protect from moisture infiltration into interior areas of doors and frames in addition to exterior surfaces. Doors and frames must continue to be protected after installation until final finishes, caps, closers and hardware are installed.

PART 2 - PRODUCTS

2.01 MANUFACTURERS: Steelcraft is specified. Equivalent products of Republic, Ceco, and Curries are acceptable.

2.02 STILE AND RAIL DOORS: Steelcraft S16, steel tubular stile and rail construction; modified to meet specified requirements.

A. Fabricate doors of 1-3/4" 16-gauge cold rolled steel.

B. Mechanically join stile and rails. Close top and bottom of door with 14-gauge channel welded to stile and rail at minimum 6" o.c.

C. Reinforce for hardware; reinforce internally with 14-gauge steel reinforcement for closers.

D. Provide glazing beads/stops for glass and glazing as specified in Section 08 80 00.

2.03 FLUSH DOORS AND FRAME MATERIALS:

A. Steel Sheet:

1. Doors: 18-gauge cold rolled, stretcher leveled; free of scale, pitting or other surface defects.

2. Frames: 16-gauge (interior) and 14-gauge (exterior) hot rolled, pickled and oiled, or cold rolled as specified above.

B. Hollow Core: Continuously reinforced with a full core of resin-impregnated kraft fiber honeycomb with 1" nested, hexagonal-shaped cells. Bond core to inside of both face sheets.

C. Primer: Manufacturer's standard rust inhibitive primer. Do not paint testing agency labels.

D. Anchors, Fasteners, Accessories: Manufacturer's standard, hot-dip galvanized at exterior.

E. Channel Fillers: Flush steel channel fillers for top channel of exterior doors.

2.04 FABRICATION FOR FLUSH DOORS AND FRAMES:

A. General:

1. Fabricate steel doors and frames rigid, neat in appearance and free from defects, warp, or buckle. Provide clean cut, straight and true molded members, well formed and aligned miters, dressed and ground smooth, and where applicable, concealed fasteners. Reinforce at corners as required to prevent sagging. Accurately form metal to required sizes and profiles, including astragals.

2. Fit, assemble, and weld units at factory or shop.

B. Doors: Seamless construction (no visible seam on face or vertical edge), of sizes and designs as indicated. Provide Z or T astragal for pairs of exterior doors.

C. Frames: Combination stop and frame channel section, rabbeted for doors, of type and styles indicated.

1. Anchors/Fasteners: Supply the proper fastenings and/or anchors to secure frames in each type of structural framing indicated.

2. Silencers/Mutes: Drill stops to receive a minimum of 3 silencers on strike jamb.

2.05 HARDWARE:

A. Preparation: Prepare hollow metal units to receive mortised and concealed finished hardware, including cutouts, reinforcing, drilling and tapping, in accordance with final Finish Hardware Schedule and templates provided by the hardware supplier. Reinforce hollow metal units to receive surface-applied hardware. Drilling and tapping for surface applied hardware will be done on the job site.

B. Location of Hardware: Locate finish hardware as indicated in final shop drawings and/or in compliance with Door and Hardware Institute publication "Recommended Location for Builder's Hardware".

2.06 FINISH: Dress tool marks and surface imperfections to smooth surfaces and remove irregularities. Chemically treat and clean doors and frames. Apply manufacturer's standard baked on rust inhibitive primer.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Install hollow metal units and accessories in compliance with final shop drawings, manufacturer's instructions, and as specified below.

B. Set frames accurately in position, plumb and aligned, and securely anchor to adjacent construction.

C. Erect fire doors and frames in compliance with NFPA 80.

D. Clearances: Provide clearances of not more than 1/8" at jambs and heads and not more than 3/4" from floor or 3/16" from thresholds.

E. Hardware: Install hardware, adjust as required to provide smooth and proper operation with secure latching or locking.

3.02 PRIME COAT TOUCH-UP: Immediately after erection, sand smooth any rusted or damaged areas of prime coat and apply touch-up with compatible air-drying primer.

END OF SECTION

SECTION 08 14 23.16 – HIGH-PRESSURE DECORATIVE LAMINATE FACED DOORS

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Interior High-Pressure Decorative Laminate Faced Doors:

1. Flush solid-core high-pressure decorative laminate doors

2. Flush fire-rated high-pressure decorative laminate doors

1.02 RELATED SECTIONS

A. Section 08 12 13.13 – Metal Frames

B. Section 08 70 00 – Door Hardware

C. Section 08 80 00 – Glazing

1.03 REFERENCES

A. ANSI A208.1 – Particleboard

B. ASTM E90 – Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements

C. ASTM E413 – Classification for Rating Sound Insulation

D. AWI Section 1300 – Architectural Flush Doors

E. NEMA LD3 – High Pressure Decorative Laminates

F. NFPA 80 – Standard for Fire Doors and Other Opening Protectives

G. UBC 7-2-1997/UL 10C – Positive Pressure Fire Tests of Door Assemblies

H. WDMA I.S. 1-A – Architectural Wood Flush Doors

1.04 SUBMITTALS

A. Comply with Section 01 33 00 – Submittals and Substitutions

B. Product Data: Submit manufacturer's product data, including door construction description and WDMA I.S. 1-A and AWI classifications.

C. Schedules: Submit manufacturer's schedules, including door dimensions, cutouts, high-pressure decorative laminate selection, and hardware. Reference individual door numbers as indicated on the drawings.

D. Samples:

1. Submit manufacturer's door construction samples for door model specified.

2. Submit manufacturer's sample chip with color and finish number.

E. Test Reports: Submit manufacturer's test results of STC ratings from testing performed by independent testing agency for sound-retardant doors.

F. Manufacturer's Certification: Submit manufacturer's certification that doors comply with specified requirements and are suitable for intended application.

G. Cleaning Instructions: Submit manufacturer's cleaning instructions for doors

H. Warranty: Submit manufacturer's standard warranty.

1.05 QUALITY ASSURANCE

A. Tolerances for Warp, Telegraphing, Squareness, and Pre-fitting Dimensions: WDMA I.S. 1-A and AWI Section 1300

B. Identifying Label: Each door shall bear identifying label including:

1. Door manufacturer

2. Order number

3. Door number

4. Fire rating, if applicable

C. Fire-Rated Doors: Labeled by Intertek/Warnock Hersey

1. Construction Details and Hardware Application: Approved by labeling agency.

1.06 DELIVERY, STORAGE AND HANDLING

A. Delivery:

1. Deliver doors to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

2. Package doors individually in polybags

B. Storage:

1. Store doors in accordance with manufacturer's instructions.

2. Store doors in clean, dry area indoors, protected from damage and direct sunlight.

3. Store doors flat on level surface.

4. Do not store doors directly on concrete.

5. Keep doors completely covered. Use covering which allows air circulation and does not permit light to penetrate.

6. Store doors between 50°F and 90°F and 25% and 55% relative humidity.

C. Handling:

1. Handle doors in accordance with manufacturer's instructions.

2. Protect doors and finish during handling and installation to prevent damage.

3. Handle doors with clean hands or clean gloves.

4. Lift and carry doors. Do not drag doors across other doors or surfaces.

1.07 ENVIRONMENTAL REQUIREMENTS

A. Do not subject doors to extreme conditions or changes in temperature or relative humidity in accordance with WDMA I.S. 1-A.

1.08 WARRANTY

A. Warrant solid core, interior doors for life of installation against warpage, delamination, and defects in materials and workmanship.

B. Defects noted during warranty period shall be corrected at no cost to Owner. Corrective work shall include labor and material for repair, replacement, refinishing, and rehanging as required.

PART – PRODUCTS

2.01 MANUFACTURER

A. VT Industries, Inc., 1000 Industrial Park, P.O. Box 490, Holstein, Iowa 51025, (800) 827-1615 or (712) 368-4381, Fax (712) 368-4111, www.vtindustries.com, E-mail: door_info@vtindustries.com; or approved equal.

2.02 GENERAL

A. High-Pressure Decorative Laminates: NEMA LD3

1. Face laminate doors with high-pressure decorative laminates.

2. Nominal Minimum Thickness for Faces and Vertical Edges: 0.048”

3. Laminate Selection: Standard products of Formica, Nevamar, Pionite, Wilsonart, or approved equal.

4. Finish: Manufacturer’s standard Premium Laminate 18

5. Grade: General purpose, horizontal grade

B. Vision Panels:

1. VT Industries steel vision frame

2. Style: No. 110

3. Finish: Color to be selected by Architect

C. Glazing: As specified in Section 08 80 00

2.03 FLUSH SOLID-CORE HIGH-PRESSURE DECORATIVE LAMINATE DOORS

A. Flush Solid-Core High-Pressure Decorative Laminate Doors:

1. Model: 303-3, particleboard core, non-rated.

2. Compliance: WDMA I.S. 1-A

a. Quality Grade: Premium grade, extra heavy duty

b. Type: PC-HPDL-5 or PC-HPDL-3

3. 7-Ply and Non-Bonded Core Construction: Not acceptable

4. Door Thickness: 1-3/4”

5. Stiles:

   a. 1-3/8” wide, before pre-fitting

   b. Structural composite lumber (SCL)

   c. Edged with high-pressure laminate before face laminates

6. Rails:

   a. Structural composite lumber (SCL)

   b. Minimum Width Before Pre-fitting: 1-3/8”

7. Core:

   a. Material: Particleboard

   b. Particleboard Compliance: ANSI A208.1, Grade 1-LD-2

8. Door Assembly:

   a. Glue stiles and rails to core.

   b. Monolithically sand core assembly to ensure minimum telegraphing of core components.

9. Laminates:

   a. Apply to core in hot press using Type I, exterior, water-resistant adhesive.

   b. 5-Ply construction

2.04 FLUSH FIRE-RATED HIGH-PRESSURE DECORATIVE LAMINATE DOORS

A. Flush Fire-Rated High-Pressure Decorative Laminate Doors:

1. Model: 1111-3, 60- and 90-minute rated

2. Compliance: WEMA I.S. 1-A

   a. Quality Grade: Premium

b. Type: FD-HDPL-5

3. Door Thickness: 1-3/4”

4. Stiles:

   a. Noncombustible material, 60- and 90-minute rated

   b. Warranted for use with standard-weight mortise butt hinges and No. 12, 1-1/4” steel threaded-to-head screws.

5. Rails:

   a. Fire-retardant material, 60- and 90-minute rated

   b. Width: Manufacturer’s standard width before pre-fitting

6. Core:

   a. Fire-retardant material

   b. Does not contain asbestos or added urea formaldehyde

7. Composite Crossbands:

   a. Apply to core before application of high-pressure decorative laminate edges.

   b. Exposed Crossbanding: Not allowed along stile edges

8. Positive Pressure:

   a. Where UBC 7-2-1997/UL 10C standards for positive pressure apply, doors shall be constructed in accordance with Category A guidelines as published by Intertek/Warnock Hersey.

   b. Smoke Gasketing: Apply smoke gasketing around frame perimeter to meet S-rating.

   c. Intertek/Warnock Hersey Category B Guidelines: Edge sealing systems not allowed on frames.

9. Electronic Barcode: “VTsmartdoor” barcode technology

   a. Location: Fire label, hinge stile of doors

b. Provide fire-rated door assembly information required for Owner's annual fire-door inspection in accordance with NFPA 80, paragraph 5.2.1.

2.05 SOUND-RETARDANT DOORS

A. Sound-Retardant Doors: Refer to Section 11 60 01.

2.06 FABRICATION

A. Stile Edges: Apply laminate edges before application of face laminates.

B. Pre-fit Doors:

1. Pre-fit and bevel doors at factory to fit openings.

2. Pre-fit Tolerances: WDMA I.A. 1-A

C. Factory-machine doors for mortised hardware, including pilot holes for hinge screws and lock fronts.

D. Top and Bottom Rails: Factory sealed with wood sealer

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine locations to receive doors. Notify Architect of conditions that would adversely affect installation or subsequent use. Do not begin installation until unacceptable conditions are corrected.

B. Ensure frames are solidly anchored, allowing no deflection when doors are installed.

C. Ensure frames are plumb, level, square and within tolerance.

3.02 PREPARATION

A. Allow doors to become acclimated to building temperature and relative humidity for a minimum of 24 hours before installation.

3.03 INSTALLATION

A. Install doors in accordance with manufacturer's instructions.

B. Install doors at locations indicated on the door schedule and drawings.

C. Install doors plumb, level, square, true to line, without warp or rack.

D. Seal exposed surfaces with a minimum of two coats of polyurethane within 4 days of fitting each door.

E. Install door hardware as specified in Section 08 70 00.

3.04 ADJUSTING

A. Adjust doors to swing freely, without binding in frame.

B. Adjust hardware to operate properly.

C. Repair minor damages to finish in accordance with manufacturer's instructions and as approved by Architect.

D. Remove and replace damaged doors that cannot be successfully repaired, as determined by Architect.

3.05 CLEANING

A. Clean doors promptly after installation in accordance with manufacturer's instructions.

B. Do not use harsh cleaning materials or methods that could damage finish.

3.06 PROTECTION

A. Protect installed doors from damage during construction.

B. Place polybags over doors after adjusting and cleaning.

END OF SECTION

SECTION 08 33 23 – OVERHEAD ROLLING DOOR

PART 1 - GENERAL

1.01 SCOPE: Provide overhead rolling door, complete, including door curtains, guides, counterbalance mechanism, hardware, operator, and installation accessories.

1.02 RELATED WORK SPECIFIED IN OTHER SECTIONS: Field painting; Section 09 91 00.

1.03 SUBMITTALS: Comply with Section 01 33 00.

A. Product Data: Submit manufacturer's product data, roughing in diagrams, and installation instructions. Include operating instructions and maintenance information.

B. Shop Drawings: Submit shop drawings for special components and installations, not fully dimensioned or detailed on manufacturer's data sheets.

1.04 QUALITY ASSURANCE:

A. Furnish overhead rolling door as a complete unit produced by one manufacturer, including hardware, accessories, mounting and installation components.

B. Insert and Anchorages: Furnish inserts and anchoring devices that must be built into structure for installation of units. Provide setting drawings, templates, instructions and directions for installation of anchorage devices. Coordinate delivery with other work to avoid delay.

PART 2 - PRODUCTS

2.01 MANUFACTURER: Cornell is specified; or approved equal.

2.02 EXTERIOR ROLLING DOORS (Type 1):

A. Product Information: Model ESD30

B. Materials:

1. Curtain: Air infiltration rate of less than .3 CFM/FT2, as tested per ASTM E283 validated by an independent testing agency. Test report required.

a. Fabrication:

1) Slat Material: No. 6F, (Listed Exterior/Interior):

a) Galvanized Steel/Galvanized Steel: Manufacturer recommended gauge based on performance requirements. Minimum 18/24 gauge, Grade 40, ASTM A 653 galvanized steel zinc coating

2) Insulation: 7/8-inch (22 mm) foamed-in-place, closed cell urethane

3) Total Slat Thickness: 15/16 inch (24 mm)

4) Flame Spread Index of 0 and a Smoke Developed Index of 10 as tested per ASTM E84

5) R-value: 8.0

6) STC Rating: Sound Transmission Class (STC) rating 27. All configurations are evaluated per ASTM E90 and based on testing a complete, operable assembly.

b. Exterior Slat Finish:

1) SpectraShield® Coating System (Color Selected by Architect)

a) ASTM A 653 galvanized base coating treated with dual process rinsing agents in preparation for chemical bonding, gray baked-on base coat and gray baked-on polyester finish coat

b) Zirconium treatment followed by baked-on polyester powder coat, with color as selected by Architect from manufacturer's standard color range; minimum 2.5 mils (0.065 mm) cured film thickness; ASTM D-3363 pencil hardness: H or better.

c. Interior Slat Finish:

1) SpectraShield® Coating System (Color Selected by Architect):

a) ASTM A 653 galvanized base coating treated with dual process rinsing agents in preparation for chemical bonding, gray baked-on base coat and gray baked-on polyester finish coat

b) Zirconium treatment followed by baked-on polyester powder coat, with color as selected by Architect from

manufacturer's standard color range; minimum 2.5 mils (0.065 mm) cured film thickness; ASTM D-3363 pencil hardness: H or better

2. Endlocks: Fabricate interlocking sections with high strength nylon endlocks on alternate slats each secured with two ¼" (6.35 mm) rivets. Provide windlocks as required to meet specified wind load.

    a. Nylon: Required up to 21'-5" width (DBG - Distance Between Guides)

3. Bottom Bar:

    a. Configuration:

        1) Insulated Bottom Bar: Reinforced extruded aluminum interior face with full depth insulation and exterior skin slat to match curtain material and gauge. Minimum 4" tall x 1-1/16" thickness.

    b. Finish:

        1) Exterior: Match slats

        2) Interior: Powder coat to match slats

    c. Air Infiltration Certification Label: Must be affixed to bottom bar

4. Guides:

    a. Fabrication:

        1) Thermal break required. Minimum 3/16 inch (4.76 mm) structural steel angles. Provide windlock bars of same material when windlocks are required to meet specified wind load. Top of inner and outer guide angles to be flared outwards to form bellmouth for smooth entry of curtain into guides. Provide removable guide stoppers to prevent over travel of curtain and bottom bar. Top 16 ½" (419.10 mm) of coil side guide angles to be removable for ease of curtain installation and as needed for future curtain service.

    b. Finish:

        1) SpectraShield® Coating System (Color Selected by Architect): Zirconium treatment followed by baked-on

polyester powder coat, color as selected by Architect from manufacturer's standard color range; minimum 2.5 mils (0.065 mm) cured film thickness; ASTM D-3363 pencil hardness: H or better

5. Counterbalance Shaft Assembly:

   a. Barrel: Steel pipe capable of supporting curtain load with maximum deflection of 0.03 inches per foot (2.5 mm per meter) of width

   b. Spring Balance: Oil-tempered, heat-treated steel helical torsion spring assembly designed for proper balance of door to ensure that maximum effort to operate will not exceed 25 lbs (110 N). Provide wheel for applying and adjusting spring torque.

6. Brackets: Fabricate from minimum 3/16-inch (5 mm) steel plate with permanently lubricated ball or roller bearings at rotating support points to support counterbalance shaft assembly and form end closures.

   a. Finish:

      1) SpectraShield® Coating System (Color Selected by Architect): Zirconium treatment followed by baked-on polyester powder coat, color as selected by Architect from manufacturer's standard color range; minimum 2.5 mils (0.065 mm) cured film thickness; ASTM D-3363 pencil hardness: H or better

7. Hood: Minimum 24 gauge galvanized steel with reinforced top and bottom edges. Provide minimum 1/4 inch (6.35 mm) steel intermediate support brackets as required to prevent excessive sag.

   a. Finish:

      1) SpectraShield® Coating System (Color Selected by Architect):

         a) ASTM A 653 galvanized base coating treated with dual process rinsing agents in preparation for chemical bonding, gray baked-on base coat and gray baked-on polyester finish coat

         b) Zirconium treatment followed by baked-on polyester powder coat, with color as selected by Architect from manufacturer's standard color range; minimum 2.5

mils (0.065 mm) cured film thickness; ASTM D-3363 pencil hardness: H or better

8. Weatherstripping:

a. Bottom Bar:

1) Motor Operated Doors: Sensing/weather edge with neoprene astragal extending full width of door bottom bar

b. Guides: Replaceable vinyl strip on guides sealing against both sides of curtain

c. Lintel Seal: Double brush seal with EPDM sandwiched between the two brush seals at door header to impede air flow.

d. Hood: Neoprene/rayon baffle to impede air flow above coil

C. Operation:

1. Motor – Standard Use – Model MG (Industrial Duty Gear Head) Operator: The operator must not extend above or below the door coil when mounted front-of-coil. Rated for a maximum of 20 cycles per hour (not to be used for consecutive hours) cULus listed (to comply with UL requirements in The United States and Canada), Totally Enclosed Non-Ventilated gear head operator(s) rated (1/3) (1/2) or (3/4) hp as recommended by door manufacture for size and type of door, 208 Volts, 1 Phase. Provide complete with electric motor and factory pre-wired motor control terminals, maintenance free solenoid actuated brake, emergency manual chain hoist and control station(s). Motor shall be high starting torque, industrial type, protected against overload with an auto-reset thermal sensing device. Primary speed reduction shall be heavy-duty, lubricated gears with mechanical braking to hold the door in any position. Operator shall be equipped with an emergency manual chain hoist assembly that safely cuts operator power when engaged. A disconnect chain shall not be required to engage or release the manual chain hoist. Operator drive and door driven sprockets shall be provided with #50 roller chain. Provide an integral Motor Mounted Interlock system to prevent damage to door and operator when mechanical door locking devices are provided. Operator shall be capable of driving the door at a speed of 8 to 9 inches per second (20 to 23 cm/sec). Fully adjustable, driven linear screw type cam limit switch mechanism shall synchronize the operator with the door. The electrical contractor shall mount the control station(s) and supply the appropriate disconnect switch, all conduit and wiring per the overhead door wiring instructions.

2. Control Station:

a. Flush mounted: "Open/Close" key switch with "Stop" push button; NEMA 1B

3. Control Operation:

a. Constant Pressure to Close:

1) 2-wire, electric sensing edge seal extending full width of door bottom bar. Contact before door fully closes shall cause door to immediately stop downward travel and reverse direction to the fully opened position. Provide a self-coiling cable connection to control circuit.

b. Momentary Contact to Close: Fail-safe, UL325-2010 Compliant Entrapment Protection for Motor Operation

1) NEMA 4X photo eye sensors consisting of a transmitter and receiver that are to be mounted within 6" (152.4 mm) of the floor, projecting an IR beam across the entire width of the door. Electrical contractor to provide low voltage wiring from the transmitter and receiver to the door operator.

c. Sensing/Weather Edge: Automatic reversing control by an automatic sensing switch within neoprene or rubber astragal extending full width of door bottom bar.

1) Electric sensing edge device. Provide a wireless sensing edge connection to motor operator eliminating the need for a physical traveling electric cord connection between bottom bar sensing edge device and motor operator.

D. Accessories:

1. Locking:

a. Masterkeyable cylinder operable from fascia side of bottom bar, options for all types of operation. Provide interlock switches on Motor operated units.

1) Standard Mortise Cylinder
2) BEST 7-Pin
3) U-Change
4) Schlage

2. Trim Package: Minimum 16-gauge, powder coated steel to match guides.

PART 3 - EXECUTION

3.01 EXAMINATION: Examine substrates and conditions under which overhead rolling door is to be installed. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION: Install doors and operating equipment, complete with necessary hardware, jamb and head mold strips, anchors, inserts, hangers, and equipment supports in strict accordance with manufacturer instructions, final shop drawings, and NFPA standard recommendations.

3.03 TESTING: Upon completion of installation, including work by other trades, lubricate, test, and adjust doors to provide easy operation, proper closing, and secure locking.

3.04 QUALITY ASSURANCE: Manufacturer to supply a certificate stating that all materials and finishes will comply with the specifications.

3.05 Train Owner's maintenance personnel on procedures and schedules related to door operation, servicing, and preventative maintenance.

END OF SECTION

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SECTION 08 41 13 – ALUMINUM ENTRANCES, STOREFRONT & FIXED FRAMING

PART 1 – GENERAL

1.01 SUMMARY: Provide materials, labor and equipment necessary to furnish and install architectural aluminum entrance, entrance framing, and fixed windows, complete in accordance with the contract documents and detail drawings.

A. Section includes:

1. Aluminum windows
2. Glass and glazing
3. Metal panels
4. Perimeter trims
5. Sills and stools
6. All installation hardware and accessories required for a secure installation
7. Shims and anchors required for a secure installation
8. Insulation between window frames and adjacent construction (optional)
9. Perimeter sealing

B. Products supplied, but not installed under this section:

1. Entrances
2. Entrance hardware
3. Entrance framing

C. Related sections:

1. Section 08 80 00 – Glass and Glazing
2. Section 08 88 53 – Security Glazing
3. Section 07 92 00 – Sealants
4. Section 08 70 00 – Hardware

1.02 REFERENCES

A. American Architectural Manufacturers Association (AAMA)

B. American Society for Testing Materials (ASTM)

1.03 SYSTEM DESCRIPTION

A. The windows shall be architectural aluminum fixed windows in accordance with ANSI/AAMA 101-93 Voluntary Specifications for Aluminum and Poly Prime Windows and Glass Doors and AAMA 910-93 Voluntary "Life Cycle" Specifications and Test Methods for Architectural Grade Windows Sliding Glass Doors for F-HC65 and F-AW65 rated windows.

B. Test Units

1. All test unit sizes and configurations shall conform to the minimum size in accordance with ANSI/AAMA 101-93 and AAMA 910-93.

2. Units submitted for laboratory testing shall be units of the manufacturer's standard construction, glazed and assembled in accordance with the manufacturer's specifications and ANSI/AAMA 101-93.

C. Performance Requirements

1. Air Infiltration: The test specimen shall be tested in accordance with ASTM E283 at a minimum window size of 6' x 6' for F-HC65 and 5' x 8' for F-AW65. The air infiltration rate shall not exceed 0.06 cfm/ft at a static air pressure differential of 6.24 psf.

2. Water Resistance: The test specimen shall be tested in accordance with ASTM E547 and STM E331 at a minimum window size of 6' x 6' for F-HC65 and 5' x 8' for F-AW65. There shall be no leakage as defined in the test method at a static air pressure differential of 12 psf.

3. Uniform Load Deflection: A minimum static air pressure difference of 65 psf shall be applied in the positive and negative direction in accordance with ASTM E330. There shall be no deflection in excess of 1 U175 of the span of any framing member.

4. Uniform Load Structural Test: A minimum static air pressure difference of 97.5 psf shall be applied in the positive and negative direction in accordance with ASTM E330. The unit shall be evaluated after each load.

5. Component Testing: Window components shall be tested in accordance with procedures described in ANSI/AAMA 101-93.

6. Condensation Resistance Test: (CRF) when tested in accordance with AAMA 1503.1-88, the condensation resistance factor shall not be less than 53.

7. Thermal Transmittance Test: (Conductive U-Value) when tested in accordance with AAMA 1503.1-88, the conductive thermal transmittance (U-Value) shall not be more than 0.59 BTU/hr/sf/°F.

8. Thermal Barrier Tests

   a. Testing shall be in general accordance with AAMA TIR-A8-1990, Structural Performance Poured and Debridged Framing System.

   b. Testing for shrink-back shall be in accordance with the following procedure:

      1. Place a 35 1U4" length of the composite section in an oven at 160°F for a minimum of one (1) hour.

      2. Remove the composite section from the oven and place in freezer at 0°F for a minimum of one (1) hour.

      3. Repeat the process until ninety (90) cycles are complete.

      4. Inspect for shrink-back of the polyurethane material. Shrink-back shall not exceed one percent (1%) of the total length.

      5. Test for loss of stiffness by loading as a beam to produce a deflection of the composite member. This load shall be sufficient to produce a stress in the aluminum equal to 100% of the allowable extreme fiber bending stress.

1.05 SUBMITTALS

A. General: Prepare, review, approve and submit specified submittals in accordance with "Conditions of the Contract". Product data, shop drawings, samples and similar submittals are defined in "Conditions of the Contract".

   1. Submittal purpose

   2. Non-requested submittals

   3. Architect's review

B. Product Data: Submit product data for each type of product specified.

C. Shop Drawings: Submit shop drawings showing layout, profiles and product components, including joint systems, expansion provisions, glazing and sealing details, hardware, anchorage, accessories, finish and colors for all aluminum entrances, storefronts and fixed framing.

D. Samples: Submit verification samples for window type and finish.

E. Calculations

1. For approval purposes, provide engineering calculations to demonstrate compliance of window components and assemblies with the specified structural requirements.

F. Quality/Control Submittals

1. Design Data: All fixed windows shall meet or exceed ANSI/AAMA 101-93 for and AAMA 910-93 for F-HC65 and F-AW65 rated windows.

2. Test Reports: Submit certified test reports, showing compliance with specified performance characteristics and physical properties.

3. Certificates: Submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and physical requirements.

4. Manufacturer's installation instructions.

1.06 QUALITY ASSURANCE

A. Qualifications

1. Installer Qualifications: The installer shall be a company specializing in the installation of aluminum windows with a minimum of three (3) years of experience.

2. Manufacturer's Qualifications: Manufacturer shall be capable of providing field service representation during construction, approving acceptable installer and approving application method.

3. The window manufacturer shall be engaged in a TQM continuous quality improvement program for a period of not less than five (5) years.

4. To assure the performance specified, the window manufacturer shall test for air infiltration and water resistance at a minimum of two units, per manufacturing line, per shift in accordance with ANSI/AAMA 191-93.

B. Regulatory Requirements

1. Published specifications, standards, tests or recommended methods of trade, industry or governmental organizations apply to work in this section.

2. Meet all handicapped requirements.

C. Certificates/Certifications

D. Field Samples

E. Mock-ups

F. Pre-installation Meetings: Conduct pre-installation meeting to verify project requirements, substrate conditions, manufacturer's installation instructions and manufacturer's warranty requirements.

G. Pre-installation Testing

1.07 DELIVERY, STORAGE AND HANDLING

A. Ordering: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.

B. Store and handle windows, mullions, trim and hardware in strict compliance with the manufacturer's instructions.

C. Protect all window materials adequately against damage from the elements, construction activities and other hazards before, during and after installation.

1.08 PROJECT CONDITIONS/SITE CONDITIONS

A. Verify existing conditions.

B. Field Measurements: Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements, fabrication schedule with construction progress to avoid construction delays.

1.09 WARRANTY

A. Product Warranty: Refer to "Conditions of the Contract" for project warranty provisions.

B. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under the Contract Documents.

1. Beneficiary: Issue warranty in the legal name of the project Owner.

2. Warranty Period

a. Windows shall be two (2) years commencing on date of shipment.

b. Insulating glass shall be warranted to be free from defects (excluding breakage) for a period of five (5) years commencing on date of shipment.

c. The installation shall be warranted against defects for one (1) year from date of installation. (Supplied by installer)

1.10 MAINTENANCE

A. Extra Materials: Deliver to Owner extra materials from same production run as products installed. Package products with protective covering and identify with descriptive labels.

PART 2 - PRODUCTS

2.01 MANUFACTURER: Kawneer is specified; equivalent systems of Efco, U.S. Aluminum, MANKO, Tubelite and Vista Wall are acceptable.

2.02 SWINGING GLASS DOORS:

A. Types: 350 medium stile, single acting, sizes as indicated, complete with all hardware, except cylinders.

B. Glass Stops: Beveled or square glass stops for 1/4" infill.

C. Glazing:

1. Interior Doors: Refer to Section 08 80 00

2. Exterior Doors: Refer to Section 08 80 00

D. Hardware: Refer to Section 08 70 00

2.03 FIXED FRAMING: Trifab II VG 451T, Center Plane, 2” x 4-1/2”, thermally broken flush glazed system for 1” insulated glazing.

2.04 FINISH: NAAMM AA-C12C42R1x high performance organic coating.

A. Kynar 500 Series; manufacturer’s standard pre-treatment complying with coating and resin manufacturer’s written instructions.

B. Manufacturer’s standard two-coat thermocured system composed of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70% polyvinylidene fluoride resin by weight; complying with AAMA 605.2.

C. Color: As selected by Architect.

2.05 OTHER MATERIALS: Provide all other materials, not specifically described but required for a complete, weathertight, and proper installation of doors and framing systems, subject to acceptance by the Architect.

PART 3 - EXECUTION

3.01 INSTALLATION: Install in compliance with manufacturer's specifications, recommendations and final shop drawings.

A. Set units plumb, level and true to line, without warp or rack of framing, doors and windows. Anchor securely in place. Provide sub-frames as detailed. Secure to structure with non-staining, non-corrosive shims, anchors, fasteners, spacers, and fillers. Use care in erection so as not to mar, abrade, or stain finished surfaces.

B. Adjust operating hardware to provide a tight fit at contact points and at weatherstripping for smooth operation and weathertight closure. Lubricate hardware and other moving parts.

C. Where aluminum is to be placed in contact with steel, concrete and other dissimilar surface, back paint the aluminum before erection with an acceptable bituminous paint.

D. Seal frames with an approved sealant in color to match frames, making a neat fully weatherproof job. Refer to Section 07 92 00 and comply with requirements of that section.

E. Protection: After erection, adequately protect exposed parts of work.

F. Cleaning: After completion of other work in the vicinity of aluminum doors and framing, thoroughly clean finished surfaces as recommended by manufacturer.

END OF SECTION

SECTION 08 56 74 – INTERIOR SOUND CONTROL WINDOWS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Provisions of the Contract and of the Contract Documents apply to this Section.

1.02 DESCRIPTION OF WORK

A. Provide sound rated window assemblies where shown on the drawings and as specified herein.

1.03 SUBMITTALS

A. For each type of window, provide the following:

1. Schedule of items to be provided under this section.

2. Manufacturer's specifications and other product data needed to demonstrate compliance with these specifications.

3. Shop drawings of the glass, frame, hardware and seals showing major operating dimensions and cross-sections of windows and seals.

4. Certified test reports indicating the acoustical performance of the window meets the Sound Transmission Class (STC) performance called out in the schedule or drawings. Test data shall be produced from an accredited independent acoustical laboratory. Reports should indicate that the test was performed on the window assembly of the type to be supplied in conformance with the requirements of test method ASTM E90-75,81,85,87 (or most current year of test methodology). Test data shall indicate type of hardware used on the window. Manufacturer shall indicate whether additional treatment of the window frame, by the insertion of grout or high-density glass/mineral fiber in the cavity between frame and wall, shall be necessary to meet the acoustical requirements of this specification. Acoustical consultant shall be the judge of technical acceptability of these data.

5. Written guarantee that the window is constructed in accordance with the laboratory tested window and free of defects in material and workmanship for a period of one year after installation.

1.04 QUALITY ASSURANCE

A. References:

1. ASTM E90: Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss in Building Partitions.

2. ASTM E336: Standard Test Method for Measurement of Airborne Sound Insulation in Buildings.

3. ASTM E413: Classification for Determination of Sound Transmission Class

B. Guarantee all material furnished and installed under this section to be free from defects in material and workmanship for a period of one year from substantial completion of the project.

C. All work of this section shall be furnished by a single manufacturer experienced in the manufacture of sound rated window assemblies for at least five years.

1.05 DELIVERY, STORAGE AND HANDLING

A. Upon award of contract and before commencement of building construction, submit to the Architect any special requirements (scheduling, opening conditions, etc.) which are necessary to assure successful installation.

B. Protect pre-glazed window units during transit, handling and storage to prevent damage, soiling, and deterioration.

C. Deliver pre-glazed window units to General Contractor with complete installation drawings and instructions for installation by the General Contractor.

D. Deliver pre-glazed window units to project site only after the building has been closed in. Store window units in the building in a dry location and stack in accordance with manufacturer's instructions.

E. Protect pre-glazed window unit assemblies, especially sound gaskets, from damage before, during and after their installation.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with these specifications, the following firms are approved manufacturers of sound rated window assemblies:

1. Wausau Window and Wall Systems, Wausau, WI (877) 678-2983

2. Mon-Ray, Inc. De-Vac, Minneapolis, MN (800) 544-3646

3. Peerless Products, Inc. Fort Scott, KS (866) 420-4000

2.02 MATERIALS, GENERAL

A. Double-glazed acoustical windows shall be factory glazed and sealed. Window system shall include glass, aluminum framing and trim, sound deadening treatments, desiccants and all accessory items as shown on the drawings and required for a complete installation, including caulking and anchorage to adjacent construction.

B. Control room windows shall be horizontal sliding and fixed units as shown on the drawings with a minimum acoustical laboratory rating of STC-45. Sliding lites shall operate in weatherstripped tracks in two separate frames that are interlocked (non-structurally) via a concealed thermal barrier. All perimeter, intermediate and center stile interfaces shall be sealed with pile or neoprene weatherstripping.

2.03 COMPONENTS

A. Glass and Airspace:

1. The exterior lite shall be 1/4” thick laminated glass and interior lite shall be 3/16” thick plate glass. Lites shall be separated by a minimum 4-1/2” air space, or as necessary to meet the acoustical performance, in accordance with the laboratory tested unit.

B. Frames:

1. Frame for STC-45 unit shall be identical to that of the acoustically tested unit. Frame shall be free of defects impairing strength and durability. Approximate frame depth to be 6”.

2. Finish shall be selected by the Architect.

PART 3 – EXECUTION

3.01 INSTALLATION, GENERAL

A. The acoustical window shall be installed under direct supervision of the manufacturer or his representative using skilled mechanics. Anchorage to the building structure shall be in accordance with approved Shop Drawings.

B. The perimeter of each window shall be caulked on both sides. The caulking shall be performed as a part of this work to insure overall performance of the window system.

C. All frames shall be packed tightly with loose, lightweight fiberglass during installation.

D. Caulk joint between frame trim and partition prior to painting.

3.02 ADJUST AND CLEAN

A. Check and readjust operation finish hardware in work just prior to final inspection. Leave work in complete and proper operating condition. Remove and replace defective work.

3.03 FIELD TESTING VERIFICATION

A. If required, the owner will retain the services of an independent acoustical consultant to conduct field sound transmission tests at any designated window locations where acoustical performance is suspected by the architect of not being in compliance with these specifications. The tests shall be conducted in accordance with ASTM E-336 to determine the Field Sound Transmission Class (FSTC) or Noise Isolation Class (NIC), as applicable and feasible. If such results indicate acoustical performance more than 5 points less than the specified STC ratings, it shall be the responsibility of the manufacturer and contractor, at their expense, to correct such deficiencies by methods approved by the architect prior to incorporation. Sound transmission tests shall be repeated and corrective measures implemented until the established performance requirements are met. If the architect determines that the materials are not as specified herein, all costs for the initial tests, as well as costs for retesting, shall be borne by the contractor and manufacturer.

END OF SECTION

SECTION 08 70 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. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.

1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.

2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.

F. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.

G. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:

1. Function of building, purpose of each area and degree of security required.
2. Plans for existing and future key system expansion.
3. Requirements for key control storage and software.
4. Installation of permanent keys, cylinder cores and software.
5. Address and requirements for delivery of keys.

H. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.

1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
3. Review sequence of operation narratives for each unique access controlled opening.
4. Review and finalize construction schedule and verify availability of materials.
5. Review the required inspecting, testing, commissioning, and demonstration procedures

I. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. 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.

1.8 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.

B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:

1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.

C. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 HANGING DEVICES

A. Hinges: ANSI/BHMA A156.1 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).

2.3 POWER TRANSFER DEVICES

A. Electrified Quick Connect Continuous Geared Transfer Hinges: Provide electrified transfer continuous geared hinges with a removable service panel cutout accessible without de-mounting door from the frame. Furnish with Molex™ standardized plug connectors with sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Manufacturers:

a. Pemko (PE) - SER-QC (# wires) Option.

B. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number and type of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.

1. Provide one each of the following tools as part of the base bid contract:

a. McKinney (MK) - Electrical Connecting Kit: QC-R001.
b. McKinney (MK) - Connector Hand Tool: QC-R003.

2. Manufacturers:

a. McKinney (MK) - QC-C Series.

2.4 DOOR OPERATING TRIM

A. Flush Bolts and Surface Bolts: Provide products conforming to ANSI/BHMA A156.3 and A156.16, Grade 1.

1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
2. Furnish dust proof strikes for bottom bolts.
3. Surface bolts to be minimum 8” in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.

4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.

5. Manufacturers:

    a. Rockwood (RO).

B. 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. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
4. Pulls, where applicable, shall be provided with a 10” clearance from the finished floor on the push side to accommodate wheelchair accessibility.
5. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.

6. Manufacturers:

    a. Rockwood (RO).

2.5 CYLINDERS AND KEYING

A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.

1. Manufacturers:

    a. Match Existing, Field Verify.
    b. No Substitution.

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. 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.

D. 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).

E. 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.

2.6 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).

2.7 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. Vertical Impact: Exceed 100 vertical impacts (20 times ANSI/BHMA A156.2 requirements).

2. 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.

3. Locks are to be non-handed and fully field reversible.

4. Manufacturers:

a. Corbin Russwin Hardware (RU) - CLX3300 Series.
b. Schlage (SC) - ND Series.
c. Yale Commercial (YA) 5400LN Series.

2.8 LOCK AND LATCH STRIKES

A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. 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.

2.9 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. Corbin Russwin Hardware (RU) - ED4000 / ED5000 Series.
b. Yale (YA) - 7000 Series.

2.10 ELECTROMECHANICAL EXIT DEVICES

A. Electromechanical Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed panic and fire exit hardware devices subject to same compliance standards and requirements as mechanical exit devices. Electrified exit devices to be of type and design as specified below and in the hardware sets.

1. Energy Efficient Design: Provide devices which have a holding current draw of 15mA maximum, and can operate on either 12 or 24 volts. Locks are to be field configurable for fail safe or fail secure operation.

2. Where conventional power supplies are not sufficient, include any specific controllers required to provide the proper inrush current.

3. Manufacturers:

a. Corbin Russwin Hardware (RU) - ED5000 Series.
b. Yale (YA) - 7000 Series.

2.11 DOOR CLOSERS

A. All door closers specified herein shall meet or exceed the following criteria:

1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers.

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. Corbin Russwin Hardware (RU) - DC6000 Series.
b. Sargent Manufacturing (SA) - 1331 Series.
c. Yale Commercial (YA) - 5800 Series.

C. Door Closers, Overhead Concealed Double Acting (Heavy Duty): Center pivot, double acting ANSI/BHMA 156.4 Grade 1 Certified Products Directory (CPD) overhead door closers. UL Listed and ADA-compliant for interior or exterior doors up to 250 lbs. Closers are non-handed, with adjustable spring strength, hydraulic back check, and two closing speed adjustments for sweep and latch. Latch speed can be independently adjustable per door direction. Cast iron body construction with 1-1/4" dual pistons and an optional hold open feature. Closer bodies shall fit in a 1-3/4" x 4" metal or aluminum transom and 2-1/2" x 4-1/2" wood frame.

1. Manufacturers:

a. Norton Rixson (RF) - 73 Series.

2.12 SURFACE MOUNTED CLOSER HOLDERS

A. Electromagnetic Door Holders: ANSI A156.15 electromagnetic door holder/releases with a minimum 20 to 40 pounds holding power and single coil construction able to accommodate.12VDC, 24VAC, 24VDC and 120VAC. Coils to be independently wound, employing an integral fuse and armatures to include a positive release button.

1. Manufacturers:

a. Norton Rixson (RF) - 980/990 Series.
b. Sargent Manufacturing (SA) - 1560 Series.

2.13 ARCHITECTURAL TRIM

A. Door Protective Trim

1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.

2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1” LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.

3. Where plates are applied to fire rated doors with the top of the plate more than 16” above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer’s catalog and template book for specific requirements for size and applications.

4. Protection Plates: ANSI/BHMA A156.6 protection plates (kick, armor, or mop), fabricated from the following:

a. Stainless Steel: 300 grade, 050-inch thick.

5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.

6. Manufacturers:

a. Rockwood (RO).

2.14 DOOR STOPS AND HOLDERS

A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.

B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 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).

2.15 ARCHITECTURAL SEALS

A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.

1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.

C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.

1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and 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. Pemko (PE).

2.16 ELECTRONIC ACCESSORIES

A. Door Position Switches: Door position magnetic reed contact switches specifically designed for use in commercial door applications. On recessed models the contact and magnetic housing snap-lock into a 1" diameter hole. Surface mounted models include wide gap distance design complete with armored flex cabling. Provide SPDT, N/O switches with optional Rare Earth Magnet installation on steel doors with flush top channels.

1. Manufacturers:

a. Securitron (SU) - DPS Series.

B. 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.

2.17 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.

2.18 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. RO - Rockwood
4. YA - Yale
5. OT - Other
6. RF - Rixson
7. SU - Securitron

Hardware Sets

Set: 1.0

Doors: 003A, 007A

2	Continuous Hinge	CFMxxSLF-HD1 SER		PE
1	Mullion	KRM200(F) (M203 and/or M204 as Required)	600	YA
1	Rim Exit Device, Nightlatch, MELR, REX	7150 B MELR 121NL	630	YA
1	Rim Exit Device, Exit Only, REX	7150 B EO	630	YA
2	Cylinder	Keyed To Match Existing System		OT
2	Door Pull	BF157 Mtg-Type 12XHD	US32D	RO
2	Surface Closer, PA, Stop	5831	689	YA
1	Threshold	2005AT MSES25SS		PE
1	Mullion Gasketing	5110BL 120"		PE
1	Perimeter Gasketing	By Door and Frame Manufacturer		OT
2	Sweep	315CN TKSP		PE

2 ElectroLynx Harness	QC-Cxxx Length as Required		MK
2 ElectroLynx Harness	QC-C1500P		MK
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: 006A

2 Continuous Hinge	CFMxxHD1		PE
1 Mullion	KRM200(F) (M203 and/or M204 as Required)	600	YA
1 Rim Exit Device, Nightlatch	7150 121NL	630	YA
1 Rim Exit Device, Exit Only	7150 EO	630	YA
2 Cylinder	Keyed To Match Existing System		OT
2 Door Pull	BF157 Mtg-Type 12XHD	US32D	RO
2 Surface Closer, PA, Stop	5831	689	YA
1 Threshold	2005AT MSES25SS		PE
1 Gasketing	2891AS TKSP		PE
1 Mullion Gasketing	5110BL 120"		PE
1 Rain Guard	346C TKSP		PE
2 Sweep	315CN TKSP		PE
2 Position Switch	DPS		SU

Set: 3.0

Doors: 100A, 109D

1 Continuous Hinge	CFMxxHD1		PE
1 Rim Exit Device, Nightlatch	7150 121NL	630	YA
1 Cylinder	Keyed To Match Existing System		OT
1 Door Pull	BF157 Mtg-Type 12XHD	US32D	RO
1 Surface Closer, PA, Stop	5831	689	YA
1 Threshold	2005AT MSES25SS		PE

1 Gasketing	2891AS TKSP		PE
1 Rain Guard	346C TKSP		PE
1 Sweep	315CN TKSP		PE
1 Position Switch	DPS		SU

Set: 4.0

Doors: 004A, 103A, 105A, 106A, 108A

3 Hinge, Full Mortise	TA2714 (NRP) 4-1/2" x 4-1/2"	US26D	MK
1 Storeroom or Closet Lock	AU 5405LN	626	YA
1 Cylinder	Keyed To Match Existing System		OT
1 Door Stop	406 / 409 / 441H	US32D	RO
3 Silencer	608-RKW		RO

Set: 5.0

Doors: 107A

6 Hinge, Full Mortise	TA2714 (NRP) 4-1/2" x 4-1/2"	US26D	MK
2 Flush Bolt	555	US26D	RO
1 Dust Proof Strike	570	US26D	RO
1 Storeroom or Closet Lock	AU 5405LN	626	YA
1 Cylinder	Keyed To Match Existing System		OT
2 Kick Plate	K1050 10" High CSK BEV	US32D	RO
2 Door Stop	406 / 409 / 441H	US32D	RO
2 Silencer	608-RKW		RO

Set: 6.0

Doors: 104A

3 Hinge, Full Mortise	TA2714 (NRP) 4-1/2" x 4-1/2"	US26D	MK
1 Privacy Lock	AU 5402LN	626	YA
1 Kick Plate	K1050 10" High CSK BEV	US32D	RO
1 Door Stop	406 / 409 / 441H	US32D	RO
3 Silencer	608-RKW		RO

Set: 7.0

Doors: 116A, 117A

3 Hinge, Full Mortise	TA2714 (NRP) 4-1/2" x 4-1/2"	US26D	MK
1 Push Plate	70C-RKW	US32D	RO
1 Pull Plate	111x70C	US32D	RO

1 Surface Closer, PA / RA	5801	689	YA
1 Kick Plate	K1050 10" High CSK BEV	US32D	RO
1 Door Stop	406 / 409 / 441H	US32D	RO
3 Silencer	608-RKW		RO

END OF SECTION

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SECTION 08 80 00 – GLAZING

PART 1 - GENERAL

1.01 SCOPE: Provide glass and glazing, complete, except glass for aluminum windows will be supplied and installed under its respective section.

1.02 QUALITY ASSURANCE: Provide safety glass (tempered). Complying with requirements of ANSI Z97.1 and CPSC 26 CRF 1201 CII, with etched or ceramic fired permanent identification visible on glass when glazed. Label each piece of glass indicating compliance with requirements. Do not remove label prior to installation.

1.03 SUBMITTALS: Comply with Section 01 33 00.

A. Product Data: Submit copy of manufacturer's specifications and installation instructions for each type of glass and glazing material. Include test data of certification substantiating that glass complies with specified requirements.

B. Samples: Prior to ordering, submit minimum 6" X 6" sample of each type and thickness of glass required for Architect's review.

1.04 PROTECTION: Protect glass surfaces and edges at all times during the construction period. Keep glass free from contamination by materials capable of staining glass.

PART 2 - PRODUCTS

2.01 GLASS: Conforming to ASTM C 1036, of the various types, classes, and forms specified.

A. Float Glass: Type I, Class 1 (transparent), Quality q3 (glazing select).

B. Tempered Glass: Types specified above, heat-strengthened (after cutting to final size) to 4 times normal strength, by process designed to eliminate tong marks or by vertical process if glass is installed to conceal tong marks.

C. Mirror Glass: Type I, Class 1 (transparent), Quality q2 (mirror), with silver coating, copper protective coating complying with CS27, and 2 mil thick painting coating; 1/4" thick.

D. Insulated Glazing:

1. Interior Doors: 1/4" thick tinted tempered float glass

2. Exterior doors: 3/4" thick, consisting of 1/4" tint as indicated on drawings tempered float, 1/4" air space, and 1/4" clear tempered float. Energy Low-E

glass with the coating on the #3 surface as manufactured by Libby-Owens-Ford Co. The center-of-glass area will provide the following performance characteristics:

a. Winter U-Values not to exceed .35 BTU/hour/square foot/degree Fahrenheit.

b. Summer U-Values not to exceed .39 BTU/hour/square foot/degree Fahrenheit.

c. Average daylight transmittance of 37%.

d. Shading coefficient (no shade) not to exceed .53.

The Low-E coating will meet the coating quality specifications as published by the manufacturer of the coated glass.

(Note: Tempered lites not required at transoms.)

3. Windows: 1" thick, consisting of 1/4" tinted, as indicated on drawings, tempered float, 1/4" air space, and 1/4" clear tempered float. Energy Low-E glass with the coating on the #3 surface as manufactured by Libby-Owens-Ford Co.; furnished and installed under Section 08 41 13 – Aluminum Entrances & Storefront. The center-of-glass area will provide the following performance characteristics:

a. Winter U-Values not to exceed .35 BTU/hour/sq. ft./deg. F.

b. Summer U-Values not to exceed .39 BTU/hour/sq. ft./deg.F.

c. Average daylight transmittance of 37%.

d. Shading coefficient (no shade) not to exceed .53.

The Low-E coating will meet the coating quality specifications as published by the manufacturer of the coated glass.

4. Exterior Windows at Tint #1: PPG SolarGRAY over Clear Solarban 60 on #3 = 1" ig. Submit tint sample prior to final approval.

5. Exterior Windows at Tint #2: VisteonBLUE over Clear Solarban 60 on #3 = 1" ig. Submit tint sample prior to final approval.

6. Exterior Windows at Tint #3: Guardian #2 Silver 20 or 32 Clear over Clear Solarban 60 on #3 = 1" ig. Submit tint sample prior to final approval.

J. Wire Glass: Type II, Class 1 (clear), Form 1 (wired and polished both sides), 1/4" thick welded square mesh.

K. Security Glazing: Refer to Section 08 88 53 – Security Glazing.

2.02 GLAZING MATERIALS: Provide materials with proven record of compatibility with surfaces contacted in installation.

A. Glazing Sealants: Tremco "Proglaze", Bostik "Chem-Calk 1200", Pecora "863", or Sonneborn "Omniglaze".

B. Glazing Gaskets: Structural rubber, molded neoprene, or cellular neoprene as recommended by manufacturer of glazing system.

C. Glazing Tape: Dap "Butyl Rubber Tape", Woodmont "Chem Tape 40", Tremco "440".

D. Setting Blocks: Neoprene or other resilient blocks of 70 to 90 shore A durometer hardness, adhesively backed on one face only, tested for compatibility with specified glazing sealants.

E. Spacers: Neoprene or other resilient blocks of 40 to 50 Shore A durometer hardness, tested for compatibility with specified glazing sealant.

F. Compressible Filler Rod: Closed-cell or waterproof-jacketed foam of polyethylene, butyl rubber, neoprene, polyurethane or vinyl, tested for compatibility with specified glazing sealants, of 5 to 10 psi compression strength (25% coverage), recommended by sealant manufacturer for use in glazing channel to prevent sealant exudation from the channel.

G. Mirror Mastic: An adhesive setting compound, produced specifically for setting mirrors by spot application method (25% coverage) without support, to be used in 1/8" to 1/2" thickness.

PART 3 - EXECUTION

3.01 INSTALLATION: Comply with recommendations of glass manufacturers and manufacturers of sealants and other glazing materials, unless otherwise indicated or specified, including preparation of surfaces.

A. Clean channel surfaces and prime as recommended by sealant manufacturer.

B. Cut glass to size as required for measured opening, provide adequate edge clearance and glass bite all around. Cut prior to tempering.

C. Do not install sheets which have edge damage or face imperfections.

D. Miter-cut and bond (weld) ends of channel gaskets at corners to provide a continuous gasket.

E. Seal face gaskets at corners with liquid elastomeric sealant to close openings and prevent withdrawal of gaskets from corners.

F. Frameless Mirror: Mirror glass, with edges ground. Apply one additional coat of moisture-resistant paint, of type recommended by mirror manufacturer, to back of mirror, and allow to dry. Coat edges of mirror with clear sealant, PPG UC-4401 mirror edge seal, or acceptable equal. Apply mirror mastic to cover not more than 25% of back of mirror. Set mirror in support on setting blocks and press against substrate to ensure bond of adhesive. Leave open ventilation space, 1/8" or more in thickness between mirror and substrate, over 75% of mirror area (wherever there is no adhesive). Do not seal off ventilation space at edges of mirror. Hold in place with masking tape, braces or mechanical clamps until mastic sets (about 1 week).

G. Remove and replace glass which is broken, chipped, cracked, abraded or damaged during the construction period.

3.02 CURING: Cure glazing sealants and compounds in compliance with manufacturer's instructions and recommendations to obtain high early bond strength, internal cohesive strength and surface durability.

END OF SECTION

SECTION 08 88 53 – SECURITY GLAZING

PART 2 – PRODUCTS

2.01 MANUFACTURER

A. Approved Manufacturers: Subject to compliance with requirements, provide products from one of the following manufacturers:

1. Isoclima Specialty Glass, LLC
Blairsville, PA
www.isoclimasg.com
(866)-412-6977

2. Global Security Glazing
Selma, AL
www.security-glazing.com
(866)-412-6977

3. Or approved equal.

2.02 WARRANTY

A. Manufacturer's Special Warranty for Laminated Security Glass: Manufacturer's standard form in which laminated-glass manufacturer agrees to replace laminated glass that deteriorates within specified warranty period. Deterioration is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation and delamination due to defects in material workmanship.

1. Warranty Period: 5 years from date of manufacture.

B. Manufacturer's Special Warranty for Insulating Glass: Manufacturer's standard form in which 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 the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1. Warranty Period: 5 years from date of manufacture.

2.03 MATERIALS

A. Basis of Design: Childgard Security Glazing by Isoclima Specialty Glass, LLC (1-866-412-6977) to meet ASTM F1233 Class 1.3 and/or 5-aa1 for a minimum of 6 minutes of forced entry resistance. Substitutions must provide third party test report indicating compliance with this testing criteria.

3.04SECURITY GLAZING TYPES

A. Insulated Security Glazing with Childgard Security Glazing by Certified Fabricator of Guardian Glass; or approved equal.

1. Overall Unit Thickness: 1”

2. Exterior Pane: 1/4" FT glass, with Low-E coating on the No. 2 surface

3. Airspace: 3/8” Black LPD Aluminum Spacer

4. Interior Pane: Childgard Security Glazing by Isoclima Specialty Glass, LLC; or Global Security Glazing

   a. Forced Entry Resistance: ASTM F1233 Class 1.4

   b. Forced Entry Resistance: 5-aa1 rated for a minimum of 6 minutes

   c. Glass Color: Crystal Gray

5. Winter U-Values not to exceed .35 BTU/hour/sq. ft./deg. F.

6. Summer U-Values not to exceed .39 BTU/hour/sq. ft./deg.F.

7. Average daylight transmittance of 37%.

8. Shading coefficient (no shade) not to exceed .53.

9. The Low-E coating will meet the coating quality specifications as published by the manufacturer of the coated glass.

10. Provide Certification for Fabrication by Vitro Architectural Glass

11. Provide test report for ASTM F1233 Class 1.4 by third party independent laboratory.

12. Provide test report for 5-aa1 by third party independent laboratory.

END OF SECTION

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SECTION 09 29 00 – GYPSUM BOARD

PART 1 - GENERAL

1.01 SCOPE: Provide gypsum wallboard work, complete, including partitions, exterior sheathing, air infiltration barrier, furred walls and areas, suspended ceilings, metal framing, sound insulation in partitions, and metal trim and accessories.

1.02 RELATED WORK SPECIFIED IN OTHER SECTIONS:

A. Lightgage Metal Framing; Section 05 40 00.

B. Taping and finishing of gypsum wallboard joints; Section 09 91 00.

C. Tile; Section 09 30 00.

D. Thermal insulation at exterior walls; Section 07 21 00.

1.03 SUBMITTALS: Comply with Section 01 33 00.

A. Product Data: Submit manufacturer's installation instructions for each gypsum wallboard component.

B. Shop Drawings: Submit drawings showing typical and special partition and ceiling assemblies. Include materials, material gages, stud spacing and bracing of studs.

1.04 QUALITY ASSURANCE:

A. Allowable tolerances; 1/8" offsets between planes of board faces, and 1/4" in 8 ft. for plumb, level, warp, and bow.

B. Fire-resistance Rating: Where work is indicated for fire-resistance ratings, provide materials and installations identical with assemblies which have been tested and listed by recognized authorities, including UL, OSU and USG. Maintain one copy on site.

C. Installation: Strictly comply with U.S. Gypsum Association and manufacturer's recommendations for accessories and joints (taped, control and expansion) location and application methods. Additional control/expansion joints beyond those shown on drawings are to be installed based on manufacturer's recommendations. Coordinate with Architect.

D. Perform work in accordance with ASTM C 840, GA-201, GA-214, GA-216 and GA-600. Maintain one copy on site.

1.05 REFERENCES:

A. ASTM C1396 – Standard Specification for Gypsum Board

B. ASTM C1178 – Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel

C. ASTM C1278 – Standard Specification for Fiber-Reinforced Gypsum Panel

D. ASTM C475 – Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board

E. ASTM C514 – Standard Specification for Nails for the Application of Gypsum Wallboard

F. ASTM C557 – Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing

G. ASTM C630 – Standard Specification for Water-Resistant Gypsum Backing Board

H. ASTM C645 – Standard Specification for Non-Load (Axial) Bearing Steel Studs, Runners (Track), and Rigid Furring Channels for Screw Application of Gypsum Board

I. ASTM C665 – Standard Specification for Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing

J. ASTM C754 – Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Board

K. ASTM C840 – Standard Specification for Application and Finishing of Gypsum Board

L. ASTM C931 – Standard Specification for Exterior Gypsum Soffit Board

M. ASTM C1002 – Standard Specification for Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases

N. ASTM E90 – Standard Test Method for Laboratory Measurement of Airborne-Sound Transmission Loss of Building Partitions

O. ASTM E119 – Standard Test Methods for Fire Tests of Building Construction and Materials

P. GA-201 – Using Gypsum Board for Walls and Ceilings

Q. GA-214 – Recommended Specification: Levels of Gypsum Board Finish

R. GA-216 – Recommended Specifications for the Application and Finishing of Gypsum Board

S. GA-600 – Fire Resistance Design Manual

T. UL – Fire Resistance Directory

U. WH (Warnock Hersey) – Certification Listings

1.06 DELIVERY, STORAGE AND PRODUCT HANDLING: Deliver materials in original packages, containers and bundles, fully identified with manufacturer's name, brand, type and grade. Store in dry, well-ventilated space, protected from the weather under cover and off the ground. Stack flat to prevent sagging. Handle to prevent damage to edges, ends and surfaces.

1.07 REGULATORY REQUIREMENTS: Conform to 2012 IBC code for fire rated assemblies as follows:

A. Fire Rated Ceiling: Listed assembly by UL

B. Fire Rated Partitions: Listed assembly by UL

PART 2 - PRODUCTS

2.01 MANUFACTURERS: U.S. Gypsum is specified. Equivalent systems of CertainTeed, Gold Bond and Georgia Pacific are acceptable, or approved equal.

2.02 MATERIALS:

A. Studs, Channels and Runners: Refer to Section 05 40 00.

B. Hangers: 8-gage, galvanized, soft, annealed wire.

C. Tie Wire: 18-gage, galvanized, soft, annealed wire.

D. Gypsum Board and Fire-rated Gypsum Board: ASTM C 1396, 5/8" thick Sheetrock Firecode (Type X), with tapered edges.

E. Abuse-resistant Gypsum Board: ASTM C 36, 5/8” thick Fiberock up to 8 feet in corridors.

F. Tile Backer Board: ASTM C 442, U.S.G. “Durock”, Georgia Pacific “Denshield Tile Backer”, or Gold Bond “WonderBoard”; 1/2” thick. Provide tape, adhesive and accessories for taping of joints, of type recommended by manufacturer.

G. Exterior Sheathing:

a. Typical: ½” thick, water-resistant gypsum core encased in black water-repellent paper on both sides and long edges.

b. At EIFS: Paperless sheathing panel of silicone-treated core, surfaced with inorganic glass mat facings and “gold colored” alkali-resistance coating; ½” thick; Georgia Pacific “DensGlass Gold”, or approved equal.

H. Air Infiltration Barrier: DuPont Tyvek Stucco Wrap. ASTM E-1677; polyolefin, cross-laminated films, woven strands or spunbonded fibers; coated or uncoated; with or without perforations to transmit water vapor but not liquid water; minimum 3 mils thick, minimum 10 perms water-vapor transmission, minimum 25 flame spread (ASTM E-84).

I. Flashing: DuPont Tyvek “FlexWrap” is specified for all windowsills. DuPont Tyvek “Straight Flash” is specified at al door and window jambs.

J. Trim Accessories: GA-201 and GA-216; provide manufacturer’s standard trim accessories of types indicated for drywall work, formed of galvanized steel unless otherwise indicated, with either knurled and perforated or expanded flanges for nailing or stapling, and beaded for concealment of flanges in joint compound. Provide all corner beads, edge trim beads, and control joint beads, types as indicated and as required by project conditions and manufacturer’s recommendations.

K. Fasteners:

a. ASTM C 1002; self-drilling, self-tapping screws for power driving with special head design for gypsum board attachment (Type S), producing surface depression for proper concealment; 1” long.

b. 1-5/8” steel screws at tile backer board, or other as recommended by manufacturer.

c. Provide other fasteners as required by project conditions and as recommended by manufacturer.

L. Acoustical Sealant: U.S.G. Acoustical Sealant; or approved equal.

M. Joint Compound: ASTM C 475, GA-201 and GA-216; U.S.G. is specified; or approved equal.

a. Impact gypsum board to standard gypsum board: “Durbond 90” with “Sheetrock Joint Tape – Heavy”.

b. All other taped joints: “Sheetrock All Purpose Joint Compound” with “Sheetrock Joint Tape”.

N. Metal Control Joint: No. 093

PART 3 - EXECUTION

3.01 INSTALLATION: Comply with ASTM C-840, manufacturer's instructions and Gypsum Construction Handbook, as specified and as indicated on the drawings. Install gypsum products, joint compounds and textures at comfortable working temperatures continuously above 50°F. In cold weather, provide controlled, well-distributed heat to keep the temperature above minimum levels.

A. Metal Studs:

1. Install studs in accordance with ASTM C 754, GA-201, GA-216 and GA-600.

2. Spacing: 16” on center or as indicated on drawings.

3. Refer to drawings for indication of partitions extending stud framing through the ceiling to the structure above. Maintain clearance under structural building members to avoid deflection transfer to studs. Provide extended leg ceiling runners.

B. Partitions: ASTM C 754, GA-201, GA-216 and GA-600; provide partition assemblies as indicated; refer to Partition Schedule. Space studs 16" o.c., unless otherwise indicated.

1. Provide runners designed to hold and align studs. Provide additional studs at door frames.

2. At insulated walls, wedge insulation between studs, and fit snugly against floor and ceiling runners and against protrusions. Run insulation over top of wall at ceiling; extend to 2’ each, unless otherwise indicated. Cut gypsum board or sound deadening board neatly in around openings, pipes, ducts, electrical boxes, outlets, fixtures, etc. Seal to fill all gaps and around entire perimeter with acoustical sealant, including floor and ceiling joints and intersections with vertical surfaces to provide a completely airtight wall.

3. At tile walls, use backer board. Install in compliance with manufacturer instructions including application to metal studs, and taping and floating of joints.

4. At fire rated assemblies, conform to tested designs for required hour ratings indicated.

5. At expansion/control joints located at door and window heads, install cripple stud above header. Do not anchor cripple to bearing stud.

C. Furred Walls/Ceilings/Areas: 5/8" gypsum board on furring channels and studs, as indicated. Shim as required to provide level surface.

D. Exterior Walls: 1/2" exterior gypsum sheathing board, air infiltration barrier with taped joints on exterior side of lightgage framing studs (specified in Section 05 40 00), insulation (specified in Section 07 21 00) and 5/8" gypsum board on interior. "FlexWrap" at all windowsills. "Straight Flash" at all door and window heads and jambs.

E. Suspended Ceilings: 5/8" gypsum board on furring channels at 24" o.c., attached to carrying channels at 4' o.c. suspended by hanger wires from the structural bracing at 4' o.c.

1. Note: Drywall suspension system may be used; direct hung heavy-duty, single-web steel main tees with furring channels and cross-tees at light fixtures; similar to U.S.G. (Donn) Rigid X or Chicago Metallic 660 Furring.

F. Application: Except where specified otherwise:

1. Apply gypsum board parallel or horizontal to studs (except where otherwise required by fire-rated assembly) with panels in longest length available.

2. Provide casing beads where edges of gypsum board meet dissimilar materials.

3. Fasten gypsum board and tile backer board with specified screws.

a. Space screws 16" o.c. for walls and 12" o.c. for ceilings for single layer. Space screws 24" o.c. for walls for base layer of double layer (both layers mechanically attached) and 16" o.c. for walls at face layer. At multiple layers, comply with drywall manufacturer's recommendations.

b. At fire-rated assemblies, conform to fastening required of rated assembly.

4. Cooperate with the carpenter in placing of backing and blocking required as backing for all millwork, fixtures, fittings and accessories. Reinforce and brace studs in partitions supporting fixtures, to provide firm backing and prevent deflection of the wall.

5. Brace studs in compliance with manufacturer's recommendations for wall height, stud spacing and other project conditions indicated. Include bracing in shop drawing submittal.

6. Arrange gypsum board joints on opposite sides of partitions to occur on different studs.

7. Install expansion/control joints:

   a. Ceilings: Install expansion/control joints in ceilings exceeding 2,500 sq. ft. in area. Do not exceed a distance of 50', in either direction, between ceiling control joints, and install a control joint where ceiling framing or furring changes direction. All joints to be installed in accordance with manufacturer's instructions and recommendations.

   b. Interior Walls: Install expansion/control joints in partitions and wall runs exceeding 30'. Do not exceed a distance of 30' between joints. Space joints equally. Consult Architect on questionable locations. Control/expansion joints to occur on each side of doors, windows and alcove heads. All joints to be installed in accordance with manufacturer's instructions and recommendations.

   c. Exterior Walls: Control/expansion joints to occur at both sides of window and door heads, and at same location where exterior masonry joints occur at exterior of building. All joints to be installed in accordance with manufacturer's instructions and recommendations.

8. Treat all internal angles formed by the intersection of either wallboard surfaces with a taped joint system.

9. Treat all vertical and horizontal external corners with metal bead corner reinforcement applied in accordance with manufacturer's instructions.

G. Joint Treatment: Finish in accordance with GA-214 Level 5.

H. Interior Gypsum Wall Finish: In accordance with GA-214 Level 4

3.02 TOLERANCES:

A. Maximum variation of finished gypsum board surface from true flatness: 1/8" in 10' in any direction.

END OF SECTION

SECTION 09 30 00 - TILE

PART 1 - GENERAL

1.01 SCOPE:

A. Provide tile work, complete, including ceramic tile. Provide trim pieces and accessories as indicated and as required for proper installation of work.

B. Refer to Finish Schedules, floor plans, and elevations for location and extent of work.

1.02 RELATED WORK SPECIFIED IN OTHER SECTIONS: Sealants; Section 07 92 00.

1.03 QUALITY ASSURANCE: Provide ceramic tile conforming to Standard Grade manufacturing requirements of TCA 137.1.

1.04 SUBMITTALS:

A. Manufacturer's Data: Submit manufacturer's installation instructions for all materials.

B. Samples: Submit full range of color samples for ceramic tile for Architect's selection. Submit sample of granite pavers and tiles and brick pavers proposed for use for Architect's verification. Submit full color range of color samples for grout, trim pieces, and accessories for Architect's selection. Submit 6" long sample of granite threshold.

C. Certification: Furnish Master Grade Certificate for ceramic tile, signed by the manufacturer and installer.

D. Shop Drawings: Submit shop drawings indicating materials, type of setting, laying pattern, and expansion joints.

1.05 DELIVERY AND STORAGE: Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use, in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.01 PORCELAIN FLOOR AND WALL TILE: Daltile is specified; or approved equal.

A. Daltile, “Ambassador”, 24” x 48” floor and wall tile.

1. Provide abrasive tile at sloped areas.

B. Provide trim tile as indicated or required by project conditions, of same material, size, color and finish as field tile, except where otherwise indicated.

2.03 MORTAR AND GROUT MATERIALS: Where Laticrete products are specified, equivalent materials of Mapei and L & M are acceptable.

A. Mortar Thinset: Factory prepared dry set Portland cement mortar mix and #4237 Laticrete tile setting liquid in proportions as recommended by Laticrete.

B. Grout: Latapoxy 2000 Industrial grade epoxy grout admix in proportions as recommended by manufacturer, full range of colors as selected by Architect.

C. Grout: Laticrete 333 Super Flexible Additive and Laticrete 211 Power install as recommended by Laticrete, full range of colors as selected by Architect.

D. Laticrete SpectraLock ProGrout, install as recommended by Laticrete, full range of colors as selected by Architect.

2.04 EXPANSION JOINT SEALANT: 2-component polyurethane sealant conforming to material and installation requirements specified in Section 07900; in color to match grout.

2.05 TILE BACKER BOARD: U.S.G. "Durock", Modulars "Wonder Board", or Laticrete "Latapanel".

PART 3 - EXECUTION

3.01 EXAMINATION: Examine areas and conditions under which tile work is to be installed. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.02 TILE BACKER BOARD: Install in compliance with manufacturer's instructions including application to substrate and taping and floating of joints.

3.03 TILE INSTALLATION:

A. General:

1. Comply with ANSI standard installation specifications A108.5. Maintain minimum temperature limits and installation practices as recommended by proprietary mortar and grout materials manufacturer.

2. Extend tile work in recesses under equipment and fixtures, to form a complete covering without interruptions. Terminate work neatly at obstructions, edges, and corners without disruption of 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, and fixtures so that plates, collars, or covers overlap tile.

4. Comply with the manufacturer's instructions for mixing and installation of materials.

5. Neutralize and seal substrates in accordance with mortar manufacturer's instructions.

B. Setting Bed: Set tile by thin-set method using specified mortar. Fill out mortar bed to thickness as required. Provide leveling coat at concrete floors where variation exceeds 1/8" in 10 ft.

C. Jointing Pattern: Ceramic Tile: Lay tile in grid pattern. Align joints when adjoining tiles on floor, base, walls and trim are the same size. Provide uniform 1/8" joint widths. Lay out tile work and center tile fields both directions in each space. Adjust to minimize tile cutting.

D. Placement: Comply with applicable requirements of ANSI A108.5 standards for installation, and manufacturer's instructions for materials.

E. Grout with specified grout.

F. Set granite threshold in same type setting bed as specified for tile.

G. Expansion Joints: Provide 3/8" wide expansion joints using specified sealant. Use polyethylene foam rod filler or other bond breaker as required to provide sealant joint approximately 1/4" thick and 3/8" wide. Tool sealant slightly concave. Extend joint through the mortar bed. Locate expansion joints at vertical intersections and perimeters of tile areas. Include layout of expansion joints on shop drawings for approval.

3.04 ADJUST AND CLEAN:

A. Cleaning: Upon completion of placement and grouting, clean all tile surfaces so they are free of foreign matter.

B. Finished Tile Work: Leave finished installation clean and free of cracked, chipped, broken, unbonded, or otherwise defective tile work.

C. Protections: Protect installed work with Kraft paper or other heavy covering during the construction period to prevent damage and wear. Prohibit all foot and wheel

traffic from using floors for at least 3 days. Before final inspection, remove protective coverings.

END OF SECTION

SECTION 09 51 00 – ACOUSTICAL CEILINGS

PART 1 - GENERAL

1.01 SCOPE: Provide acoustical ceilings, complete, including elements of the suspension system, trim, and facilities for the support and attachment of lighting fixtures, air diffusers and grilles. See Finish Schedule and Reflected Ceiling Plan for locations.

1.02 SUBMITTALS: Comply with requirements of Section 01 33 00.

A. Shop Drawings: Submit shop drawings, for Architect's review, indicating location of ceiling units and items of work which are to be coordinated with the ceilings, and framing and support details for all work supported by the suspension system.

B. Samples: Submit full range 12" X 12" color samples of acoustical material and color samples of main runner, cross tee, and wall molding for Architect's selection.

C. Warranty: Submit executed warranty.

1.03 PRODUCT DELIVERY, STORAGE, AND HANDLING: Deliver acoustical units in manufacturer's original unopened packages, fully identified with type, finish, performance data and compliance labels. Handle and store in accordance with manufacturer's instructions and recommendations.

1.04 JOB CONDITIONS: Do not install interior acoustical units until space has been enclosed and is weathertight, until wet work has been completed and is dry, until work above ceiling is complete, and until temperature and humidity conditions will be continuously maintained at values near those indicated for final occupancy.

1.05 REFERENCES:

A. American Society for Testing and Materials (ASTM):

1. ASTM A 1008 Standard Specification for Steel, Sheet, Cold Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.

2. ASTM A 641 Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.

3. ASTM A 653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.

4. ASTM C 423 Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.

5. ASTM C 635 Standard Specification for Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.

6. ASTM C 636 Recommended Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.

7. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials.

8. ASTM E 1414 Standard Test Method for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum.

9. ASTM E 1111 Standard Test Method for Measuring the Interzone Attenuation of Ceilings Systems.

10. ASTM E 1264 Classification for Acoustical Ceiling Products.

11. ASTM E 1477 Standard Test Method for Luminous Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers.

12. ASTM D 3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.

13. ASTM E 119 Standard Test Methods for Fire Tests of Building Construction and Material.

PART 2 - PRODUCTS

2.01 ACOUSTICAL MATERIALS: Armstrong, USG, and CertainTeed are specified, or approved equal.

A. ACT-1: Lay-In Panel (Tegular)

1. Characteristics:

a. Material: Wet formed mineral fiber
b. Surface Finish: Factory-applied vinyl latex paint
c. Color: White
d. Light Reflectance: LR 0.86
e. Size: 24" x 24" x 5/8"
f. Edge Detail: Angled tegular lay-in
g. NRC: 0.75
h. CAC (CSTC): Minimum 35
i. Surface Burning Characteristics: Class A (Flame Spread 25 or under), UL labeled

j. Insulation Valve: Average R factor (at 75°), 1.6

2. Pattern: Armstrong Fine Fissured 1756

B. ACT-2: Lay-In Panel (RH-90)

1. Characteristics:

a. Material: Wet formed mineral fiber
b. Surface Finish: Factory-applied vinyl latex paint
c. Color: White
d. Light Reflectance: LR 0.86
e. Size: 24" x 24" X 5/8"
f. Edge Detail: Square cut lay-in
g. NRC: 0.75
h. CSTC: Minimum 35
i. Surface Burning Characteristics: Class A (Flame Spread 25 or under), UL Labeled
j. Insulation Value: Average R factor (at 75 degrees Fahrenheit), 1.5
k. RH90 Performance: No visible sag under conditions not to exceed 90 degrees Fahrenheit and 90% humidity

2. Pattern: Armstrong Fine Fissured RH90 1754

C. ACT-3: Acoustical 2 x 2 Lay-in Ceiling: "Optima" square lay-in; or approved equal. NRC above 0.95

2.02 SUSPENSION SYSTEM MATERIALS: Provide suspension system materials, conforming to ASTM C-635, Seismic Category as defined in Section 00 73 00, by acoustical unit manufacturer.

A. Components: All main beams and cross tees shall be commercial quality hot-dipped galvanized steel, as per ASTM A-653. Main beams and cross tees are double-web steel construction with type exposed flange design. Exposed surfaces chemically cleansed, capping pre-finished galvanized steel in baked polyester paint. Main beams and cross tees shall have rotary stitching.

1. Structural Classification: ASTM C-635 Heavy Duty

2. Color: White and match the actual color of the selected ceiling tile, unless noted otherwise.

3. Acceptable Product: Prelude XL 15/16" Exposed Tee as manufactured by Armstrong World Industries, Inc.

B. Attachment Devices: Size for five times design load indicated in ASTM C-635, Table 1, Direct Hung unless otherwise indicated.

C. Wire for Hangers and Ties: ASTM A-641, Class 1 zinc coating, soft temper, pre-stretched, with a yield stress load of at least times three design load, but not less than 12-gauge at 4' spacing.

D. Edge Moldings and Trim: Metal or extruded aluminum of types and profiles indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations, including light fixtures, that fit type of edge detail and suspension system indicated. Provide moldings with exposed flange of the same width as exposed runner.

E. Accessories

2.03 DRYWALL SUSPENSION SYSTEM: Provide 1-1/2" wide face, G40, 0.018" metal thickness meeting ASTM C645, length as required and span ties per manufacturer's recommendations at all drywall ceiling and metal soffits.

2.04 CEILING DIFFUSERS: Refer to reflected ceiling plan. Golterman & Sabo (G&S) ceiling diffusers; or approved equal. Wenger is an approved manufacturer.

A. Type A: Wedge diffusers (WCD), Quadriatic Diffuser Panels

B. Type B: Pyramidal diffusers (PCD)

C. Characteristics:

1. Core: 0.125 thermoformed copolymer
2. Shape: Wedge
3. Size: As indicated on drawings
4. Mounting: 15/16" lay-in ceiling grid system
5. Finish: Textured white
6. Flammability: Class "A" rating per ASTM E84

PART 3 - EXECUTION

3.01 INSTALLATION AND WORKMANSHIP: Install mechanical suspension system and acoustical units in strict compliance with ASTM C-635, Seismic Category as defined in Section 00 73 00, and with manufacturer's directions.

A. Install in the patterns indicated on the drawings, in such a manner to permit border units of the greatest possible size, unless otherwise indicated on the Reflected Ceiling Plan.

B. Refer to Architectural Reflected Ceiling Plan for the locations of lighting fixtures, air supply and return diffusers, grilles, and registers, which will be installed in the ceilings, and which will replace and/or pierce the acoustical unit. Refer to electrical and mechanical drawings for quantities.

C. Exposed Grid:

1. Install acoustical ceiling suspension system level and true to line, with neat and close-fitting joints between spliced and intersecting members. Grid to be square, and ends and cross tees tightly butted, and faces in the same plane. Do not rest flanges of the cross tees on the flanges of the main runners.

2. Neatly and accurately cut and place acoustical panels to fit snugly into the main and cross tees, with no space between the bottom of the acoustical panels and grid system, and without gaps or panel edges showing in the finished installation.

D. Seismic Requirements:

1. Minimum 2” wall molding

2. Grid must be attached to two adjacent walls – opposite walls must have a 3/4" clearance

3. Ends of main beams and cross tees must be tied together to prevent their spreading

4. Heavy-duty grid system

5. Ceiling areas over 1,000 s.f. must have horizontal restraint wire or rigid bracing

6. Ceiling areas over 2,500 s.f. must have seismic separation joints or full height partitions

7. Ceilings without rigid bracing must have 2” oversized trim rings for sprinklers and other penetrations

8. Changes in ceiling plane must have positive bracing

9. Cable trays and electrical conduits must be independently supported and braced

10. Suspended ceilings will be subject to special inspection

11. Perimeter support wires

3.02 CLEANING: Clean soiled or discolored acoustical units, trim, molding, and suspension members after installation. Touch up scratches, abrasions, voids, and other defects in painted surfaces. Remove and replace work, which cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

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SECTION 09 68 13 – MODULAR FLOORING TILES

PART 1 – GENERAL

1.01 THIS SECTION INCLUDES

A. Textile composite flooring modules as shown on the drawings and schedules and as indicated by the requirements of this section.

1.02 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract (including General and Supplementary Conditions and Division 1 sections) apply to the work in this section only.

1.03 RELATED SECTIONS

A. Oher Division 9 sections for floor finishes related to this section but not the work of this section.

B. Division 3 Concrete - not included work this section.

C. Division 6 Wood and Plastics - not included work this section.

D. Division 7 Thermal and Moisture Protection - not included work this section.

1.04 QUALITY ASSURANCE AND REGULATORY REQUIREMENTS

A. Qualifications of flooring installation contractor: All work shall be done by installation firms specializing in commercial flooring and carpet installation. It is required, that the firm or individual shall be a member of the Floor Covering Installation Contractors Association (FCICA) and/or certified by the Certified Floorcovering Installers Association (CFI). Flooring contractor to be specialty contractor normally engaged in this type of work and shall have three (3) years minimum documented experience in commercial installation of similar flooring materials and participation in manufacturer's environmental program including responsible flooring removal, recycling, and installation.

B. Flooring contractor will be responsible for the proper product installation, including floor preparation in all the areas indicated in the drawings to receive Kinetex modules. The installation standard will be as listed in J+J Flooring Group Kinetex Installation Instructions.

C. Flooring contractor to provide owner a written warranty that guarantees the completed installation to be free from defects in materials and workmanship for a period of no less than two (2) years after job completion.

D. Manufacturer qualifications: Manufacturing facility to ISO 14001 certified and have a minimum of 20 years' experience in the manufacture of commercial flooring.

E. Manufacturer to offer a reclamation program for the recycling of existing broadloom carpet, modular carpet tile and textile composite flooring.

F. All warranties must be issued by the manufacturer as standard published warranties on all types of flooring modules within this document. Second source warranties that involve parties other than the textile composite flooring manufacturer are unacceptable. If the product fails to perform as warranted when installed according to the J+J Flooring Group's Kinetex installation instruction and maintained according to J+J Flooring Group's Kinetex maintenance instructions, the affected area will be repaired or replaced at the expense of the manufacturer. J+J Flooring Group will provide standard published written performance warranties for the following:

1. Lifetime product performance. Will not delaminate along seams or lose more than five (5%) percent by weight of fiber during its useful life.

2. Lifetime static propensity, meaning built-in protection below 3.0 kv as tested under AATCC-134.

3. Lifetime stain removal

4. Lifetime colorfastness (light and crocking)

G. Manufacturer to provide field service experts to assist in project start-up as required by the job and will notify owner, architect, general contractor, or another designated contact if any installation instructions are not followed.

H. Provide flooring material to meet the following test performance criteria as tested by a recognized independent testing laboratory. Certified test reports shall be submitted by the manufacturer for each test method. Requirements listed below must be met by all products being submitted for approval:

1. Pill Test / DOC-FF-1-70 (ASTM D-2589) - Requirement: Pass

2. Flooring Radiant Panel / ASTM E-648 - Requirement: Class I (Above .45 w/cm)

3. CRI VOC Chamber Test/Indoor Air Quality test (CRI-IAQ) Green Label Plus™ Test.

4. Lightfastness: Rating of not less than 5 on International Grey Scale after 40 SFU's when tested in accordance with AATCC Test Method 16E.

5. Crockfastness: Minimum stain rating on International Grey Scale of not less than 5 wet or dry when tested in accordance with AATCC Test Method 165.

6. Atmospheric Fading: Burned Gas shall not be less than 5 on International Grey Scale after two cycles on each test as per AATCC Test Method 129 Ozone and AATCC Test Method 23.

7. Noise Reduction Coefficient (ASTM C 423-02): NRC Rating of 0.30

8. Impact Insulation Classification (ASTM E 492-09): IIC Rating of 64

9. Slip Resistance (ASTM 1028-96): Complies with ADA Guidelines for level surface

10. Thermal Insulation (ASTM C 518): R-4

1.05 SUBMITTALS

A. Submit to architect and/or owner ten (10) days prior to bid, two (2) 6.5" x 6.5" (minimum size) finished samples of the exact type of flooring proposed, including quality, pattern, color and backing.

B. Submit to architect and/or owner ten (10) days before bid, any proposed substitutions for consideration. Submit at least three (3) references of installations using the same flooring technology, as described within this text. Include contact names and telephone numbers.

C. Submit manufacturer's warranties, installation instructions, and maintenance instructions before bid date.

D. Submit the manufacturer's certification that the flooring has been tested by an independent laboratory and complies with the required flammability tests as well as other testing requirements as listed under 1.04 F.

1.06 ENVIRONMENTAL/FIELD CONDITIONS

A. Deliver all materials to the installation site in the manufacturer's original packaging and in good condition. Packaging to contain manufacturer's name and marks, identification number, shipping and handling instructions and related information.

B. Delivered and stored materials must be available for inspection as required by the owner, architect, general contractor and/or the manufacturer.

C. Sub-floor preparation is to include all required work to prepare the existing floor for installation of the product as specified in this document. Sub-floor preparation shall meet all conditions as specified in J+J Flooring Group's Kinetex textile composite flooring installation instructions.

D. Sub-floor preparation will include, as required, the removal and repair of the existing floor surface. It is required that the floor of a renovation project be inspected before the bid date.

E. All materials, including adhesives, are to be delivered to the site of installation at a minimum of 48 hours prior to the start of installation and stored in a clean and dry room that measures above 65°F and below 95°F and measures between 10% and 65% relative humidity (RH). To maintain temperature and relative humidity, permanent heating and air conditioning systems (HVAC) must be in operation. Place pallets of textile composite flooring modules on a flat surface (do not double stack pallets). After work is completed, the ambient room temperature should remain at 65°F and relative humidity between 10% and 65% for 48 hours. These materials and related adhesives shall be protected from the direct flow of heat from heating fixtures and appliances such as hot-air registers, radiators, or other. Site conditions shall include those specified in the flooring manufacturer's installation instructions and shall also include sufficient heat, light and power required for effective and efficient working condition.

F. Once the temperature and relative humidity in area for installation have been stabilized, loose lay the modules within the installation area and allow them to precondition for 48 hours prior to installation. Module installation shall not commence until painting and finishing work is complete and ceiling and overhead work is tested, approved and completed. Traffic shall be closed during the installation of the textile composite flooring products. Verify concrete slabs are dry per the standards for bond and moisture tests listed in the manufacturer's installation instructions.

1.07 SUBSTITUTIONS

A. All Bid submittals must conform to the specifications in this document.

B. All test results to be in accordance with a certified independent testing laboratory.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturer: Kinetex, a brand of J+J Flooring Group, P.O. Box 1287, Dalton, GA, 30722. (800) 241-4586. JJFLOORINGGROUP.COM. Please contact BRAD BUNCH, (479) 305-4004, brad.bunch@jjflooringgroup.com. Any alternate manufacturer and/or product must meet or exceed those requirements specified under all sections of this document in pattern, color, and fiber. Any substitutions must be made in accordance with Section 1.00 of this document.

2.02 TEXTILE COMPOSITE FLOORING MATERIALS

A. Kinetex flooring modules (tiles):

1. Product:
    a. Network Modular 1842
    b. Flash 1818
    c. Pop 1816
    d. Propel 1817
    e. Umbra 1819
2. Color: TBD
3. Backing: Polyester Felt Cushion
4. Dye Method: Solution Dyed
5. Wear Layer: Universal Fibers Polyester
6. Total Weight (Nominal Average): 4.5 oz - 5.2 oz / square foot
7. Pattern Repeat: N/A
8. Soil Release: Yes
9. Standard Size: 24" x 24" (approx. (60.96 cm x 60.96 cm)
10. Warranties: Lifetime Product Performance, Colorfastness to Light & Crocking, Stain Removal, Static Protection, Protection from Edge Ravel and Delamination Failure; Lifetime Dimensional Stability.
11. Testing Specifications - Pill Test: Yes
12. Testing Specifications - Flooring Radiant Panel: Class 1
13. Testing Specifications - Smoke Density: Less than 450.0 flaming (ASTM E 662)

14. Testing Specifications - Static Test: Less than 3.0kv (AATCC-134)
15. Recycled content: Minimum of 55% recycled content
16. NSF/ANSI 140 Platinum Certified
17. Closed-loop recyclable

2.03 ADHESIVES

A. Kinetex® Adhesive, an aggressive, pressure-sensitive adhesive designed for the installation of Kinetex textile composite flooring modules is required.

B. Kinetex PreFix®, a quick installation for all Kinetex textile composite flooring products. The release liner easily peels away to reveal a series of pre-applied adhesive strips that securely anchor the Kinetex module in place, (PreFix Primer is required).

2.04 ACCESSORIES

A. Kinetex requires protective transition 3/16-inch to other floor covering thickness. Provide transition/reducing strips tapered to meet abutting materials as indicated in the drawings.

B. Provide aluminum edge with lip to protect Kinetex edge.

PART 3 – EXECUTION

3.01 INSPECTION

A. Examine and verify that sub-floor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive installation of modules.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive installation of modules.

C. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to sub-floor surfaces.

D. Verify that concrete sub-floor surfaces are dry enough and ready for flooring installation by testing for moisture emission rate and alkalinity in accordance with ASTM F 710; obtain instructions if test results are not within limits recommended by J+J Flooring Group.

E. Verify that required floor-mounted utilities are in correct location.

F. J+J Flooring Group requires that Kinetex textile composite flooring be inspected prior to installation for proper style, color and potential defects. No claims will be honored if the modules are installed with visible defects. Should there be a problem, call J+J Flooring Group's Customer Relations Department at 800.241.4586.

3.02 PREPARATION

A. Starting installation constitutes acceptance of sub-floor conditions.

B. Surface Preparation: Dust, dirt, debris and non-compatible adhesive must be removed before the installation begins. Surfaces must be smooth and level with all holes and cracks filled with Portland cement-based patch reinforced with polymers. Kinetex Adhesive cannot be applied to any substrate where chemical or solventbased cleaners have been used.

C. Latex Adhesives: Old latex adhesives must be mechanically scraped down to a bare residue. Latex adhesive residues must be smooth and level with all holes and cracks filled with a Portland cement-based patch reinforced with polymers or encapsulated with APAC ENCapSeal. Note: Failure to remove or seal, old latex adhesive may cause installation failure, shifting, buckling or edge curling; these conditions will not be covered under warranty.

D. Cut Back Adhesives: Must be wet mechanically scraped to a minimum residue and encapsulated with APAC ENCapSeal. Note: Failure to remove or seal old cut back adhesive may cause installation failure, shifting, buckling or edge curling; these conditions will not be covered under warranty.

E. Concrete Moisture Testing and pH Testing: Substrate surfaces must be tested for moisture emission. It is the responsibility of the owner or owner's representative to perform moisture testing prior to starting the installation. ASTM-F 2170-2 relative humidity probe moisture testing is required. Acceptable relative humidity probe testing results are up to 95% RH when using Kinetex Adhesive and up 99% RH when using Kinetex PreFix. Alkalinity tests should also be performed per ASTM F 710. The maximum acceptable pH is 10.0 when using Kinetex Adhesive and 11.0 when using Kinetex PreFix. Nte: pH readings of 9.0 - 11.00, Commercialon Premium Sealer is required.

SUBFLOORS

F. New Concrete: New concrete must be fully cured and free of moisture (see ASTM F 710). New concrete requires a curing period of approximately 90 days.

G. Old Concrete: Old concrete must be checked for moisture. Dry, dusty, porous floors must be primed or encapsulated with APAC ENCapSeal. Note: Primers will not correct a moisture problem.

H. Wood: Wood floors must be APA flooring grade smooth and level, or CanPly Select Grade. If the floor is uneven, an approved underlayment will be required.

I. Terrazzo / Marble: Level all grout lines with Portland cement-based patch reinforced with polymers. Glossy surfaces must be sanded for proper adhesive bond. Waxes and similar finishes must be removed.

J. Other Hard Surfaces (VCT/VAT): Tiles must be well secured to the floor or removed. Broken, damaged or loose tiles must be replaced. Waxes and similar finishes must be removed from VCT before applying adhesive. Existing sheet vinyl is not a suitable substrate for modular installation and must be removed.

K. Carpet: Remove old carpet and carpet adhesives by scraping or other mechanical means. Any remaining adhesive residues may be covered with a Portland based patching compound or encapsulated with TriSeal Sealer.

3.03 INSTALLATION OF TEXTILE COMPOSITE FLOORING

A. Install flooring in strict accordance with the finish drawings and J+J Flooring Group's Kinetex installation instructions.

B. Adhesive System - Kinetex requires use of Kinetex Adhesive or PreFix pre-applied adhesive for all Kinetex flooring modules.

1. Full Spread Kinetex Adhesive: The spread rate for Kinetex Adhesive is approximately 1080 square feet per four gallon pail and can be spread using a 1/16" x 1/32" x 1/32" U-notched trowel or applied using a 3/8" foam or nap roller. Allow to dry until transparent or adhesive does not transfer to finger when touched. Drying time will vary with temperature, humidity and air velocity, however modules must be installed within two hours after adhesive has dried. Note: Inadequate amounts of adhesive can cause modules to shift and move and will not be covered by warranty. J+J Flooring Group will not be responsible for the adhesive bond where other adhesives have been used.

2. PreFix Pre-Applied Adhesive:

a. PreFix Primer Application (REQUIRED) Note: Read all installation instructions thoroughly.

1) Pour the diluted primer onto the substrate and roll on using 3/8" nap or foam roller. Do not puddle. Additional coats may be required upon visual inspection over extremely porous concrete.

2) Allow the material to dry to the touch. Lower substrate temperatures and/ or higher humid conditions could extend the drying time

b. Installing PreFix Kinetex Modules: After the PreFix primer has dried, begin the installation at the intersection of the central module anchor lines. Peel off the release film and save it to be recycled. Complete the installation one quarter area at a time laying the modules firmly and accurately along the anchor lines. Follow approved installation method(s) for each specific product.

C. Module Placement: Arrows are printed on the module backing to show pile/machine direction. A tight installation without compression is mandatory for optimum performance and appearance of the modular installation. It is critical that each module uniformly touch each adjoining module without a gap. To ensure a clean tight fit, do not pull/tug or slid-in modules, but instead lay each module into its location against the adjoining module. Use your hands to press/form the module into place where the new module meets the previously installed module. See specific product specifications for approved installation method(s).

Note: To reposition a Kinetex module during installation, remove it by gently lifting all four sides of the module with a spatula or putty knife, rotating around each side of the module doing a little at a time. The very center of the module should be the last part of the module touching the floor upon removal. Do not stretch a module while it is in the adhesive in order to align next to an adjoin modular. An attempt to stretch will likely result in the module pulling back to its original position. NEVER ATTEMPT TO REMOVE A MODULE ALL AT ONCE BY PULLING ONE OR ONLY TWO SIDES OF THE MODULAR. DOING SO MAY LEAD TO DISTORTING THE MODULE.

D. Pallet and Bundle Sequencing: It is very important to install Kinetex modules in the order they were manufactured; this is easily accomplished by selecting pallets in sequential order and following the numbers located on each bundle of modules. Typically, an installation will begin with the lowest bundle numbers and progress through the highest numbers until the project is complete. Installing modules by bundle sequence will assure the most even uniform look possible. (For layout and installation instructions refer to J+J Flooring Group's Kinetex Installation Instructions.)

E. Stairs: Use single or double undercut stair nosing and cut modules. Then, using full spread Kinetex Adhesive, install modules on steps and risers, inserting the stair nosing edge and the top of the riser edge of each module into the vinyl undercut.

F. Completing Installation: To avoid dislodging modules, do not walk on or move furniture onto modules until the area is completely anchored. Roll entire area with 75-100 lb. roller in both directions (north-south and east-west) after completion of installation. It is also required that sheets of plywood or hardboard be laid over the new modular surface when transporting heavy furniture on carts or dollies. As a final step, vacuum the entire area with an upright vacuum.

3.04 INSTALLATION OF ACCESSORIES

A. Install accessories as required by drawings and per manufacturer's specifications.

3.05 CLEANING AND PROTECTION

A. Use a moist cloth when wet; if dry, use a solvent based product applied to a towel then worked onto the Kinetex module for removal of contaminants such as adhesive, paint, oil and grease. Follow J+J Flooring Group's maintenance guidelines.

B. Clean and vacuum surfaces.

END OF SECTION

SECTION 09 84 33 – SOUND-ABSORBING WALL UNITS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Sound-absorbing wall units.
B. Sound-diffusing/absorbing wall units.

1.2 REFERENCES

A. ASTM International
   1. ASTM C423 Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
   2. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials.
   3. ASTM E795 Standard Practices for Mounting Test Specimens During Sound Absorption Tests.

1.3 SYSTEM DESCRIPTION

A. Sound-absorbing wall units as shown on the drawings.
B. Flame Spread / Smoke Developed Characteristics: Tested by independent, accredited NVLAP facility according to ASTM E 84 and NFPA 255.
   1. Composite Flame Spread Rating: 25 (maximum)
   2. Smoke Developed: 450 (maximum)

C. Acoustical Characteristics (ASTM C423): As described below.

1.4 SUBMITTALS

A. General: Submit listed submittals in accordance with Conditions of the Contract and Division 1 Submittal Procedures Section.
B. Product Data: Submit manufacturers' technical data including basic system description, options and component sizes. Identify all applicable features and options. Cross out any inapplicable features or options.
C. Shop Drawings: The contractor shall produce and submit shop drawings of products and suspension or mounting systems overlaid on base drawings (interior elevations or reflected ceiling plans) supplied electronically by the architect. Show overall layout with dimensions and references to details as necessary for penetrations, joints, ends and intersections with other materials or building components. Submit schedule of all quantities and finishes. Field-verify site conditions with dimensions shown on shop drawings.
D. Samples: Submit up to four (4) verification samples of finishes, colors and textures.

E. Test Reports: Certified test reports from independent testing agencies showing compliance with specified performance requirements.
F. Maintenance Data: Submit material datasheet indicating written cleaning and maintenance recommendations.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: The supplier shall have a minimum of 5 years of experience manufacturing the specified products.
B. Installing Contractor: The installer shall be experienced in the installation of systems similar in complexity to those required for this project. The installer shall meet all the following requirements, and provide validation at the request of the Architect:
   1. Adequate plant and equipment to complete the work.
   2. Complete knowledge and compliance with OSHA for all installation techniques.
   3. All installers shall be experienced employees of installing contractor.
   4. Adequate staff with the appropriate technical experience.
   5. Suitable financial status to meet the obligations of the work.

C. Dimensional Tolerances of Finished Units: Plus or minus 1/16 inch for the following:
   1. Thickness.
   2. Edge Straightness.
   3. Overall length and width.
   4. Squareness from corner to corner.
   5. Chords, radii, and diameter.

1.6 DELIVERY, STORAGE, AND HANDLING

A. General: Comply with Division 1 Product Requirements Section.
B. Delivery: Deliver materials in manufacturer’s original, unopened, undamaged containers with identification labels intact.
C. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions. Do not store panels on end. Protect edges from damage.
D. Handling: Acoustical wall panels are fragile and must be removed from packaging and handled with care.
E. Waste Management and Disposal: Dispose of all packaging materials and debris in a safe and environmentally responsible manner according to the instructions set forth by the General Contractor, local ordinances or codes and the Environmental Protection Agency.

1.7 PROJECT CONDITIONS

A. Environmental Requirements: Do not install units until wet work, such as concrete and plastering, is complete; the building is enclosed; and the temperature and relative humidity are stabilized.

1.8 WARRANTY

A. Submit to Owner or Owner's Representative a written and dated warranty issued by the unit manufacturer warranting the units against defects in materials or manufacturing for a minimum period of one (1) year from the date of substantial completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. All products listed in this section shall be furnished by one (1) manufacturer, selected from the list below. Products from alternative manufacturers will be considered as long as the proposed product meets the performance and salient characteristics (to include size, color, texture, pattern, shape, acoustical characteristics) indicated in this specification and inherent in the referenced products, as determined by the Architect and Acoustical Consultant.
   1. G&S Acoustics; or
   2. Kinetics Noise Control; or
   3. J.R. Clancy; or
   4. Wenger; or
   5. Approved equal.

2.2 SOUND-ABSORBING WALL UNITS

A. Convex Wall Diffuser Panels (WD=Type I, refer to drawings): Acoustically-configured, polycylindrical convex molded thermoplastic panel, 0.125 inch (3 mm) thick, width and length indicated, and with the following characteristics:

   1. Basis of Design Product: Wenger Type I Convex Wall Diffuser.

   2. Fabric Covering: Manufacturer's standard, color and pattern as selected.

   3. Wall Panel Mounting Method: Metal wall bracket with panel-mounted z-bracket.

   4. Sound Transmission Class (STC): ASTM E 90 and ASTM E 413: 23.

   5. Acoustical Performance, Sound Absorption Coefficients, One-third Octave Band Center Frequency, Hz, for 48 by 48 inches (1219 by 1219 mm) unit, Mounting Type A.

      a. 125Hz = 0.18.
      b. 250Hz = 0.18.
      c. 500Hz = 0.13.
      d. 1000Hz = 0.10.
      e. 2000Hz = 0.12.

f. 4000Hz = 0.16.

B. Convex Wall Diffuser/Absorber (WD=Type I) Panels (WT=Type II, refer to drawings): Acoustically-configured, selectively sound-absorptive polycylindrical convex molded thermoplastic panel, 0.125 inch (3 mm) thick, width and length indicated, with sound attenuation board adhered to internal surface of panel.

1. Basis of Design Product: Wenger Type II Convex Wall Diffuser Panels.

2. Fabric Covering: Manufacturer's standard, color and pattern as selected.

3. Wall Panel Mounting Method: Metal wall bracket with panel-mounted grooved button.

4. Sound Transmission Class (STC): ASTM E 90 and ASTM E 413: 23.

5. Acoustical Performance, Sound Absorption Coefficients, One-third Octave Band Center Frequency, Hz, for 48 by 48 inches (1219 by 1219 mm) unit, Mounting Type A.

a. 125Hz = 0.34.
b. 250Hz = 0.27.
c. 500Hz = 0.14.
d. 1000Hz = 0.11.
e. 2000Hz = 0.11.
f. 4000Hz = 0.19.

PART 3 - EXECUTION

2.3 MANUFACTURER'S INSTRUCTIONS

A. Compliance: Comply with manufacturer's product data, including product technical bulletins, product catalog installation instructions and product carton instructions for installation.

2.4 EXAMINATION

A. Site Verification of Conditions: Examine installation area for compliance with all manufacturers' project environmental requirements and ensure uninstalled products have been stored, handled and acclimatized properly prior to commencing installation. Inspect all substrates for completion and quality of work to ensure that surfaces are level, plumb, clean, dry and completely cured from water or solvent evaporation, and is acceptable for product installation in accordance with manufacturer's instructions. Do not commence installation if the structural capacity of the substrate is questionable or inadequate.

B. Do not install wall units until unsatisfactory conditions are corrected.

2.5 PREPARATION

A. Coordinate all installation work with other trades. Coordinate with all other trades to verify that components associated with mechanical, electrical, lighting, data, telecommunication, audio, video, fire suppression and other building systems are installed behind or above designated installation areas prior to commencing installation. Coordinate the exact size, location and sequencing of building system components that penetrate the ceiling/wall panels.
B. Protection: Protect all floor, wall and ceiling finishes against possible damage prior to commencing installation and during installation.
C. Surface Preparation: When necessary, field measure substrates to acquire accurate dimensions of panels and submit final dimensions to manufacturer.

2.6 INSTALLATION

A. Install wall panels in locations as indicated on the drawings and according to manufacturer's guidelines and industry standards.
B. Use attachment method as submitted an approved in the shop drawings.

2.7 CONSTRUCTION

A. Interface with Other Work: Support all light fixtures, HVAC air inlet/outlet devices, speakers, signage, sprinkler heads/piping, etc. independently from panels. Contractor shall not use panels to support the weight of any other building element or component.

2.8 ADJUSTING

A. Adjust panels so that surfaces are aligned, flush and level or plumb and gaps in between units are of a consistent width and straight.
B. Remove and replace at no extra charge any damaged panels that cannot be repaired to the Owner's and Architect's satisfaction.

2.9 CLEANING

A. Keep site free from accumulation of waste and debris.
B. Clean exposed surfaces of wall units in accordance with manufacturer's recommendations after installation is complete.
C. Replace any and all wall units that have stains, tears, abrasions, or other defects.

2.10 PROTECTION

A. Upon completion of work, protect installed surfaces from damage or soiling until project substantial completion and owner occupancy.

END OF SECTION

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SECTION 09 91 00 - PAINTING

PART 1 - GENERAL

1.01 SCOPE:

A. Provide painting and finishing of interior and exterior items and new and existing surfaces throughout the project, except as otherwise indicated. Provide field painting of hangers, exposed steel and iron work, of primed metal surfaces and exposed-to-view pre-finished metal surfaces of items, as required to match adjacent surfaces, and equipment installed under mechanical and electrical work. This includes, but is not limited to, all exposed conduit, fire sprinkler piping, gas piping, hangers, ductwork, supports, etc. If it can be seen, paint it. Refer to those respective sections for painting requirements. Provide touch-up of pre-finished items as required to match original finish.

B. Do not paint new brick, water repellent coating, acoustical ceilings, laminated plastic and pre-finished items except as noted above.

1.02 RELATED WORK IN OTHER SECTIONS:

A. Section 09 29 00 – Gypsum Board

1.03 SUBMITTALS: Comply with Section 01 33 00.

A. Paint Schedule: Submit paint schedule listing each material cross-referenced to the specific paint and finish system and application. Identify by manufacturer's catalog number and general classification.

B. Samples: Submit samples of finishes type and color on specified materials for verification.

1.03 QUALITY ASSURANCE:

A. Regulatory Requirements: Comply with applicable codes and regulations of governmental agencies having jurisdiction including those having jurisdiction over airborne emissions and industrial waste disposal. Where those requirements conflict with this specification, comply with the more stringent provisions.

1. Regulatory changes may affect the formulation, availability, or use of specified coatings. Confirm availability of coatings to be used prior to job going out to bid, and before start of painting job.

B. Field Sample: When and as directed by the Architect, apply one complete coating system for each color and gloss, and texture required. When approved, the sample

panel areas will be deemed incorporated into the work and will serve as the standard by which the subsequent work of this section will be judged.

1.04 DELIVERY AND STORAGE: Deliver materials to the job site in original, new and unopened packages and containers bearing manufacturer's name and label.

PART 2 – PRODUCTS

2.01 MANUFACTURERS: Provide paints, enamels, stains, varnishes, and admixtures of first line quality as manufactured by Sherwin-Williams, Farrell-Calhoun, Pratt & Lambert, Glidden, Benjamin Moore, Sterling/Iowa and Pittsburgh.

2.02 MATERIALS: See paragraph 3.05, SCHEDULE OF PAINT TREATMENT for materials. All finish coats shall contain mildewcides. Grind in the factory all exterior colors and interior deep tone colors. Shop mixing is not permitted. Colors as selected by Architect, and subject to modification on the job at the Architect's discretion.

PART 3 - EXECUTION

3.01 EXAMINATION: Examine the areas and conditions under which painting work is to be performed. Do not proceed with the work until unsatisfactory conditions have been corrected. Starting of painting work will be construed as acceptance of the surfaces within any particular areas.

3.02 SPACE PREPARATION: Perform all preparation and cleaning procedures in strict accordance with the paint manufacturer's instructions and as herein specified. Remove all hardware, plates, lighting fixtures, and similar items in place and not to be finish painted, or provide protection prior to surface preparation and painting operations. Remove, if necessary, for the complete painting of the items and adjacent surfaces. Reinstall the removed items by workmen skilled in the trades involved, after painting is completed.

A. Cementitious Materials: Prepare cementitious surfaces to be painted by removing all chalk, dust, dirt, grease, oils, and by roughening as required to remove glaze. Determine the alkalinity and moisture content of the surfaces to be painted by performing appropriate tests. If the surfaces are found to be sufficiently causing blistering and burning of the finish paint, correct this condition before application of paint.

B. Wood: Clean wood surfaces to be painted of all dirt, oil, or other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sandpaper smooth those surfaces exposed to view and dust off. Prime, stain, or seal wood require to be job painted immediately upon delivery to job. Prime edges, ends, faces, undersides, and backsides of such wood, including cabinets, counters, cases, etc. Scrape and clean small, dry seasoned knots, and apply a thin coat of white shellac or other

recommended knot sealer, before application of the priming coat. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sandpaper smooth when dried.

C. Gypsum Wallboard: Treat all joints, nail heads and other depressions in the surface of the wallboard, in accordance with the recommended manner, with a taped joint system by the gypsum wallboard manufacturer. Do not paint over gypsum wallboard work until taped joints are thoroughly dry. Tape all joints to deck.

D. Ferrous Metals: Touch-up shop-applied prime coats which have damaged or bare areas. Wire-brush, solvent clean, and touch up with the same primer as the shop coat.

E. Galvanized Surfaces: Clean free of oil and surface contaminates with an acceptable non-petroleum-based solvent.

F. Existing Surfaces (including plaster, brick, block): If in sound condition and of uniform porosity, no primer is required (unless required for proper bonding of specified paint type). Remove rust, dirt, grease, and loose and peeling paint from surface and spot prime with appropriate primer. Remove surface contamination by washing with powdered commercial cleaner. Rinse thoroughly and allow to dry. Dull glossy surfaces with fine sandpaper or steel wool. Spot prime with appropriate primer. Paint as specified.

3.03 APPLICATION:

A. Apply paint by brush, roller, spray, or other acceptable practice in accordance with the manufacturer's directions. Use brushes best suited for the type of material being applied. Use rollers of carpet, velvet back, or high pile sheep’s wool as recommended by the manufacturer for material and texture required.

B. The number of coats and paint film thickness required is the same regardless of the application method. Do not apply succeeding coats until the previous coat has completely dried. Sand between each enamel or varnish coat application with fine sandpaper, or rub surfaces with pumice stone where required to produce an even smooth surface in accordance with the coating manufacturer's directions.

C. Apply additional coats when undercoats, stains, or other conditions show through the final coat of paint, until the paint film is of uniform finish, color and appearance.

D. Give special attention to ensure that all surfaces, including edges, corners, crevices, welds, and exposed fasteners receive a film thickness equivalent of that of flat surfaces.

3.04 CLEAN-UP: Thoroughly clean all spots, smears, spills, etc. Remove from the site all discarded paint materials, rubbish cans and rags at the end of each workday.

3.05 SCHEDULE OF PAINT TREATMENTS (where applicable): Refer to drawings for locations

Treatment No.	Surface & Location	Coats	Product
1	Exterior & Interior Ferrous Metal	3	Shop-priming is specified under the respective metal section. 1st Coat: Rust primer 2nd & 3rd Coats: Exterior alkyd industrial-gloss paint
2	Exterior & Interior Galvanized Metal	3	Shop-priming is specified under the respective metal section. Pre-Treatment: Solvent wash 1st Coat: Galvanized iron primer 2nd & 3rd Coats: Exterior alkyd industrial-gloss paint
3	Other Metal (factory-finished, primed, or pre-finished), including roof-mounted units	2	Clean and prime abraded spots as specified in metal sections and finish in two coats as specified for adjoining surfaces
4	Exterior Plywood Construction Sign	2	1st Coat: 100% Acrylic emulsion primer 2nd Coat: Semi-gloss 100% acrylic latex
5	Interior Wood & Plywood	3	1st Coat: Oil-penetrating stain 2nd & 3rd Coats: Semi-gloss polyurethane varnish
			Note: On open-grain wood such as oak, use paste wood filler prior to staining
6	Interior Gypsum Board	2	1st Coat: Latex wall primer 2nd & 3rd Coats: Semi-gloss 100% acrylic latex enamel, except flat paint where indicated
7	Interior Concrete	3	1st Coat: Acrylic primer 2nd & 3rd Coats: Semi-gloss 100% acrylic latex enamel
8	Existing Surfaces	2	1st & 2nd Coats: Semi-gloss 100% acrylic latex enamel

9	Interior CMU walls indicated to receive epoxy coating	3	1st Coat: 100% Acrylic block filler 2nd & 3rd Coats: Water-based acrylic epoxy, full-gloss
10	Interior Gypsum Board indicated to receive epoxy coating	3	1st Coat: Latex wall primer 2nd & 3rd Coats: Water-based acrylic epoxy, full-gloss
11	Interior CMU	3	1st Coat: Block filler 2nd & 3rd Coats: Semi-gloss acrylic latex enamel
12	Acoustical Wall Board	3	1st Coat: Primer by manufacturer 2nd & 3rd Coats: Waterborne Acrylic Dry Fall (B4241)
13	Aluminum (mill-finished)		Treat with vinyl wash coat and then user primer and finish coats as specified for adjoining surfaces
14	Interior Plywood & Wood (painted)	3	1st Coat: Wall or wood primer 2nd & 3rd Coats: Semi-gloss alkyd enamel
15	Plywood Floor (painted)	2	1st & 2nd Coats: Industrial enamel
16	Exterior Cedar Board & Batten	1	"Wood Scape" premium exterior stain, consult Architect for desired finish
17	Interior Cedar Board & Batten	1	"Wood Classic" interior stain, consult Architect for desired finish
18	Accent Colors	2	Allow for 10% of surfaces to be painted in deep-tone colors as directed by Architect
19	Epoxy Concrete Floor	2	Surface Prep: Grind floor to achieve profile; consult manufacturer. 1st & 2nd Coats: Macro Poxy 646 Fast Cure Epoxy B58W610 with H&C Shark Grip

20	Epoxy Concrete Floor	2	1st Coat: Sherwin-Williams ArmorSeal 8100 Water-based Epoxy Floor Coating; B70-8100 Series (reduced 1 pint of water per gallon) 2nd & 3rd Coats: Sherwin-Williams ArmorSeal 8100 Water-based Epoxy Floor Coating
21 SATIN	Cementitious Siding, Common Brick, Stucco, Tilt-up, Precast & Poured-in-Place Concrete	3	1st Coat: SW Loxon Concrete & Masonry Primer Sealer, LX02W50 (5.3-8.0 mils wet, 2.1-3.2 dry) 2nd Coat: SW A-100 Exterior Latex Satin, A82 Series 3rd Coat: SW A-100 Exterior Latex Satin, A82 Series (4.0 mils wet, 1.5 mils dry per coat)
22 FLAT	Cementitious Siding, Common Brick, Stucco, Tilt-up, Precast & Poured-in-Place Concrete	3	1st Coat: SW Loxon Concrete & Masonry Primer Sealer, LX02W50 (5.3-8.0 mils wet, 2.1-3.2 dry) 2nd Coat: SW A-100 Exterior Latex Flat, A6 Series 3rd Coat: SW A-100 Exterior Latex Flat, A6 Series (4.0 mils wet, 1.5 mils dry per coat)

END OF SECTION

SECTION 10 14 00 – SIGNAGE

PART 1 – GENERAL

1.01 SCOPE: Signage, complete.

1.02 SUBMITTALS

A. Manufacturers must submit three references showing products for projects completed within the last six years.

B. Submit manufacturer's technical data and installation for each type of sign.

C. Submit shop drawings listing sign size, letterform and letter heights.

D. Submit one full-size sample sign of type, style and color specified, including method of attachment. If approved, the sample will become part of the job.

1.03 SIGN TYPE DESCRIPTION

A. Signage shall consist of room number and room function to meet the requirements of Americans with Disabilities Act 2010 (ADA) and ANSI A117.1-2003.

PART 2 – PRODUCTS

2.01 MANUFACTURER

A. Provide products from Mohawk Sign Systems, Inc., Best Manufacturing Co., Signature Signs, Inc.; or approved equal.

2.02 GRAPHIC PROCESS

A. Signage by allowance as stated in Section 01 21 00. Sign schedule will be established with Owner prior to manufacturing.

B. All signs shall be manufactured using Graphic Process Series 200A-Sand carved using Format D.

1. Tactile characters shall be raised the required 1/32" from sign face. Glue-on letters or etched backgrounds are not acceptable.

2. All text shall be accompanied by Grade 2 Braille. Braille shall be separated 2" from the corresponding raised characters. Grade 2 Braille translation to be provided by signage manufacturer.

3. Perimeter borders shall be 3/8".

4. All letters, numbers and/or symbols shall contrast with their background, either light characters on a dark background or dark characters on a light background. Characters and background shall have a non-glare finish.

C. Plaque material shall be melamine plastic laminate, approximately 1/8" thick with contrasting core color. The melamine shall be non-static, fire retardant and self-extinguishing. The plastic laminate will be impervious to most acids, alkalis, alcohol, solvents, abrasives and boiling water.

D. Letterform shall be Gill Sans upper case or other San Serif or Simple Serif letterforms.

E. Size of letters and numbers shall be as follows:

1. Room numbers shall be 1"

2. Lettering for room I.D. signs shall be 3/4"

3. Symbol size shall be 4"

4. Standard Grade 2 Braille shall be 2" below copy

5. Copy Position: CC (centered/centered) or as indicated on drawings

2.03 SIGN SIZE

A. Room Function Signs: 4" HIGH X 8" WIDE.

B. Restroom signs shall be design ADA-4 size 8"x8" with a 4" accessibility symbol, gender symbol and the verbal description placed directly below followed by Grade 2 Braille.

C. Corners: 2" radius

D. Allow three (3) room numbers and fifteen (15) characters per room.

2.04 EXTERIOR WALL SIGNS: At exterior front doors.

A. Design: M203-9 Black duranodic aluminum frame sign, size 9" x 9".

B. Insert material, ES Plastic, color as selected by Architect.

C. Insert shall contain a 4” accessibility symbol with the verbal description, “Entrance” using 1” Gill Sans upper case letters directly below followed by Grade 2 Braille.

2.05 PANEL SIGNS:

A. General: Provide panel signs that comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes, and details of construction.

B. Manufacturers:

1. Best Manufacturing Co.;

2. Mohawk Sign Systems;

3. Signature Signs, Inc.; or approved equal.

C. Aluminum Sheet and Plate: ASTM B 209 (ASTM B 209M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of 5005-H15.

D. Unframed Panel Signs: Fabricate signs with edges mechanically and smoothly finished to comply with the following requirements:

1. Edge Condition:

2. Corner Condition: Rounded to radius indicated.

E. Brackets: Fabricate brackets and fittings for bracket-mounted signs from extruded aluminum to suit panel sign construction and mounting conditions indicated. Factory-paint brackets in color matching background color of panel sign.

F. Graphic Content and Style: Provide sign copy that complies with requirements indicated on drawings for size, style, spacing, content, mounting height and location, material, finishes, and colors of signage.

PART 3 – EXECUTION

3.01 INSTALLATION

A. General: Locate signs and accessories where indicated, using mounting methods of types described and in compliance with manufacturer’s written instructions.

1. Install signs level, plumb, and at heights indicated, with sign surfaces free from distortion and other defects in appearance.

B. Mounting of Interior Wall Signs: Signs shall be mounted using vinyl tape. The signs shall be mounted 60" from the floor to the center of the sign on the latch side. The distance between the doorframe and sign on the latch side should be 2". Installer/User assumes responsibility for suitable installation of the signs.

C. Wall-Mounted Panel Signs: Attach panel signs to wall surfaces using methods indicated below:

1. Shim Plate Mounting: Provide 1/8" thick, concealed aluminum shim plates with pre-drilled and countersunk holes, at locations indicated, and where other mounting methods are not practicable. Attach plate with fasteners and anchors suitable for secure attachment to substrate. Attach panel signs to plate using method specified above.

2. Mechanical Fasteners: Use non-removable mechanical fasteners placed through pre-drilled holes. Attach signs with fasteners and anchors suitable for secure attachment to substrate as recommended in writing by sign manufacturer.

3. Where panel signs are scheduled or indicated to be mounted on glass, provide matching plate on opposite side of glass to conceal mounting materials.

D. Bracket-Mounted Units: Provide manufacturer's standard brackets, fittings, and hardware as appropriate for mounting signs that project at right angles from walls and ceilings. Attach brackets and fittings securely to walls and ceilings with concealed fasteners and anchoring devices to comply with manufacturer's written instructions.

E. Dimensional Characters: Mount characters using standard fastening methods recommended in writing by manufacturer for character form, type of mounting, wall construction, and condition of exposure indicated. Provide heavy paper template to establish character spacing and to locate holes for fasteners.

1. Flush Mounting: Mount characters with backs in contact with wall surface.

2. Projected Mounting: Mount characters at projection distance from wall surface indicated.

END OF SECTION

SECTION 10 14 19.23 – ALUMINUM DIMENSIONAL CHARACTERS

1 PART 1 – GENERAL

1.1 SUMMARY

A. Provisions established within the General and Supplementary Conditions of the Contract, Division 1 - General Requirements, and the Drawings are collectively applicable to this Section.

B. Provide and install cast dimensional letters including hardware, etc., complete.

C. This scope is to be included in the base bid and IS NOT part of the interior signage allowance stated in Section 01 21 00 and specified in Section 10 14 00.

1.2 QUALITY ASSURANCE

A. Obtain all products in this section from a single supplier.

B. Installation shall be performed by installer specialized and experienced in work similar to that required for this project.

1.3 SUBMITTALS

A. Submit in accordance with requirements of Division 1.

B. Product Data: Submit product data for specified products. Include material details for each sign specified.

C. Shop Drawings: Submit shop drawings showing layout, profiles, and product components, including dimensions, anchorage, and accessories.

D. Samples: Submit standard color chart for selection purposes and selected colors for verification purposes.

E. Installation: Submit supplier’s installation instructions.

F. Closeout Submittals:

1. Submit operation and maintenance data for installed products, including precautions against harmful cleaning materials and methods.
2. Submit warranty documents specified herein.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of Division 1.

1. Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.
2. Deliver products in manufacturer's original, unopened, undamaged containers with identification labels intact.
3. Store products protected from weather, temperature, and other harmful conditions as recommended by supplier.
4. Handle products in accordance with manufacturer's instructions.

1.5 WARRANTY

A. Project Warranty: Comply with requirements of Division 1.

B. Manufacturer's Warranty: Submit manufacturer's standard warranty document executed by authorized company official.

1. Warranty Period: Lifetime Warranty on finish of letters.

2 PART 2 – PRODUCTS

2.1 SIGNAGE SYSTEMS

A. Acceptable Manufacturers:
   1. DFI Architectural Signs, 219 West 7th Street, North Little Rock, AR 72114 501-372-8881 (P), 501-372-8882 (F)
   2. Substitutions: Submit in accordance with Section 01 33 00.

B. Acceptable Product: Cast Aluminum

C. Material:
   1. Cast Aluminum Letters, Helvetica Font, refer to drawings for letter heights
   2. Finish is brushed aluminum with clear coat.
   3. See drawings for letters.

D. Mounting Method: Projected Mount with 1” spacers.

2.2 FABRICATION - GENERAL

A. Comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes, and details of construction.

B. Design, fabricate, and install sign assemblies to prevent buckling, opening up of joints, and over-stressing of welds and fasteners.

C. Mill joints to a tight, hairline fit. Form joints exposed to the weather to exclude water penetration.

D. Conceal fasteners if possible; otherwise, locate fasteners where they will be inconspicuous.

E. Create signage to required sizes and layout. Comply with requirements indicated for design, dimensions, finish, color, and details of construction.

3 PART 3 – EXECUTION

3.1 EXAMINATION

A. Verify installation conditions previously established under other sections are acceptable for product installation in accordance with manufacturer's instructions.

B. Scheduling of installation by Owner or its representative implies that substrate and conditions are prepared and ready for product installation. Proceeding with installation implies installer’s acceptance of substrate and conditions.

3.2 INSTALLATION

A. Install product in accordance with supplier’s instructions.

B. Install product in locations indicated using mounting methods recommended by sign manufacturer and free from distortion, warp, or defect adversely affecting appearance.

C. Install product level, plumb, and at heights indicated.

D. Install product at heights to conform to Americans with Disabilities Act Accessibility Guidelines (ADAAG) and applicable local amendments and regulations.

E. Install signs within the following tolerances and in accordance with manufacturer's recommendations:
   1. Interior Signs: Within 1/4 inch vertically and horizontally of intended location.
   2. Exterior Signs: Within 1 inch vertically and horizontally of intended location.

3.3 CLEANING, PROTECTION, AND REPAIR

A. Repair scratches and other damage which might have occurred during installation. Replace components where repairs were made but are still visible to the unaided eye from a distance of 10 feet.

B. Remove temporary coverings and protection to adjacent work areas. Clean installed products in accordance with manufacturer's instructions prior to Owner's acceptance. Remove construction debris from project in accordance with provisions in Division 1.SIGN SCHEDULE

C. Schedule: Refer to signage schedule and Drawings for sizes, locations, and layout of signage types, sign text copy, and graphics.

END OF SECTION

BLANK

SECTION 10 21 13.19 – PLASTIC TOILET COMPARTMENTS

PART 1 – GENERAL

1.01 SUMMARY: Solid plastic toilet compartments and urinal screens, complete.

1.02 RELATED WORK SPECIFIED IN OTHER SECTIONS:

A. Toilet Accessories; Section 10 28 13.

1.03 SUBMITTALS: Comply with Section 01 33 00.

A. Product Data: Submit manufacturer's detailed technical data for materials, fabrication and installation.

B. Shop Drawings: Submit shop drawings for the fabrication and erection of toilet partition assemblies and urinal screens not fully described by manufacturer's data. Show anchorages, gages of steel, hardware fittings and fastenings. Submit setting drawings, templates and instructions for the installation of anchorage devices built into other work.

C. Samples: Submit full color range of plastic samples for selection by Architect. Submit sample of metal finish for Architect's verification.

1.04 QUALITY ASSURANCE:

A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication, where possible, to ensure proper fitting of work. However, allow for adjustments where taking of field measurements before fabrication might delay work.

B. Coordination: Furnish inserts and anchorages which must be built into other work for installation of toilet compartments. Coordinate delivery with other work to avoid delay.

PART 2 – PRODUCTS

2.01 MANUFACTURERS: Scranton Industries, Global, General Partitions, or approved equal.

2.02 COMPARTMENTS AND SCREENS:

A. Type: Solid plastic, polymer resin.

B. Compartment Style: Overhead braced and floor anchored.

C. Screen Style: Wall hung.

2.03 MATERIALS:

A. Solid Plastic: High density, solid polymer resin (HDPE) with homogenous color throughout. Provide material not less than 1" thick with seamless construction with edges eased.

B. Pilaster Shoes and Sleeves (Caps): ASTM A-666, Type 302 stainless steel, not less than 0.0312" thick and 3" high; manufacturer's standard #4 directional finish.

C. Stirrup Brackets: Manufacturer's standard ear or U-brackets for attaching panels to walls and pilasters; stainless steel.

D. Full Height (Continuous) Brackets: Stainless steel

E. Hardware and Accessories: Manufacturer's standard design; chrome plated brass or #4 stainless steel.

F. Heat-sink Strip: Manufacturer's standard continuous, extruded aluminum strip in manufacturer's standard finish.

G. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, chrome-plated steel, or brass, finished to match hardware, with theft-resistant-type heads and nuts. For concealed anchors, use hot-dip galvanized, cadmium-plated, or other rust-resistant protective-coated steel.

2.04 FABRICATION:

A. Provide standard panels and pilasters fabricated for compartment system. Provide units with cutouts and drilled holes to receive partition-mounted hardware, grab bars, and accessories.

B. Provide aluminum heat-sink strips at exposed edges of HDPE units to prevent burning.

C. Overhead Braced and Floor Anchored Compartments: Provide manufacturer's standard corrosion supports, leveling mechanism, fasteners and anchors at pilasters to suit floor conditions. Make provisions for setting and securing continuous head rail at top of each pilaster. Provide shoes at pilasters to conceal supports and leveling mechanism.

D. Wall-hung Screens: Provide units in sizes of same construction and finish as compartment panels.

E. Doors:

1. Unless otherwise indicated, provide 24” wide in-swinging doors for standard toilet compartment and 36” wide out-swinging doors with minimum 32” wide clear opening for compartments indicated to be handicapped accessible. Verify size and opening with Architect.

2. Hardware: Furnish hardware for each compartment to comply with ANSI A117.1 for handicapped accessibility and as follows:

a. Hinges: Manufacturer’s standard self-closing type that can be adjusted to hold door open at any angle up to 90°.

b. Latch and Keeper: Manufacturer’s standard surface-mounted or recessed latch unit with combination rubber-faced door strike and keeper designed for emergency access. Provide units that comply with accessibility requirements of authorities having jurisdiction at compartments indicated to be handicapped accessible.

c. Door Pull: Manufacturer’s standard unit that complies with accessibility requirements of authorities having jurisdiction at out-swinging doors. Provide units on both sides of doors at compartment indicated to be handicapped accessible.

d. Coat Hook: Provide coat hook/bumper on back of all doors.

2.05 FINISH: Manufacturer’s standard colors, as selected by Architect.

PART 3 – EXECUTION

3.01 INSTALLATION: Comply with manufacturer’s instructions and final shop drawings.

A. Install partitions rigid, straight, plumb and level.

B. Provide uniform clearance of not more than ½” between pilasters and walls, and not more than 1” between panels and walls.

C. Secure pilasters to floor and level, plumb and tighten. Secure continuous head rail to each pilaster with not less than 2 fasteners. Hang doors and adjust so tops of doors are parallel with overhead brace when doors are in closed position.

D. Attach screens with anchoring devices according to manufacturer’s written instructions and to suit supporting structure. Set units level and plumb and to resist lateral impact.

3.02 ADJUST AND CLEAN:

A. Adjust and lubricate hardware for proper operation. Set hinges on in-swinging doors to hold open approximately 30° from closed position when unlatched. Set hinges on out-swinging doors to return to fully closed position.

B. Clean exposed surfaces of partition systems using materials and methods recommended by manufacturer and provide protection as necessary to prevent damage during remainder of construction period.

END OF SECTION

SECTION 10 28 13 – TOILET ACCESSORIES

PART 1 - GENERAL

1.01 SCOPE: Provide accessories, complete, for toilet rooms and mop closet.

1.02 RELATED WORK SPECIFIED IN OTHER SECTIONS:

A. Unframed mirrors; Section 08 80 00 - Glass and Glazing.

1.03 SUBMITTALS:

A. Product Data: Submit technical data and installation instructions for each toilet accessory.

B. Shop Drawings: Submit shop drawings showing grab bar installation. Provide setting drawings, instructions and directions for installation of anchorage devices in other work.

1.04 JOB CONDITIONS: Coordinate accessory locations with other work to avoid interference and to assure proper operation and servicing of accessory units.

PART 2 - PRODUCTS

2.01 MANUFACTURERS: Bobrick, Bradley, or ASI or equal.

2.02 MATERIALS:

A. Stainless Steel: ASI type 302/304, No. 4 finish, 22-gage minimum.

B. Fasteners: Screws, bolts, and other devices of same material as accessory unit, or of galvanized steel where concealed.

2.03 ACCESSORIES: Letter in parentheses indicates accessory key as scheduled on drawings.

A. Paper Towel Dispenser Surface-mounted (A): Bobrick B-262, Bradley 250-15, or ASI 0210.

A.1 Paper Towel Dispenser and Receptacle Combination Semi-recessed (A.1): Bobrick B-3949, Bradley 234-10, or ASI 0469-BLSM.

B. Soap Dispenser, Wall-mounted (B): Bobrick B-112, Bradley 6542 or ASI 0341.

B.1 NOT USED

C. Toilet Paper Dispenser, Surface-mounted, Dual Rolls (C): Bobrick B-2741, Bradley 5241, or ASI 0264-1A, without controlled delivery.

C.1 NOT USED

D. Grab Bars (D): B-6206399 Series, Bradley 812-2 Series, or ASI 3200-P; straight bar, 36" long. Strongly secure fastenings to steel backing plate or by other accepted methods to withstand contemplated stress. Submit shop drawings of Anchoring methods.

E. Grab Bars (E): B-6206399 Series, Bradley 812-2 Series, or ASI 3200-P; straight bar, 42" long. Strongly secure fastenings to steel backing plate or by other accepted methods to withstand contemplated stress. Submit shop drawings of Anchoring methods.

F. Grab Bar (F): B-6206399 Series, or ASI 3200-P; vertical straight bar, 18" long. Strongly secure fastenings to steel backing plate or by other accepted methods to withstand contemplated stress. Submit shop drawings of Anchoring methods.

G. Sanitary Napkin Receptacle, Surface-mounted (G): Bobrick B-270, Bradley 4781-15, or ASI 0852.

H. Framed Mirror 24” X 36” (H): Bobrick B-165, Bradley 781, or ASI 0620.

J. Mirror (J): Refer to Section 08 80 00 Glazing

K. NOT USED

L. NOT USED

L.1 NOT USED

L.2 NOT USED

M. Mop & Broom Holder (M): Bobrick B-223 x 24, Bradley 9953, or ASI 0796-A.

N. NOT USED

N.1 NOT USED

P. NOT USED

Q. NOT USED

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Install toilet accessory units in accordance with manufacturer's instructions, using fasteners which are appropriate to substrate and recommended by manufacturer of unit.

B. At grab bars strongly secure fastenings to steel backing plate or by other accepted methods. Submit shop drawings of anchoring methods.

C. Install units plumb and level, firmly anchored in location and at heights indicated or directed by Owner's representative.

END OF SECTION

BLANK

SECTION 10 90 00 - MISCELLANEOUS SPECIALTIES

PART 1 - GENERAL

1.01 SCOPE: Furnish miscellaneous specialties, complete.

1.02 RELATED WORK SPECIFIED IN OTHER SECTIONS: Finish Painting; Section 09 91 00.

1.03 SUBMITTALS: Comply with Section 01 33 00. Submit installation instructions for each specialty item.

A. Product Data: Submit manufacturer's technical data and installation instructions for accessory item specified.

B. Shop Drawings: Submit shop drawings indicating location, details of installation, finishes, and other pertinent data.

C. Samples: Submit samples of full color line for Architect's selection for materials, fabrics, and other items specified.

PART 2 - PRODUCTS

2.01 FIRE EXTINGUISHER AND CABINET: Larsen's Manufacturing Company is specified. Equivalent product of J. L. Industries is acceptable. Location as indicated on Drawing.

A. Cabinet: Model 2409-R2 steel cabinet for recessed installation or 2409-R4-R7 for semi-recessed installation; with clear acrylic glazed door. Provide in manufacturer's standard white color de-glossed for field painting. Provide flat trim in same finish as cabinet. Supplier to verify depth of wall for recessed or semi-recessed installation and depth of semi-recessed cabinet prior to order of cabinet.

B. Extinguisher: MP10 4A-60B:C multi-purpose, 10 lb. heavy-duty steel extinguisher.

2.02 CAST BRONZE PLAQUE: 18” x 24”, letter style and background color as selected by Architect. Copy – 1/4” letter size, allow for maximum number of letters.

2.03 MARKER BOARD & TACK BOARD: Claridge is specified. Equivalent products of Greensteel, Newline Products, Inc. and Carolina are acceptable; or approved equal.

A. Type: Series 5, factory-built unit

B. Boards: Type A, 8’ marker board, 4’ tack board, as indicated on plans.

1. Marker Board: LCS porcelain enamel, 24-guage face sheet on 1/2" hardboard; white

2. Tack Board: 1/2" thick core consisting of 1/4" fabric-faced cork on 1/4" hardboard; standard fabric color as selected by Architect.

C. Perimeter Trim & Chalk Trough: 5/8” aluminum trim and standard chalk trough with clear anodized finish.

D. Fasteners: Furnish with fasteners for secure mounting

E. Music Staff Lines: Provide 4 sets of staff lines at marker boards.

2.04 KNOX BOX: Provide knox box, model and manufacturer as required by local fire authority.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Install each accessory in compliance with manufacturer's instruction and final shop drawings.

B. Install at locations and mounting heights indicated or as directed by Architect.

END OF SECTION

SECTION 11 60 01 – SOUND CONTROL DOOR ASSEMBLIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Sound-control doors including the following:
   1. Integrated sound control door assemblies.

1.2 RELATED SECTIONS

A. Section 08 12 13.13 - Metal Doors and Frames.

1.3 REFERENCES

A. American National Standards Institute (ANSI):
   1. ANSI 115.1: Specifications for Steel Door and Frame Preparation for Hardware.
   2. ANSI A250.10: Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.

B. ASTM International (ASTM):
   1. ASTM A1008/A 1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
   2. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
   3. ASTM E 413 - Classification for Rating Sound Transmission.

C. Code of Federal Regulations (CFR):
   1. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials.

D. International Organization for Standardization (ISO): ISO 9001 Quality management systems - Requirements.

E. National Fire Protection Association (NFPA): NFPA 80 - Standard For Fire Doors and Other Opening Protectives.

F. Underwriter's Laboratory (UL):
   1. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies.

1.4 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Provide test results by certified independent testing laboratory indicating compliance with performance requirements.

C. Shop Drawings:
   1. Include fabrication and installation details. Distinguish between factory and field work.

D. Closeout Submittals:
   1. Operation and Maintenance Data: For adjusting, repairing and replacing components and accessories.
   2. Warranty: Submit manufacturer's warranty.
   3. As-Built Drawings: For completed work.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Minimum 5 years' experience in design and manufacturing of similar products on projects of similar size, scope and complexity, and with the production capacity to meet the construction and installation schedule.

B. Installer Qualifications: ESTA-certified and experienced in installation of the work of this section and acceptable to the manufacturer and in the regular employ of the manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original unopened containers with manufacturer's labels attached. Do not deliver material until spaces to receive them are clean, dry, and ready for their installation. Ship to jobsite only after roughing-in, painting and other finishing work has been completed, installation areas are ready to accept work.

B. Handle and install materials to avoid damage.

1.7 WARRANTY

A. Special Warranty for Sound Control Doors: Manufacturer's written warranty indicating manufacturer's intent to repair or replace components of sound-control door assemblies that fail in materials or workmanship within 5 years from date of Substantial Completion. Failures are defined to include, but are not limited to, the following:
   1. Fracturing or breaking of unit components including doors and hardware resulting from normal use other than vandalism.
   2. Warping or deterioration of components not resulting from leaks, flooding, or other uncontrolled moisture or humidity.
   3. Failure of acoustical gaskets and seals.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Wenger Corporation, including all Wenger, J.R. Clancy and GearBoss product brands; or approved equal. Wenger Corporation, which is located at: 555 Park Dr.; Owatonna, MN 55060; Toll Free Tel: 800-4WENGER (493-6437);

Tel: (507) 455-4100; Fax: (507) 455-4258; Email: request info (info@wengercorp.com); Wenger Corporation - Syracuse, which is located at 7041 Interstate Island Road, Syracuse, NY 13209; Toll Free Tel: 800-836-1885; Tel: (315) 451-3440; Email: request info (info@wengercorp.com); Web: https://www.wengercorp.com

B. Requests for substitutions shall be considered in accordance with provisions of Section 01 33 00.
   1. Manufacturers seeking approval shall submit the following:
      a. Product data, including third-party certified acoustical data and proposed graphic/drawing layout for this project.
      b. Project references: Minimum of 5 installations not less than 3 years old, of comparable size, scope and complexity of this project, complete with owner contact information.
      c. Sample warranty.
   2. Submit substitution request not less than required days prior to bid date.
   3. Approval shall be indicated by issuance of written Addendum.
   4. Approved manufacturers shall meet separate requirements of Submittals Article.
   5. Manufacturers' products that are either listed as pre-approved in these Specifications or who have been granted approval as an alternate must still demonstrate all of the material performance and operational characteristics required by this Section.

2.2 INTEGRATED SOUND CONTROL DOOR ASSEMBLIES

A. Basis of Design: Sound Control Door Assemblies as manufactured by Wenger Corporation.

B. Performance Requirements: Provide sound-control door assemblies identical to assemblies tested by an independent testing agency per ASTM E 90 with the specified minimum certified STC rating per ASTM E 413 for the configurations indicated.
   1. Acoustical performance shall meet manufacturer's published data for transmission loss based on door type specified.

C. Compliance for Fire-Rated Sound-Control Door and Frame Assemblies:
   1. NFPA 80 compliant, listed and labeled by a testing and inspection agency acceptable to authorities having jurisdiction.
   2. Test at equalized pressure per UL 10C.

D. Safety Glass Compliance: Products must comply with testing requirements in 16 CFR 1201 for Category II materials.

E. Compliance with Accessibility Requirements:
   1. Americans with Disabilities Act/Architectural Barriers Act (ADA/ABA).
   2. Accessibility Guidelines for Buildings and Facilities (ADAAG).
   3. ANSI A117.1.
   4. FED-STD-795 Uniform Federal Accessibility Standards.

F. Sound-Control Door Assemblies: Provide sound-control door assemblies consisting of acoustically engineered door and frame combination with engineered sound seals.
   1. Designation as scheduled on Drawings.
   2. Door Configuration: As scheduled on Drawings.
   3. Door Leaf Size: As scheduled on Drawings.
   4. Glazing Lite Size, per Door: As scheduled on Drawings.
   5. Assembly Sound Transmission Class (STC): As scheduled on Drawings.

G. General: Provide flush-type steel sound-control doors minimum 2-1/2 inch (64 mm) thick, with split, crimped, and gasketed isolation construction with harmonically unbalanced steel face thicknesses and window lite thicknesses. Fabricate without visible seams on exposed faces.
   1. Door Cores: Manufacturer's standard meeting specified STC rating.
   2. Door Face Sheets: 14 gauge/0.067 inch (1.7 mm) and 12 gauge/0.093 inch (2.3 mm) cold-rolled steel sheet, on opposing faces.

H. Door Hardware Reinforcement: Minimum 14 gauge (0.067 inch) (1.7 mm), hot-rolled or cold-rolled steel sheet as reinforcement for hinges, lock face, flush bolts, closers, and concealed holders.

I. Acoustic Vision Lite Assembly: Metal-framed unit consisting of harmonic vibration-resistant 1/4 inch (6.0 mm) and 3/8 inch (9.0 mm) thick laminated glazing with 2.81 inch (71 mm) interspace.

J. Frame Fabrication:
   1. Materials: 14 gauge/0.067 inch (1.7 mm) cold-rolled steel sheet.
   2. Construction: Full-welded unit.
   3. Corners: Mitered and reinforced.
   4. Frame Design: Split frame design with integrated frame support for metal threshold.
   5. Frame Acoustic Liner, Non-Fire-Rated Doors: Factory-installed sound-absorbing material behind acoustic seal rabbet.

K. Frame Hardware Reinforcement: Minimum 14 gauge/0.067 inch (1.7 mm) reinforcement for hinges, lock face, and closers.

L. Door Hardware: Provide manufacturer's standard acoustical seals, threshold, and hinges required to achieve sound control performance requirements specified.

M. Acoustical Seals:
   1. Door Bottoms: Fixed in place foam and fiberglass-backed, teflon-coated sweep seal, field-adjustable, providing sound control seal without mechanical drop operation.

N. Hinges: Cam-lift wrap-around continuous barrel-type hinge.

O. Metal Thresholds: Flat, smooth plate stainless steel, 5/16 inch (7.9 mm) high, profiled to provide sound control seal with door bottom seal.

P. Locksets: Provide door manufacturer's standard mortise lockset.

Q. Other Door Hardware: Refer to requirements of Section 08 71 53 - Security Door Hardware.

R. Fasteners: Refer to Section 06 10 00 - Rough Carpentry.

S. General Fabrication:
1. Fabricate sound-control door assemblies to same tolerances as tested units meeting performance requirements.
2. Form surfaces smooth and flush with invisible joints when doors are closed.
3. Factory-assemble doors, frames, manufacturer-provided hardware, and glazed lites.

T. Door Fabrication:
1. Form metal doors to required sizes with minimum radius.
2. Join door faces at vertical edges by welding or crimping method identical to manufacturer's tested units.

U. Frame Fabrication:
1. Form metal frames to required sizes with minimum radius.
2. Weld joints continuously.
3. Make joints smooth, flush, and invisible.
4. Provide plaster guards where required to contain grout or mortar.

V. Hardware Preparation: In compliance with ANSI A115.1.
1. Factory-prepare assemblies to received hardware.
2. Prepare for hardware mounting as recommended by manufacturer in accordance with manufacturer's acoustically tested assemblies.

W. Primer: Factory primed for field-applied painted finish.
1. Type: Manufacturer's standard, lead- and chromate-free primer.
2. Compliance: ANSI A250.10.
3. Thickness: Minimum 0.7 mils (0.018 mm) thick.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine installation areas and mounting surfaces with Installer present, for compliance with manufacturer's installation tolerances including required clearances, floor level, location of blocking and anchoring reinforcements, and other existing conditions that may affect installation or performance.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work. If preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Proceed with installation only after correction of unsatisfactory conditions.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION - GENERAL

A. Install manufactured units in accordance with manufacturer's recommendations, approved submittals, and in proper relationship with adjacent construction.

B. Clean exposed surfaces. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.

3.4 INSTALLATION OF SOUND-CONTROL DOORS

A. Prior to installation, adjust sound-control door frames to within tolerances recommended by manufacturer.

B. Prepare doors and frames to accept field-applied door hardware specified in other sections. Apply bituminous coating to inside surfaces of frames to be filled with mortar or grout. Do not otherwise modify doors and frames in the field.

C. Install units plumb, square, in proper alignment and secured to opening, within manufacturer's recommended tolerances. Comply with manufacturer's installation instructions and approved submittals.
   1. Masonry and Concrete Walls: Where indicated, fill space between frames and adjacent wall construction with mortar or grout. Where required, pump frames full after installation; plug and fill grout access holes.

D. Install hardware uniformly and precisely, using supplied shims. Apply sealant to threshold and both sides of frame cross member under threshold. Allow for final adjustment of hardware following installation.

E. Adjust units and hardware so doors operate smoothly without warp or bind and close with uniform frame alignment and seal compression.

F. Comply with NFPA 80 for fire-rated openings.

3.5 CLEANING AND PROTECTION

A. Repair or replace defective work as directed by Architect upon inspection.

B. Clean surfaces. Touch up marred finishes, or replace damaged components that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by manufacturer.

C. Protect installed products from damage, abuse, dust, dirt, stain, or paint until completion of project. Do not permit use during construction.

END OF SECTION

SECTION 12 21 13 – HORIZONTAL VENETIAN BLINDS

PART 1 – GENERAL

1.01 SCOPE: Provide horizontal Venetian blind units for all exterior windows, complete.

1.02 QUALITY ASSURANCE: Provide each blind as a complete unit produced by one manufacturer, including hardware, accessory items, mounting brackets and fastenings.

1.03 SUBMITTALS: Comply with Section 01 33 00.

A. Product Data: Submit installation instructions including methods of installation for each type of opening and supporting structure.

B. Submit samples of each exposed metal finish, cords and tassels.

C. Shop Drawings: Submit shop drawings for special blind components which are not fully dimensioned or detailed in manufacturer's product data. Include typical elevation layout indicating proposed division between blind units and meeting edges at corners.

PART 2 - PRODUCTS

2.01 MANUFACTURER: Levolor "Riviera" is specified. Equivalent product of Graber, Inc. is acceptable

2.01 BLIND UNITS:

A. Head Rail: Manufacturer's standard channel-shaped headrail fabricated from minimum .025 thick steel.

B. Bottom Rail: Manufacturer's standard tubular steel bottom rail designed to withstand twisting and sagging. Contour top surface to match slat curvature. Close ends with manufacturer's standard metal or plastic caps, finished to match rail. Finish rail to match slats.

C. Slats: Nominal 1" wide, fabricated of minimum .010 aluminum, with rounded corners.

D. Slat Supports: Support slats parallel and straight with integrally braided polyester ladders to assure proper tilt control and adequate overlap of slats.

E. Tilter: Manufacturer's standard enclosed, lubricated, tilting mechanism which will tilt and securely hold the tilting wand, slats and bottom rail at any set angle.

F. Lift Cord: Manufacturer's standard braided high strength synthetic fibers to provide maximum strength and flexibility, sized to suit blind type. Provide nylon self-aligning type cord equalizer, to maintain horizontal blind position.

G. Cord Lock: Crash-proof cord lock, securely fastened to head and equipped with a revolving serrated cam to facilitate stopping of blinds at any point of ascending or descending travel.

H. Hardware: Manufacturer's standard brackets, supports and internal reinforcement. Finish exposed hardware to match rail color. Provide unit with all operating hardware machine clinched to and enclosed in metal head.

I. Finish: Prime slats with chromate conversion, followed by manufacturer's standard glass-smooth, baked on synthetic resin enamel in standard color as selected by the Architect.

2.03 FABRICATION AND OPERATION:

A. Prior to fabrication, verify actual opening dimensions by accurate site measurements.

B. Fabricate components of blinds with non-corrosive, non-staining, non-fading materials completely compatible with each other and requiring no lubrication during normal expected life.

C. Fabricate blinds to fill the openings as indicated from head to sill and jamb to jamb.

D. Space supporting cords in accordance with manufacturer's standards.

E. Space slats to provide overlap for light exclusion when in fully closed position.

F. Operation: Equip blind units for full-tilting operation with slats rotating approximately 180 degrees. Place lift operating controls on left hand side of blind units. Equip units with full-height raising to manufacturer's minimum stacking dimension, with lifting cord locks for stopping blinds at any point of ascending or descending travel. Place cords on right hand side of blind units.

PART 3 - EXECUTION

3.01 INSPECTION: Examine the substrates and conditions under which the horizontal Venetian blinds are to be installed. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION:

A. Install units in accordance with manufacturer's instructions and accepted shop drawings. Provide intermediate supports at intervals to permit easy entrance and removal of head, and to ensure level head and slat position.

B. Provide adequate clearance between sash and division between blinds to permit unencumbered operation of sash hardware.

END OF SECTION

BLANK

SECTION 13 34 19 – METAL BUILDING SYSTEM

PART 1 – GENERAL

1.01 SUMMARY: Rigid frame pre-engineered metal building system, complete, including structural framing, roofing, siding and aggregate siding, fascia and soffits, insulation, gutters and downspouts, and flashing and trim. Metal Building Manufacturer to review, coordinate and accommodate all loads and equipment supporting structures as indicated within the construction documents including architectural, structural, civil, mechanical, electrical, plumbing and fire protection.

1.02 RELATED WORK SPECIFIED IN OTHER SECTIONS:

A. Concrete floor and installation of anchor bolts; Section 03 30 00 and 05 50 00, respectively.

B. Joint Sealants; Section 07 92 00.

C. Aluminum Entrances, Storefront and Fixed Framing; Section 08 41 13.

D. Exterior load-bearing steel wall studs; Section 05 40 00.

E. Miscellaneous metals; Section 05 50 00.

F. Overhead Rolling Door; Section 08 33 23.

G. Steel doors and frames; Section 08 12 13.13.

H. Flashing and Sheet Metal Work; Section 07 62 00.

I. Division 22, Plumbing

J. Division 23, Mechanical

K. Division 26, Electrical

1.03 SUBMITTALS: Comply with Section 01 33 00.

A. Product Data: Submit manufacturer's product information, specifications and installation instructions for building components and accessories.

B. Shop Drawings: Submit complete erection drawings, showing anchor bolts settings, sidewall, endwall and roof framing, transverse cross-sections, covering and trim details, and accessory installation details to clearly indicate proper assembly of building components.

C. Samples: Submit samples of roofing panel, siding panels, fascia and soffit panel with specified finish verification by Architect. Include samples of fasteners to be used for application of panels. Include sample of sealants and closures.

D. Certification: Submit written certification prepared and signed by professional engineer, registered to practice in state where building is erected, verifying that building design meets loading requirements and codes of authorities having jurisdiction. Submit calculations with certification.

E. Certificates: Submit certificates that manufacturer and installer complies with requirements included under "Quality Assurance" article.

1.04 SYSTEM PERFORMANCE REQUIREMENTS:

A. General: Engineer, design, fabricate and erect pre-engineered metal building system to withstand loads from winds, gravity, structural movement including movement thermally induced, seismic movement and to resist in-service use conditions that the building will experience, including exposure to weather, without failure.

1. Design each member to withstand stresses resulting from combinations of loads that produce maximum allowable stresses in that member as prescribed in Metal Building Manufacturers Association's (MBMA) "Design Practices Manual" and as specified.

B. Structural Framing and Roof and Siding Panels: Design primary and secondary structural members and exterior covering materials for applicable loads and combinations of loads in accordance with MBMA's "Design Practices Manual" and as specified.

1. For structural steel members, comply with AISC "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings" for design requirements and allowable stresses.

2. For light-gage steel members, comply with AISI "Specification for the Design of Cold-formed Steel Structural Members" and "Design of Light-gage Steel Diaphragms" for design requirements and allowable stresses.

3. For welded connections, comply with AWS "Standard Code for Arc and Gas Welding in Building Construction."

C. Design Loads: Design each member to withstand stresses resulting from combinations of loads that produce maximum percentage of actual to allowable stress in that member, as prescribed in MBMA "Design Practices Manual"; comply with codes of authorities having jurisdiction and as specified.

D. Wind Uplift Resistance: Design metal building assemblies that meet requirements of UL 580, Class 90 for wind uplift resistance.

E. Design Requirements:

1. Maximum purlin live load deflection shall not exceed span/360 or 1", whichever is smaller, in areas supporting ceilings. Maximum purlin live load deflection shall not exceed span/240 or 1", whichever is smaller, in areas not supporting ceilings.

2. Frame live load deflection shall not exceed span/360 or 1 ½".

3. Maximum girt lateral deflection from wind or seismic loads shall not exceed span/240 for girts providing lateral support for metal siding only. Maximum girt lateral deflection from wind or seismic loads shall not exceed span/360 for girts providing lateral support for brick.

4. Maximum building side sway (drift) from wind loads shall not exceed wall height/240. Seismic drift shall not exceed limits in ASCE 7, Table 12.12-1 with actual drift determined by section 12.8.6.

5. Design Loads:

a. Roof Dead Load: Actual weight of roof structure.

b. Collateral Load: Hanging equipment, lights, ceilings, etc., (7 psf minimum collateral dead load). Include actual weight of suspended equipment.

c. Wind: 115 mph ultimate, 3-second gusts

d. Seismic: Refer to structural notes

e. Codes: 2021 Arkansas Fire Prevention Code
2021 International Building Codes (or latest edition)
MBMA Metal Building System Manual (latest edition)

1.05 QUALITY ASSURANCE:

A. Manufacturer's Qualifications: Provide pre-engineered metal building manufactured by firm experienced in manufacturing metal building systems that are similar to those indicated for this project and have a record of successful in-service performance. Provide MBMA certification that pre-engineered metal building meets specified requirements.

1. AISC Certification for Category MB: An AISC certified manufacturer that designs and produces metal building systems and components in an AISC certified facility.

B. Installer Qualifications: Engage an experienced installer to erect pre-engineered metal building who has specialized in erection and installation of types of metal building system similar to that required for this project and who is certified in writing by metal building system manufacturer as qualified for erection of manufacturer's products.

C. Manufacturer to schedule and conduct a mandatory pre-construction seminar for all erection crew members and job superintendent. Notify Architect at least 48 hours prior to meeting.

1.06 DELIVERY, STORAGE AND HANDLING:

A. Deliver and store pre-fabricated components, sheets, panels and other manufactured items so they will not be damaged or deformed.

B. Stack materials on platforms or pallets, covered with tarpaulins or other suitable weathertight ventilated covering. Store metal sheets or panels so that water accumulations will drain freely. Do not store sheets or panels in contact with other materials that might cause staining.

1.07 WARRANTIES: As stated in Section 00 72 00 – General Conditions, all warranties will begin from the date of Substantial Completion. Specific items covered under this warranty include, but are not limited to: roof panels, side seams, panel endlaps, roof-to-wall flashing, ridge flashings, hip flashings, valley flashings, high side eave flashings, rake flashings, approved expansion joints, approved curb and penetration flashings, approved built-in gutters, approved gutters and approved wall panel systems. Liabilities will be limited to the cost of the repairs, including labor and materials, of the installation of the roof systems. The warranty will require the installers to be approved, trained and tested by the manufacturer and the manufacturer's representative is to inspect the roof system throughout installation and provide a final inspection certification. Examples are Butler's Weathertight Gold Warranty, and MBCI Single Source I Warranty. All warranties must extend to and include the Owner of the building as identified in the Owner/Contractor agreement or other contractual documents.

A. Wall Panels: Three (3) years materials and workmanship, 20 years panel finish.

B. Fascia and Soffits: Three (3) years materials and workmanship, 20 years panel finish.

C. Materials, Components and Accessories: Three (3) years materials and workmanship.

PART 2 – PRODUCTS

2.01 MANUFACTURERS: Alliance Steel Building Systems is specified. United Structures of America; Ruffin; Mesco; Butler; American Building Systems, "Metallic Building Company" – Pinnacle Structures; Varco Pruden; Central States Building Works; and ACI are approved. Other manufacturers must be submitted for pre-bid approval in accordance with Section 01 33 00.

2.02 MATERIALS:

A. Hot-rolled Structural Shapes: ASTM A36 or A992.

B. Tubing or Pipe: ASTM A-500, Grade C

C. Members Fabricated from Plate or Bar Stock: 42,000 psi minimum yield strength; ASTM A-529, A-570 or A-572.

D. Members Fabricated by Cold Forming: ASTM A-607, Grade 50.

E. Galvanized Steel Sheet: ASTM A-446, with G90 coating.

F. Galvalume Steel Sheet: ASTM A-792.

G. Bolts for Structural Framing: Comply with requirements of ASTM A-307 or A-325 as necessary for design loads and connection details.

2.03 STRUCTURAL FRAMING COMPONENTS:

A. Rigid Frames:

1. Hot-rolled structural steel. Factory-welded and shop-painted, built-up "I" shape or open web rigid frame consisting of uniform beams and columns. Furnish complete with attachment plates, bearing plates and splice members. Factory-drilled for bolted field assembly. Provide rigid frame at end walls where indicated.

2. Length of span and spacing of frames as indicated, except slight variations acceptable to metal manufacturer's standard.

B. End Wall Columns: Factory-welded, built-up of "I" shape or hot-rolled sections. Fabricate a minimum of ¼" thick steel. Shop-painted.

C. Wind Bracing: Adjustable, threaded steel rods, ½" diameter minimum; ASTM A-36 or A-572, Grade D.

D. Secondary Framing:

1. Purlins, eave struts, end wall beams, flange and sag bracing; minimum 16-gage rolled formed sections. Shop-painted.

2. Base channel, sill angle, end wall structural members (except columns and beams), purlin spacers; minimum 14-gage cold-formed steel.

E. Bolts: ASTM A-307 or A-325 as necessary for design loads and connection details. Shop-painted, except provide zinc or cadmium-plated units when in direct contact with panels.

F. Fabrication: Shop-fabricate to indicated size and section, complete with base plates, bearing plates and other plates as required for erection, welded in place and with required holes for anchoring or connections shop-drilled or punched to template dimensions. Shop connections power-riveted, bolted or welded. Field connections bolted.

G. Shop Painting: Clean surfaces to be primed of loose mill scale, rust, dirt, oil, grease and other matter precluding paint bond. Follow procedures of SSPC-SP3 for power tool cleaning, SSPC-SP7 for brush-off blast cleaning, and SSPC-SP1 for solvent cleaning.

1. Prime structural steel primary and secondary framing members with manufacturer's standard rust-inhibitive primer having over 50% rust-inhibitive pigment.

2. Prime galvanized members, after phosphoric acid pre-treatment, with zinc dust-oxide primer.

2.04 SOFFIT PANELS: By metal building manufacturer.

A. FP12 Soffit Panel and Support

1. Soffit: 24-gage steel conforming to ASTM A-446 with KXL; 1 mil Kynar-based coating applied to exterior surface of G90 galvanized steel; color as selected by Architect. Interior surface is coated with off-white 0.5 mil wash coat. Manufacturer to provide standard means of attachment.

2. Accessories: Provide manufacturer's standard trim, support, vertical and lateral bracing, accessories and other items essential to completeness of soffit system. Manufacturer to insure soffit will meet all local codes for wind uplift and seismic requirements.

2.05 SIDING PANELS: By metal building manufacturer.

A. Wall Panels: 36” wide factory-formed panels

1. Siding: 26-gage steel conforming to ASTM A-446 with KXL; 1 mil Kynar-based coating applied to exterior surface of G90 galvanized steel; colors as selected by Architect.

B. L.T. 3.3 panel symmetrical corrugated 7.2 rib.

C. Panels shall be one piece from base to building eave except where length exceeds 41’ or otherwise becomes prohibitive for handling purposes, in which case, provide endlaps. Endlaps occur a support member.

D. Accessories:

1. Provide manufacturer’s standard trim and accessories and other items essential to completeness of metal wall system.

2. Contiguous flashings shall be factory fabricated by panel manufacturer from 22-gage nominal thickness G90 galvanized steel with textured pre-finished factory applied coating to match panels.

2.06 FASTENERS: Manufacturer’s recommended system of self-tapping screws, bolts and nuts, self-locking rivets, self-locking bolts, end-welded studs and other suitable fasteners designed to withstand design loads.

A. Provide metal-backed neoprene washers under heads of fasteners bearing on weather side of panels.

B. Use aluminum or stainless steel fasteners for exterior application and galvanized or cadmium-plated fasteners for interior applications.

C. Locate and space fastenings for true vertical and horizontal alignment. Use proper type fastening tools to obtain controlled uniform compression for positive seal without rupture of neoprene washer.

D. Provide fasteners with heads matching color of roofing and siding sheets by means of plastic caps or factory-applied coating.

2.07 INSULATION:

A. Wall:

1. Glass Fiber Blanket Insulation: Not less than 0.6 lbs. per cubic foot density, glass fiber blanket with UL flame spread classification of 25 or less.

2. Vapor Retarder Facing: Atlas WMP-VR (Reinforced Vinyl) flame-resistant vapor retarder facing material consisting of two vinyl films laminated to fiberglass scrim reinforcement.

3. Retainer Strips: 26-gage formed galvanized steel retainer clips colored to match insulation facing.

4. Tape: White color, type as recommended by manufacturer.

2.08 FLEXIBLE CLOSURE STRIPS: Closed-cell, expanded cellular rubber, self-extinguishing, cut or pre-molded to match corrugation configuration of roofing and siding sheets. Provide where indicated and necessary to ensure weathertight construction.

2.09 SEALING TAPE: 100% solids, pressure-sensitive polyisobutylene compound tape with release paper backing. Not less than ½" wide and 1/8" thick, non-sag, non-toxic, non-staining and permanently elastic.

2.10 JOINT SEALANT: Polyurethane, as recommended by building manufacturer, meeting requirements specified in Section 07 92 00.

2.11 SHEET METAL ACCESSORIES: Provide coated steel sheet metal with coated steel roofing and siding panels. Manufacturer must be present at pre-construction meeting

A. Gutters: 24-gage galvanized steel BELOW EAVE GUTTERS are specified; No others will be accepted. Form in 8' sections, complete with end pieces, outlet tubes and other special pieces as required. Size in accordance with SMACNA. Join sections with riveted and soldered or sealed joints. Furnish gutter supports spaced at manufacturer's recommendations, constructed of 16ga galvanized steel, color to match gutters. Provide standard bronze, copper or aluminum wire ball strainers at each outlet. Finish to be KXL in standard color as selected by Architect. Manufacturer must attend pre-construction meeting.

B. Downspouts: Use largest standard size. Form in maximum length sections Provide complete with elbows and offsets. Join sections with minimum 1-1/2" telescoping joints. Provide fasteners for top, bottom and 5' o.c. intermediately between, designed to securely hold downspouts not less than 1" away from walls. Material and finish to match gutters, unless noted otherwise.

2.12 FABRICATION:

A. General: Design pre-fabricated components and necessary field connections required for erection to permit easy assembly and disassembly.'

1. Fabricate components in such a manner that once assembled, they may be disassembled, repackaged and reassembled with minimum amount of labor.

2. Clearly and legibly mark each piece and part of the assembly to correspond with previously prepared erection drawings, diagrams and instruction manual.

B. Structural Framing: Shop-fabricate framing components to indicated size and section with base plates, bearing plates and other plates required for erection, welded in place. Provide holes for anchoring or connections shop-drilled or punched to template dimensions.

1. Shop Connections: Provide power-riveted, bolted or welded shop connections.

2. Field Connections: Provide bolted field connections.

PART 3 – EXECUTION

3.01 ERECTION:

A. Framing: Erect structural framing true to line, level and plumb, rigid and secure. Level base plates to a true even plane with full bearing to supporting structures, set with double-nutted anchor bolts. Use a non-shrinking grout to obtain uniform bearing and to maintain a level base line elevation. Moist-cure grout for not less than 7 days after placement.

B. Purlins and Girts: Provide rake or gable purlins with tight-fitting closure channels and fascias. Locate and space wall girts to suit door and window arrangements and heights. Secure purlins and girts to structural framing and hold rigidly to a straight line by sag rods.

C. Bracing: Provide diagonal rod or angle bracing in roof and in sidewalls as indicated.

1. Moment-resisting frames will be the primary bracing system and sidewall rod bracing will not be allowed.

2. Where diaphragm strength of roof or wall covering is adequate to resist wind forces, rod or other forms of bracing will not be required.

D. Framed Openings: Provide shapes of proper design and size to reinforce opening and to carry loads and vibrations imposed, including equipment furnished under mechanical and electrical work. Securely attach to building structural frame.

3.02 SIDING, FASCIA AND SOFFIT PANELS:

A. General:

1. Arrange and nest sidelap joints so that prevailing winds blow over, not into, lapped joints. Lap ribbed or fluted sheets one full rib corrugation. Apply panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line. Protect factory finishes from damage. Show rib dimensions and lap installation on shop drawings.

2. Provide weather seal where required for weathertightness; flash and seal roof panel at eave and rake with rubber, neoprene or other enclosures to exclude weather.

B. Siding, Fascia and Soffit Panels: Comply with manufacturer's recommendations.

1. Apply elastomeric sealant continuous between metal base channel (sill angle) and concrete and elsewhere as necessary for waterproofing. Handle and apply sealant and back-up in accordance with sealant manufacturer's recommendations.

2. Align bottoms of panels and fasten panels with clips as recommended by manufacturer.

3. At soffit panels, install white wash coat on exterior side.

C. Accessories: Install below-eave gutter (all other gutters are unacceptable), downspouts, hangers and supports, trim, flashing and other sheet metal accessories in accordance with manufacturer's recommendations and details for positive anchorage to building and weathertight mounting. Flash penetrations for positive weathertightness.

3.03 CLEANING AND TOUCH-UP: Clean component surfaces of matter that could preclude paint bond. Touch-up abrasions, marks, skips and other defects to shop-primed surfaces with same type material as shop primer.

END OF SECTION

SECTION 13 48 13 – SOUND ISOLATION AND CONTROL

PART 1 – GENERAL

1.01 DESCRIPTION

A. Certain complete rooms (walls, floors, ceilings, etc.) requiring special sound control are designated as acoustically sensitive; these are listed in section 230550 Noise Control for Mechanical Systems. This has been done where sound isolation is important. The Contractor shall ensure that the sound control performance of structures be maintained in accordance with the drawings and specifications.

B. Where a room is designated acoustically sensitive or sound critical, all typical details for airtightness that are appropriate to the room shall be employed, as well as any special details as may be required.

C. Every precaution shall be taken to maintain construction completely airtight around a room (walls, floor, ceiling) per the Finish Schedule. Construction joints, structural penetrations, mechanical and electrical duct penetrations, pipe and conduit penetrations, electrical boxes and fixtures, cabinets, doors access panels, windows, frames, supports, etc. shall all be built and installed in such manner as to prevent sound transmission. Provide lintels, extra frames, blocking, escutcheons, grouting, gaskets, packing caulking, taping, filling, etc. as required to control sound transmission.

D. Penetrations through fire-rated partitions shall be sealed per details in the AC drawings or in accordance with ASTM E-814 and corresponding UL System drawings for fire rated openings.

E. If a condition occurs where penetration of the structure by a duct, pipe, conduit, etc., is not shown clearly on the drawings (or described in the specifications), the Contractor shall ask immediately for clarification of the method necessary to install the particular item.

1.02 APPLICABLE REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM) E497 – Standard Practice for Installing Sound Isolating Lightweight Partitions.

B. ASTM C919 – Practice for Use of Sealants in Acoustical Applications.

1.03 TYPICAL AIRTIGHTNESS DETAILS

A. The drawings show typical details for airtightness and designate specific materials and components to be used. The Contractor shall be alert for conditions that may require special details or materials in order to achieve airtightness and shall bring these to the attention of the Architect.

1.04 WARRANTY

A. Warrant acoustical sealants, packing and caulking against faulty workmanship and defective materials for a period of 5-years after date of substantial completion.

PART 2 – PRODUCTS

2.01 GENERAL

A. Refer to the details on the architectural drawings and to the list of products below. Products shall be required in addition to other similar products specified elsewhere. Products specified herein include the following:

1. 1.5 PCF Insulation

a. For use in packing the flutes of metal deck at the top of wall heads.

b. Manufacturer:

1) Industrial Insulation Type 701 unfaced, from Owens Corning Fiberglass Corporation, Toledo, OH 800-438-7465

2) Insul-Shield 150 from Johns Manville, Denver, CO 800-654-3103

3) Insulation Board from Knauf Fiber Glass GmbH, Shelbyville, IN 317-398-4434

4) or approved equal.

2. 3 PCF Black Board Insulation

a. Fiberglass board for ceilings shall be 4-inch thick, as called out in the drawings or specifications. It shall be installed on the undersides of the roof deck and inside mechanical rooms, as shown on the drawings and called out on the finish schedule.

b. Fiberglass board shall be fiberglass insulation with a black mat surface acrylic coating without manufacturer's markings. This coating shall be damage resistant, not tearing or abrading easily. Fiberglass board shall be 3 PCF minimum density meeting the requirements of NFPA90-A. Fiberglass board and adhesives shall comply with ASTM E-84 and shall have a maximum flame spread rating of 25 and smoke rating of 50.

c. In the event that a total thickness of 4-inches cannot be achieved with a single layer of material, it is acceptable acoustically to use two layers of 2-inch thick insulation.

d. Manufacturer:

1) Select Sound Black Acoustic Board from Owens Corning Fiberglas Corporation, Toledo, OH 419-248-8000 www.owenscorning.com

2) AcoustaBoard Black or CertaPro AcoustaBoard Black from CertainTeed, Valley Forge, PA 610-341-7000 www.certainteed.com

3) INC C-700 from Industrial Noise Control, Addison, IL 312-620-1998

4) or approved equal

3. 4-5 PCF Insulation

a. For use in packing the spaces between penetrating objects and partitions, leaving no voids or spaces.

b. Manufacturer:

1) Sound Attenuation Batt Insulation from Owens Corning Fiberglas Corporation, Toledo, OH 800-438-7465

2) Noise Reducer Batts from CertainTeed, Valley Forge, PA 215-341-7000

3) Thermal Shield from Johns Manville, Denver, CO 800-654-3103

4) Quiet Therm from Knauf Fiber Glass GmbH, Shelbyville, IN 317-398-4434

5) or approved equal.

4. 10 PCF Insulation

a. 10 PCF insulation shall be 3/4-inch thick rigid glass fiber or neoprene sponge rubber (conforming to ASTM-D01056, Grade SCE 41).

b. For use sealing wall heads and around beam penetration in concrete or concrete masonry unit walls.

c. Manufacturer:

1) Type AFG-10 from Mason Industries, Hauppauge, NY 631-348-0282.

2) Type PIB from Kinetics Noise Control, Dublin, OH 614-889-0480.

3) Neoprene Sponge Rubber from Metropolitan Rubber Company, Hackensack, NJ 201-489-0909.

4) or approved equal

5. Acoustical Sealants:

a. For closing small openings and joints up to a maximum of 1/2-inch wide. Sealant backed with glass fiber packing, closed cell neoprene pipe insulation, compressible joint filler or resilient backer rod.

b. Acoustical sealant shall be applied in continuous beads, a minimum depth of 1/4". The material shall be resilient and non-setting. Spray-on sealants are not acceptable.

c. Seal at the following locations:

1) Sound-rated partitions on both sides where facings abut dissimilar materials.

2) Around the perimeter, in the angle formed by panels and abutting dissimilar materials.

3) At all intersections and penetrations of floors, ceilings, walls, and columns. iv. At all panel terminations in door and window frames, and at control joint to panels.

4) Around all cutouts for lights, cabinets, pipes and plumbing, HVAC ducts, electrical boxes, etc.

d. The following products are acceptable for partitions not having a fire-rating:

1) Acoustical Sealant by U.S. Gypsum, Chicago, IL 312-321-4000.

2) Acoustical Sealant by Tremco Manufacturing Company, Beachwood, OH 810427-2901.

3) AC20®FTR Acoustical Sealant by Pecora Chemical Corporation, Harleysville, PA 215-723-6051.

4) Acoustical Sealant 808 by Protective Treatments, Dayton, OH 513-890-3150.

5) Acoustical Caulking CC-75 by Mason Industries, Hauppauge, NY 516-348-0282.

6) or approved equal.

e. The following products are acceptable for fire-rated partitions:

1) CP 25 Caulk by 3M Corporation, St. Paul, MN 612-733-4076. NOTE: Use CP 25N/S Caulk for penetrations of vertical partitions and CP 25S/L Caulk for penetrations of horizontal partitions.

2) Acoustical Sealant by Specified Technologies, Somerville, NJ 800-992-1180.

3) FS 1900 Series Sealant Intumescent Elastomeric Firestop by International Protective Coatings, Oakhurst, NJ 800-334-8796.

4) or approved equal.

6. Elastomeric Closed Cell Neoprene Insulation:

a. For use in sealing penetrations in partitions, floors or ceilings of acoustically sensitive or sound critical rooms, pack material completely in space between penetrating object and partition, leaving no voids or spaces.

b. Manufacturers:

1) AP Armaflex SS (Self Seal Insulation)

2) AP Armaflex II Sheet and Roll Insulation.

3) or approved equal.

7. Neoprene Closure Strips:

a. Where partitions intersect a metal deck, the cavity shall be sealed as shown on the drawings with a neoprene deck closure. Closure material shall be shaped to fit exactly the metal deck shape. Material shall be 1" thick EPDM closed cell synthetic rubber (neoprene) with the following properties.

b. Physical Properties:

1) Density: 12 - 16 pcf.

2) % Water Absorption – Vacuum Method (ASTM D-1056): By Weight: 0.95%, By Volume: 0.18%.

3) % Elongation (ASTM D-412): 210%.

4) Tensile (ASTM D-412): 190 psi

5) % Compression set after 22 hours at 70o F at 50% deflection (ASTM D-1056): 32.9%

6) Ozone Resistance – Bent loop samples in Mast ozone chamber. at 50 pphm ozone and 100o F (ASTM D-1171): No cracking after 72 hours.

7) 25% Compression Deflection in psi (ASTM D-575, unaged): 5.1%

8) Low Temperature Brittle test at -40o F (ASTM D-746, Method B): No brittleness

9) High Temperature at 212o F (ASTM D-573): No deleterious effects

c. Manufacturers:

1) Closures, Inc., by Houston Foam Plastics, Houston, TX 1-800-231-1762.

2) Rubatex Corporation, Bedford, VA 1-800-RUBATEX.

3) or approved equal.

8. Fire Barrier (Acoustical) Putties:

a. For closing large openings and joints typically over 1-inch wide but no wider than 3-inches. Applied full depth or backed with dense safing insulation, as detailed.

b. Non-shrinking, highly adhesive, minimum 40 psf density fire barrier putty.

c. Manufacturers:

1) CP 25N/S No Sag or CP25S/L Self Leveling Fire Barrier Caulk by #M Electrical Division.

2) Type FSP Firestop Putty by Nelson Electrical Division of General Signal.

3) Fyre Putty by Unifrax Corporation, Fibers Division.

4) or approved equal.

9. Removable Fire Stop Bags:

a. Removable fire stop bags to be used inside cable passes at sound critical partitions.

b. Firestop bags shall be constructed of tightly woven, durable coated fiberglass cloth, filled with a combination of mineral fibers, incombustible components, water-insoluble intumescent agents and special fire-retardant additives. Firestopping ability of bags shall be unaffected by extreme heat or cold, be insoluble in water and have high chemical resistance. Bags shall be tested in accordance ASTM E814 (UL1479) for fire resistance. Bags shall provide 2, 3 or 4 hour fire rating as required and as specified by architect or engineer.

c. Manufacturers:

1) KBS Sealbags or KBS Flamesafe Bags from International Protective Coatings, Inc. (800) 334-8796.

2) or approved equal.

10. Acoustical Floating Wood Floor:

a. If needed, provide a vapor barrier of 6 mil thickness carbonated polyethylene film on the slab before commencement of wood flooring construction. Sheets shall be taped at joints which shall be overlapped 3" minimum. Where slab is depressed or recessed, vapor barrier shall be run up at the perimeter of the floor for trimming following installation of finish flooring material.

b. Isolators shall be 2” high. Mounts shall be imbedded in the insulation 16” o.c. in all directions. The material shall be in roll form and should be rolled out within the specified area. The mounts should not be mechanically secured to the structural floor, adhesive is acceptable. Additional mounts or mounts with higher load capacity should be determined at the perimeter of the area by the manufacturer if a perimeter wall will be built on top of the floating floor.

c. The entire perimeter of the floor shall be held back 3/4" from the walls and all other obstructions such as columns. This shall prevent movement of the floor into solid contact with the wall. Place a layer of 3/4" thick, 10 PCF insulation around the entire perimeter of the floor as well as penetrations such as columns, pipes, etc. The height of the pad shall be the full depth of the finished floor. Thus, when the flooring is in place, the vertical perimeter isolation pad shall entirely fill the gap.

d. Lay a layer of 3/4" plywood sheets on top of the mounts.

e. Lay down 30 lb. construction felt on top of first layer of plywood sheets.

f. Screw a second layer of 3/4" plywood sheets at right angles to the base sheets, staggering the joints by 16" in both directions and allowing 1/8" expansion voids between sheets ensuring that no seams line up.

g. Adhere the finished flooring to the plywood using adhesive and methods as approved by manufacturer.

h. Apply continuous beads of Acoustical Sealant over the top of the 3/4" thick, 10 PCF insulation. Place resilient or wood base around the perimeter of the floor and at any obstructions. Wood base shall be attached to the wall but shall be held clear of the floor by 1/4" vertically to allow continued resiliency of floors.

i. Manufacturers:

1) Type RIM from Kinetics Noise Control, Dublin, OH (614) 889-0480.

2) or approved equal.

11. Combination Spring/Neoprene Hangers:

a. Combination neoprene element and spring hanger shall consist of a steel frame containing a neoprene isolation element at the top and a coil steel spring seated in a neoprene cup on the bottom. Both the element and the cup shall be molded with a neoprene bushing that passes through the steel frame. The neoprene element shall be capable of an average deflection of 0.35”. The steel spring shall be capable of a minimum static deflection of 0.75” with a minimum additional travel to solid of 1/2”. Spring diameter and hanger box lower hole size shall be large enough to permit the hanger rod to swing through a 30˚ arc before contacting the box and short circuiting the spring. Hanger shall be factory pre-compressed 70% of the total deflection determined by the assigned load per hanger. Hanger shall be manufactured with provision for bolting or attaching to ceiling flat iron straps, rods or steel runners. Hanger shall be of a failsafe design.

b. Manufacturers:

1) Type W30N from Mason Industries, Hauppauge, NY 631-348-0282.

2) Type RSH-30A from Vibration Mountings and Controls, Bloomingdale, NJ 201838-1780.

3) Type SRH from Kinetics Noise Control, Dublin, OH 614-889-0480.

12. Resilient Partition Isolation Pad:

a. Resilient partition isolation pad shall consist of neoprene coated fiberglass pad and neoprene isolation step bushing. The fiberglass pad shall be 1/2" thick and designed to carry continuous loads up to 25-psi without excessive creep or pad failure. Pad deflection shall be 0.175-inches at maximum rated load. Bushing shall be a 1/2" thick, 60-durometer rubber element that prevents any rigid contact of the anchor to the base and top plate of the stud wall. Proper compression of the bushing during installation shall be governed by a bronze spacer, inserted through the center-hole of the bushing, and fender washer, positioned on top of the bushing; and, shall allow installation of a 1/4" diameter anchor. Bushings shall be spaced at 16” on center.

b. Manufacturers:

1) Type KSM from Kinetics Noise Control, Dublin, OH (614) 889-0480.

2) or approved equal.

2.02 PLUMBING ACOUSTIC ISOLATION

A. Acoustical Isolation System: Consisting of through-stud isolators, pipe clamps, riser clamp pads, neoprene and felt lining material and associated support bracketry. For applications requiring acoustical isolation of tubing, piping, and equipment from structure including all restrooms adjacent to the Main Hall and as called out on the drawings.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Hubbard Enterprises/Holdrite; Silencer System used with Hubbard/Holdrite Stout Bracket System, or a comparable product by an approved manufacturer.

PART 3 – EXECUTION

3.01 PRE-INSTALLATION CONFERENCE

A. Prior to the start of installation of the work of this Section, the Contractor shall review areas of potential interference and conflict with the requirements for airtight construction to see that airtightness is achieved where scheduled.

3.02 INSTALLATION

A. The following is required for all partitions, walls, floors and other constructions in rooms designated acoustically sensitive or sound critical. The requirements of this section do not supersede the fire safety requirements of fire rated assemblies: however, additional constructions (such as steel cover plates and escutcheons) may be necessary to maintain sufficient sound isolation of fire rated assemblies, depending upon the firestopping materials (such as fire stop pillows/bags or low density silicone foams) chosen to seal penetrations.

1. Extend construction to a minimum of 1/2-inch and a maximum of 1-inch of adjacent construction to provide a suitable space for packing and caulking.

2. Cut openings in construction accurately for electrical boxes, piping, ductwork and other penetrating elements. Leave enough space around such elements so they remain free of rigid connection with the surrounding construction.

3. Prior to packing and caulking penetrations as detailed herein, verify that all penetrating elements such as piping, ductwork, conduit, etc. are free and clear of the opening to be packed and caulked.

4. Apply all acoustical sealants and caulks in accordance with the manufacturer's instructions.

B. Penetrations of Single Stud Drywall Constructions:

1. Ductwork:

a. Wrap duct with 1" thick elastomeric closed cell neoprene sheet insulation, 1.5 PCF fiberglass insulation or mineral wool. Extend sheet insulation a minimum of 2-inches beyond the width of the partition on either side.

b. Install drywall tight to the sheet insulation.

c. Trim sheet insulation to the width of the partition, and seal airtight with acoustical sealant or fire-rated acoustical sealant if partition is fire-rated.

2. Pipe/conduit diameter = 1” or larger:

   a. Wrap with 1/2” thick elastomeric closed cell neoprene pipe insulation, 1.5 PCF fiberglass insulation or mineral wool. Extend wrapping a minimum of 2-inches beyond the width of the partition on either side.

   b. Install a metal pipe sleeve around the neoprene insulation.

   c. Install the drywall around the sleeve and spackle tightly to full thickness of partition.

   d. Trim pipe insulation and sleeve to the width of the partition, and seal airtight with acoustical sealant or fire-rated acoustical sealant if partition is fire-rated.

3. Pipe/conduit diameter < 1”:

   a. Wrap with 1/2” thick closed cell neoprene pipe insulation, 1.5 PCF fiberglass insulation or mineral wool. Extend wrapping a minimum of 2-inches beyond the width of the partition on either side.

   b. Install the drywall tight to the neoprene pipe wrap.

   c. Trim neoprene insulation to the width of the partition, and seal airtight with acoustical sealant or fire-rated acoustical sealant if partition is fire-rated.

C. Multiple Pipe/Conduit Penetrations:

1. Where a series of conduits or pipes are penetrating the wall/floor/ceiling, each duct/conduit/pipe shall be separated by minimum 4-inches in all directions.

2. Multiple pipe/conduit penetrations at one location (i.e. one large opening for a series of runs) are not recommended.

D. Penetrations of Double Stud Drywall:

1. Use same techniques described above EXCEPT do not bridge the two studs or wythes with solid members such as sleeves or stud frames. Each sleeve or frame must be for each individual wythe or stud.

E. Intersection of Gypsum Board and Metal Deck:

1. Wall perpendicular or at a sharp angle to the metal deck ribs: Secure top channel of wall to deck. Pack the void between the ribs with 1.5 PCF fiberglass or mineral wool insulation so that it is tight and compact with no air or light gaps. Bring drywall up to within 1/2-inch following the profile of the deck, and fill gap with a continuous bead of acoustical sealant on backer rod.

2. Wall parallel or at a shallow angle to the metal deck ribs: Secure 18-gauge sheet metal plate to the underside of the deck ribs, spanning the rib to where the top channel of the wall will attach if needed. Plate should span the full width of as many ribs as is necessary to be wider than the thickness of the wall construction. Alternatively, attach the top track to the metal deck flute. Pack the void between the metal deck and the plate/stud track with 1.5 PCF insulation so that it is tight and compact with no air or light gaps. Secure top channel of wall to steel plate and/or deck where applicable. Bring drywall up to within 1/2-inch the steel plate/metal deck and fill gap with a continuous bead of acoustical sealant on backer rod.

3. These intersections shall be installed in a manner that results in complete air tightness through the structure.

F. Intersection of Gypsum Board Partition and Steel Beam:

1. Wall parallel or at a shallow angle to the metal deck ribs: Construct the wall so that it seals tight to the deck as described above. As the wall intersects the beam, secure the top channel to the underside of the beam and fully around the beam forming out a box. Pack the void between the wall and the beam with 4-5 PCF insulation so that it is tight and compact with no air or light gaps. Extend the gypsum board into the web of the beam so that it is within 1/2-inch of the beam vertical member. Apply a continuous bead of acoustical sealant between the gypsum board and the beam/fireproofing.

2. Wall perpendicular or at a sharp angle to the metal deck ribs: Seal the voids of the deck ribs as described above. Secure the top channel to the underside of the beam. Attach the drywall to the stud, stopping within 1/2-inch of the bottom of the beam. Run the drywall up past the beam, if it is possible, to within 1/2-inch of the deck above. Pack the space between the beam and the edge of the wall with 4-5 PCF insulation. Insulation should be snug fit so that no device to hold the material in place is required. Apply a continuous bead of acoustical sealant between bottom flange of beam and insulation and the wall.

3. These intersections shall be installed in a manner that results in complete air tightness through the structure.

END OF SECTION

SECTION 22 00 00 -
PLUMBING BASICS

PART 1 GENERAL

1.01. SCOPE:

A. Install all fixtures as shown on the plans. Field verify exact locations.

B. Provide all equipment and specialties shown on the plans or specified herein.

C. Provide all necessary support, trim and accessories required.

D. All fixtures indicated to be ADA compliant shall be installed in full compliance with ADA guidelines.

1.02. Fixtures shall be equal to those scheduled on the Drawings.

1.03. All items furnished under this section shall be submitted for approval prior to ordering.

1.04. Fixtures shall meet all applicable code requirements and all authorities having jurisdiction.

PART 2 PRODUCTS

2.01. GENERAL:

A. Fixtures shall be non-absorbent throughout and free from waves, kiln marks or discoloration.

B. All surfaces coming in contact with walls, floors or other flat surfaces shall be flat.

C. All enameled iron ware shall be acid-resisting.

2.02. TRIM:

A. All exposed finished metal parts shall be chromium-plated; except, rough-bodied parts shall be nickel-plated.

B. All supplies shall be IPS brass; except, where otherwise specified.

C. All fixtures will be provided with supply stop.

D. Traps for lavatories and sinks shall be chrome-plated cast brass P-traps with clean-out.

E. Provide cast brass, chrome-plated, set screw type, escutcheons on supply and waste piping.

F. All trim for ADA fixtures shall be ADA-compliant.

2.03. CLEAN OUTS:

A. Caulking plugs: Cast iron cleanouts for caulking into soil pipe hub with straight threaded, plated raised hex head plug having tapered shoulder that seats against seal.

B. Wall cleanouts for dry wall or block construction shall be cast iron caulking ferrule for soil pipe hub, plated cast iron raised head plug with seal, tapped for machine screw, and stainless steel round access cover plate secured to plug by counter-sunk brass screw.

C. Wall cleanouts for plaster for tile wall construction shall be cast iron caulking ferrule for soil pipe hub, plated cast iron raised head plug with seal, tapped for machine screw, and cast Nickel alloy round flush access cover with polished top, anchor lugs, and cover plate secured to plug by counter-sunk brass screw.

D. Floor cleanouts shall be adjustable cast iron floor cleanout, coated cast iron internal cleanout plug with seal, polished nickel alloy rim and round scoriated cover plate, secured to plug by counter-sunk screw. Provide recessed top where cleanout occurs in tile floor. Provide cleanout marker when cleanout occurs in carpet.

E. Cleanouts to grade shall be cast iron cleanout, plated cast iron counter-sunk plug with seal, adjustable head and heavy-duty loose set round scoriated tractor cover.

2.04. WATER HEATERS:

A. Provide tank water heaters with ASTM rated T&P valve. T&P valve shall discharge per authority having jurisdiction, full size to outside the building or to an indirect waste receptor by means of an air gap.

B. Provide tank water heater with drain pan per authority having jurisdiction.

C. Provide tank water heater with Thermal Expansion tank per authority having jurisdiction.

PART 3 EXECUTION

3.01. All fixtures subject to damage prior to completion of building shall be protected in an approved manner. Job must be turned over to Owner with all fixtures clean and free from damage.

3.02. All wall-hung water closets and urinals shall be supported on chair carriers.

3.03. Unless specified to be furnished with chair carrier, wall-hung lavatories, sinks, and other fixtures. shall be secured to wall with back-up plate and threaded rods. Contractor shall provide all backing, reinforcing, hangers, bolts, anchors and brackets required.

3.04. Fixtures mounted and on uneven surfaces shall be bedded in an approved manner as per fixture manufacturer, owner, and engineer.

3.05. All hot and cold water supplies to plumbing fixtures or to shower heads shall have a drop-ear fitting secured to prevent movement.

3.06. AMERICANS WITH DISABILITIES ACT

A. All plumbing facilities shall be installed in compliance with the requirements of the Americans with Disabilities Act. Requirements include the following:

1. Water closet flush controls shall be mounted on the wide side of the toilet area.

2. Tub controls shall be mounted on the end wall on the entry side of the tub centerline.

3. Shower controls on stalls up to 36” wide shall be mounted on the side wall opposite the seat on the entry side of the shower centerline, and on stalls up to 60” wide shall be mounted on the back wall on the right side of the centerline.

4. Hot water piping and traps on fixtures supplied with hot water shall be insulated.

5. All controls and operating mechanisms shall be operable with one hand and without tight grasping, pinching, or twisting of the wrist.

B. Fixture and controls mounting heights, clear knee space, access clearances, etc. shall comply with ADA required dimensions, and as on details or schedules when shown.

3.07. Do not route piping through electrical or electronic enclosures, or above electrical gear located in other areas unless unavoidable. Install drip pan under piping which must be run through electrical spaces. Installation to be per National Electrical Code and as approved by local authority.

END OF SECTION

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SECTION 22 0015
FIRESTOPPING AND SMOKE STOPPING

PART 1 - GENERAL

1.01. SUMMARY

A. Section includes:

1. Through-penetration firestopping in fire rated construction.

B. Scope:

1. The scope of the work shall include the mechanical systems, HVAC piping and ductwork, plumbing piping, fire protection piping, and other systems installed by the contractor.

1.02. 1.02 REFERENCES

A. Underwriters Laboratories

1. U.L. Fire Resistant Directory

a. Through-penetration firestop devices (XHCR)

b. Fire resistance ratings (BXUV)

c. Through-penetration firestop systems (XHEZ)

d. Fill, void, or cavity material (XHHW)

B. American Society for Testing and Materials Standards:

1. ASTM E 814-88: Standard Test Method for Fire Tests of Through-Penetration Firestops.

1.03. 1.03 DEFINITIONS

A. Assembly: Particular arrangement of materials specific to given type of construction described or detailed in referenced documents.

B. Barriers: Time rated fire walls, time rated ceiling/floor assemblies, and structural floors.

C. Firestopping: Methods and materials applied in penetrations and unprotected openings to limit spread of heat, fire, gasses and smoke.

D. Penetration: Opening or foreign material passing through or into barrier or structural floor such that full thickness of rated materials is not obtained.

E. System: Specific products and applications, classified and numbered by Underwriters Laboratories, Inc. to close specific barrier penetrations.

F. Sleeve: Metal fabrication or pipe section extending through thickness off barrier and used to permanently guard penetration. Sleeves are described as part of penetrating system in other sections and may or may not be required.

1.04. SYSTEM DESCRIPTION

A. Design Requirements

1. Fire-rated construction: Maintain barrier and structural floor fire resistance ratings including resistance to cold smoke at all penetrations, connections with other surfaces or types of construction, at separations required to permit building movement and sound or vibration absorption, and at other construction gaps.

2. Smoke barrier construction: Maintain barrier and structural floor resistance to cold smoke at all penetrations, connections with other surfaces and types of construction and at all separations required to permit building movement and sound or vibration absorption, and at other construction gaps.

1.05. SUBMITTALS

A. Submit in accordance with general conditions unless otherwise indicated.

B. Product data: Manufacturer's specifications and technical data including the following:

1. Detailed specification of construction and fabrication

2. Manufacturer's installation instructions.

C. Shop drawings: Indicate dimensions, description of materials and finishes, general construction, specific modifications, component connections, anchorage methods, hardware, and installation procedures, plus the following specific requirements.

1. Details of each proposed assembly identifying intended products and applicable UL System number, or UL classified devices.

2. Manufacturer or manufacturers’ representative shall provide qualified engineering judgements and drawings relating to non-standard applications as needed.

D. Quality control submittals:

1. Statement of qualifications.

E. Applicators' qualifications statement:

1. List past projects indicating required experience.

1.06. QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

B. Applicator: Company specializing in performing the work of this section with minimum three years documented experience and approved by manufacturer.

1.07. REGULATORY REQUIREMENTS

A. Conform to applicable code for fire resistance ratings and surface burning characteristics.

B. Provide certificate of compliance from authority having jurisdiction indicating approval of combustibility.

1.08. ENVIRONMENTAL REQUIREMENTS

A. Do not apply materials when temperature of substrate material and ambient air is below 60 degrees F.

B. Maintain this minimum temperature before, during, and for 3 days after installation of materials.

C. Provide ventilation in areas to receive solvent cured materials.

D. Furnish forced air ventilation during installation if required by manufacturer.

E. Keep flammable materials away from sparks or flame.

F. Provide masking and drop cloths to prevent contamination of adjacent surfaces by firestopping materials.

G. Comply with manufacturing recommendations for temperature and humidity conditions before, during and after installation of firestopping.

1.09. SEQUENCING

A. Sequence work to permit firestopping materials to be installed after adjacent and surrounding work is complete.

1.10. QUALITY ASSURANCE

A. Installer's qualifications: Firm experienced in installation or application of systems similar in complexity to those required for this project, plus the following:

1. Acceptable to or licensed by manufacturer, State or local authority where applicable.

2. At least 2 years experience with systems.

3. Successfully completed at least 5 comparable scale projects using this system.

B. Local and State regulatory requirements: Submit forms or acceptance for proposed assemblies not conforming to specific UL Firestop System numbers, or UL classified devices.

C. Materials shall have been tested to provide fire rating at least equal to that of the construction.

1.11. DELIVERY, STORAGE, AND HANDLING

A. Packing and shipping:

1. Deliver products in original unopened packaging with legible manufacturer's identification.

2. Coordinate delivery with scheduled installation date, allow minimum storage at site.

B. Storage and protection: Store materials in a clean, dry, ventilated location. Protect from soiling, abuse, moisture and freezing when required. Follow manufacturer's instruction.

1.12. PROJECT CONDITIONS

A. Existing conditions:

1. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.

2. Proceed with installation only after penetrations of the substrate and supporting brackets have been installed.

1.13. GUARANTEE

A. Submit copies of written guarantee agreeing to repair or replace joint sealers which fail in joint adhesion, co-adhesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, or general durability or appear to deteriorate in any other manner not clearly specified by submitted manufacturer's data as an inherent quality of the material for the exposure indicated. The guarantee period shall be one year from date of substantial completion.

PART 2 PRODUCTS

2.01. THROUGH-PENETRATION FIRESTOPPING OF FIRE-RATED CONSTRUCTION

A. Systems or devices listed in the U.L. Fire Resistance Director under categories XHCR and XHEZ may be used, providing that it conforms to the construction type, penetrant type, annular space requirements and fire rating involved in each separate instance, and that the system be symmetrical for wall applications. Systems or devices must be asbestos-free.

1. Additional requirements: Withstand the passage of cold smoke either as an inherent property of the system, or by the use of a separate product included as a part of the U.L. system or device, and designed to perform this function.

2. Acceptable manufacturers and products: Those listed in the U.L. Fire Resistance directory for the U.L. System involved and as further defined in Part 3.06 of this section.

3. All firestopping products must be from a single manufacturer. All trades shall use products from the same manufacturer.

4. Products shall be 3M firestopping products and systems or equal.

2.02. SMOKE-STOPPING AT SMOKE PARTITIONS

A. Through-Penetration Smoke-Stopping: Any system complying with the requirements for through-penetration firestopping in fire-rated construction, as specified in this section, is acceptable, provided that the system includes the specified smoke seal or will provide a smoke seal. The length of time of the fire resistance may be disregarded.

B. Construction-Gap Smoke-Stopping: Any system complying with the requirements for construction-gap firestopping in fire-rated construction, as specified in this section, is acceptable, provided that the system includes the specified smoke seal or will provide a smoke seal. The length of time of the fire resistance may be disregarded.

2.03. MATERIALS

A. Firestopping Material: Single or multiple component silicone elastomeric rubber type foam compound mixed with incombustible non-asbestos ceramic fibers.

B. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces.

2.04. 2.04 ACCESSORIES

A. Fill, void or cavity materials: As classified under category XHHW in the U.L. Fire Resistance Directory.

B. Forming materials: As classified under Category XHKU in the U.L. Fire Resistance Directory.

PART 3 EXECUTION

3.01. EXAMINATION

A. Verification of conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.

1. Verify barrier penetrations are properly sized and in suitable condition for application of materials.

2. Do not proceed until unsatisfactory conditions have been corrected.

3.02. SURFACE PREPARATION

A. Clean surfaces to be in contact with penetration seal materials, of dirt, grease, oil, loose materials, rust, or other substances that may affect proper fitting, adhesion, or the required fire resistance.

3.03. INSTALLATION

A. Apply primer and materials in accordance with manufacturer’s instructions.

B. Install penetration seal materials in accordance with printed instruction of the U.L. Fire Resistance Directory and in accordance with manufacturer's instruction.

C. Seal holes or voids made by penetrations to ensure an effective smoke barrier.

D. Where floor openings without penetrating items are more than four inches in width and subject to traffic or loading, install firestopping materials capable of supporting same loading as floor.

E. Apply firestopping material in sufficient thickness to achieve rating and to a uniform density and texture.

F. Protect materials from damage on surfaces subject to traffic.

G. Install material at walls or partition openings which contain penetrating sleeves, piping, ductwork, conduit and other items requiring firestopping.

H. Place firestopping in annular space around fire dampers before installation of damper's anchoring flanges - installed in accordance with fire damper manufacturer's recommendations.

I. Where large openings are created in walls or floors to permit installation of pipes, ducts, cable tray, bus duct or other items, close unused portions of opening with firestopping material tested for the application. See U.L. Fire Resistance Directory.

J. Install smoke stopping as specified for firestopping.

K. Where rated walls are constructed with horizontally continuous air space, double width masonry, or double stud frame construction, provide vertical 12-inch-wide fiber dams for full thickness and height of air cavity at maximum 15-foot intervals.

L. Dam material to remain.

3.04. FIELD QUALITY CONTROL

A. Examine penetration sealed areas to ensure proper installation before concealing or enclosing areas.

B. Keep areas of work accessible until inspection by applicable code authorities.

C. Perform under this section patching and repairing of firestopping caused by cutting or penetration by other trades.

3.05. ADJUSTING AND CLEANING

A. Clean adjacent surfaces of firestopping materials.

B. Clean up spills of liquid components.

C. Neatly cut and trim materials as required.

D. Remove equipment, materials and debris, leaving area in undamaged, clean condition.

3.06. PROTECTION OF FINISHED WORK

A. Protect adjacent surfaces from damage by material installation.

3.07. SYSTEMS AND APPLICATION

A. The installation shall be as required by manufacturer for type of construction, Type of U.L. systems, type of penetration, and type of fire stopping system.

END OF SECTION

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SECTION 220030
ELECTRICAL REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY:

A. This section specifies the basic requirements for electrical components which are to be provided for operation of mechanical equipment. These components include, but are not limited to, motors, starters, and disconnect switches when indicated, furnished as an integral part of packaged mechanical equipment, or furnished separately for mechanical equipment.

B. Furnish all motor controllers and contactors, not furnished as part of a motor control center, for proper operation of all motors.

C. Specific electrical requirements (i.e., horsepower and electrical characteristics) for mechanical equipment are specified within the individual equipment specification sections and scheduled on the drawings.

1.02 REFERENCES:

A. NEMA Standards MG 1: Motors and Generators.

B. NEMA Standard ICS 2: Industrial Control Devices, Controllers, and Assemblies.

C. NEMA Standard 250: Enclosures for Electrical Equipment.

D. NEMA Standard KS 1: Enclosed Switches.

E. National Electric Code (NFPA 70).

1.03 SUBMITTALS:

A. Separate submittal is not required. Submit product data for motors, starters, and other electrical components with submittal data required for the equipment for which it serves, as required by the individual equipment specification sections.

1.04 QUALITY ASSURANCE:

A. Electrical components and materials shall be UL labeled.

B. The electrical work shall comply with the National Electric Code.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Equipment shall be by same manufacturer, except those items furnished by an equipment manufacturer as an integral part of his equipment. Where possible the equipment shall be by the same manufacturer specified by electrical.

2.02 MOTORS: The following are basic requirements for simple or common motors. For special

motors, more detailed and specific requirements are included in the individual equipment specifications.

A. Torque characteristics shall be sufficient to satisfactorily accelerate the driven loads.

B. Motor sizes shall be large enough so that the driven load will not require the motor to operate in the service factor range.

C. 2-speed motors shall have 2 separate windings on poly-phase motors.

D. Temperature Rating: Rated for 40 degree C (104 degree F). environment with maximum 90 degree C (194 degree F) rise for continuous duty at full load (Class B insulation).

E. Starting Capability: Frequency of starts as indicated by automatic control system, and not less than 5 evenly spaced starts per hour for manually controlled motors.

F. Service Factor: 1.15 for poly-phase motors and 1.35 for single phase motors.

G. Motor Construction: NEMA Standard MG 1, general purpose, continuous duty, Design "B", except "C" where required for high starting torque.

1. Frames: NEMA Standard No. 48 or 56; use driven equipment manufacturer's standards to suit specific application.

2. Bearings:

a. Ball or roller bearings with inner and outer shaft seals.

b. Re-greasable, except permanently sealed where motor is normally inaccessible for regular maintenance.

c. Designed to resist thrust loading where belt drives or other drives produce lateral or axial thrust in motor.

d. For fractional horsepower, light duty motors, sleeve type bearings are permitted.

3. Enclosure Type:

a. Open drip-proof motors for indoor use where satisfactorily housed or remotely located during operation.

b. Guarded drip-proof motors where exposed to contact by employees or building occupants.

c. Weather protected Type I for outdoor use, Type II where not housed.

4. Overload Protection: Built-in thermal overload protection and, where indicated, internal sensing device suitable for signaling and stopping motor at starter.

5. Noise Rating: "Quiet".

6. Efficiency:

a. Motor shall comply with the efficiency requirements of the Energy

Independence and Security Act of 2007.

b. Motors smaller than 1 HP shall have minimum full load efficiencies levels per NEMA Standards.

c. Motors 1 HP and larger shall be premium efficiency.

7. Nameplate: Indicate the full identification of manufacturer, ratings, characteristics, construction, special features and similar information.

2.03 STARTERS, ELECTRICAL DEVICES, AND WIRING:

A. Motor Starter Characteristics:

1. Enclosures: NEMA 1, general purpose enclosures with padlock ears, except in wet locations shall be NEMA 3R or NEMA 12 with conduit hubs installed by contractor, or units in hazardous locations which shall have NEC proper class and division.

2. Type and size of starter shall conform to adopted standards and recommended practices of the National Electric Code and Underwriters' Laboratories.

B. Manual Switches: Manual switches shall have:

1. Pilot lights and extra positions for multi-speed motors.

2. Overload protection: Melting alloy type thermal overload relays.

3. Manual starters / switches are to be used on fractional horsepower motors only.

C. Magnetic Starters:

1. Momentary contact push buttons and pilot lights, properly arranged for single speed or multi-speed operation as indicated.

2. Trip-free thermal overload relays, each phase.

3. Interlocks, witches and similar devices as required for coordination with control requirements of controls sections.

4. Built-in 120 volt control circuit transformer, with 2 primary and one secondary fuse, where service exceeds 240 volts. Fuses sized to carry holding coil circuit and other connected devices.

5. Externally operated manual reset.

6. Under-voltage release or protection (3-wire control).

7. Branch circuit protection shall meet type 2 coordination protection.

8. A hand-off-auto selector switch shall be provided in addition to start-stop buttons for all devices being controlled automatically.

9. Phase loss relay.

a. Provide protective relays with DPDT 600V rated contacts, locking potentiometer undervoltage adjustment, and LED indicating light at each starter for motors greater than 5 HP. Equal to Square D Class 8430, Type MPD, mounted in suitable enclosure.

D. Motor Connections:

1. Flexible conduit, except where plug-in electrical cords are specifically indicated.

E. Heater Contactors:

1. Contactors for resistance heat shall be by same manufacturer as starters unless furnished with heaters. Contactors shall be of the magnetic type and mounted in NEMA Type 1 general purpose enclosure. Contactors shall carry a UL listing and shall be rated for 100,000 cycles.

F. Disconnect Switches:

1. Fusible Switches: Fused, each phase; heavy duty; horsepower rated; non-teasible, quick-make, quick-break mechanism; dead front line side shield; solderless lugs suitable for copper or aluminum conductors; spring reinforced fuse clips; electro silver plated current carrying parts; hinged doors; operating lever arranged for locking in the "open" position; arc quenchers; capacity and characteristics as indicated.

2. Non-fusible Switches: For equipment less than 1 horsepower, switches shall be horsepower rated; toggle switch type; quantity of poles and voltage rating as indicated. For equipment 1 horsepower and larger, switches shall be the same as fusible type.

2.04 CAPACITORS:

A. Features:

1. Individual unit cells, all welded steel housing, each capacitor internally fused, non-flammable synthetic liquid impregnant, craft tissue insulation, and aluminum foil electrodes.

2. KVAR size shall be as required to correct motor power factor to 90 percent or better and shall be installed on all motors 1 horsepower and larger that have an uncorrected power factor of less than 85 percent at rated load.

PART 3 - EXECUTION

3.01 GENERAL

A. Install motors on motor mounting systems in accordance with motor manufacturer's instructions, securely anchored to resist torque, drive thrusts, and other external forces inherent in mechanical work. Secure sheaves and other drive units to motor shafts with keys and Allen set screws, except motors of 1/3 hp and less may be secured with Allen set screws on flat surface of shaft. Unless otherwise indicated, set motor shafts parallel with machine shafts.

B. Deliver starters and wiring devices which have not been factory-installed on equipment unit to electrical installer for installation.

C. Install starters and wiring devices at locations indicated, securely supported and anchored, and in accordance with manufacturer's installation instructions. Locate for proper operation access, including visibility, and for safety. Do not cover equipment data or informational tags when device is to be mounted on equipment.

D. Install control connections for motors to comply with NEC and applicable provisions of Electrical. Install equipment grounding except where non-grounded isolation of motor is indicated.

E. Connect protective relays to line side lugs of the motor starter and wire control contacts into motor starter circuit.

F. Label starters with engraved plastic nameplate describing the equipment served, e.g., "A.C. Unit No. 1". Nameplates shall be U.V. stabilized for use indoor / outdoor. Attach nameplates with clear silicone sealant.

END OF SECTION

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SECTION 22 00 75
PLUMBING IDENTIFICATION

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes the following mechanical identification applications:

1. Equipment identification.
2. Pipe identification.
3. Valve tags.
4. Valve schedule.

1.2 SUBMITTALS

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

B. Product Schedule: Provide schedule indicating each type of identification material to be used for equipment, piping, and ductwork. Indicate colors to be used.

C. Valve Schedule: Submit a valve schedule for each piping system, typewritten and reproduced on 8-1/2" x 11" bond paper. Provide three (3) copies. Mark valves which are intended for emergency shut-off, normally open, normally closed, and similar special uses by special flag in the margin of the schedule. Include the following for each valve:

1. Valve identification number
2. System
3. Purpose
4. Location
5. Type
6. Size
7. Manufacturer

1.3 QUALITY ASSURANCE

A. ASME Compliance: Comply with ASME A13.1, "Scheme for the Identification of Piping Systems", for letter size, length of color field, for colors not included in the schedule herein, and for viewing angles of identification devices for piping.

1.4 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with location of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 PRODUCTS

2.1 EQUIPMENT IDENTIFICATION

A. Engraved Plastic Laminate Identification Signs

1. General: Provide engraving stock melamine plastic laminate in the sizes and thicknesses indicated, with engraver's standard letter style, black with white core (letter color) except as otherwise indicated, punched for mechanical fastening except where using adhesive mounting.

2. Thickness: 1/16 inch for units up to 20 inches square or 8 inch length; 1/8 inch for larger units.

3. Fasteners: Self tapping stainless steel screws except use contact-type, permanent adhesive where screws cannot or should not penetrate the substrate. Where sign cannot be attached directly to device or equipment, attach with brass chain.

4. Letter sizes: Minimum ¼ inch for names of units if viewing distance is less than 24 inches, ½ inch for viewing distances up to 72 inches, and proportionally larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of the principal lettering.

2.2 PIPE IDENTIFICATION

A. Subject to compliance with requirements, provide pipe markers by one of the following:

1. Seton
2. Brady
3. Brimar
4. EMED

B. All above grade piping shall be identified with pipe markers with colors as indicated. Identification shall have proper legend and meet OSHA specifications. Comply with ASME A13.1, unless otherwise noted.

C. For piping where diameter including insulation is less than 8 inch, pipe markers shall be plastic, pre-tensioned, semi-rigid type that encircles entire pipe without the use of adhesives. Tape and sticker types are unacceptable.

D. For piping where diameter including insulation is 8 inch or greater, pipe markers shall be plastic, full-band, semi-rigid type strapped to pipe using manufacturer's standard stainless steel bands.

E. Underground line markers: Manufacturer's standard permanent, bright colored, continuous printed, plastic tape intended for direct burial service, not less than 6" wide and 4 mils thick. Provide tape with printing which most accurately indicates the type of buried pipe.

F. Identification Schedule:

Piping System	Legend	Band/Text Color
1. Plumbing Piping System		
Cold Water	Cold Water	Green/White
Hot Water	Hot Water	Green/White

Hot Water Return	Hot Water Return	Green/White

2. Gas Piping System

Low Pressure Natural Gas	Low Pressure Gas	Yellow/Black
High Pressure Natural Gas	High Pressure Gas	Yellow/Black
Gas Vent	Gas Vent	Yellow/Black
LP Gas	Propane Gas	Yellow/Black

3. Sanitary Sewer System

Sanitary Waste	Sanitary Sewer	Green/White
Sanitary Vent	Sanitary Vent	Green/White
Acid Waste	Acid Waste	Orange/Black

4. Storm Drain System

Storm Drain	Storm Drain	Green/White

5. Miscellaneous Piping Systems

Compressed Air	Air (PSI)	Blue/White
Vacuum - Process	Vacuum	White/Black
Fuel Oil Supply	Fuel Oil Supply	Yellow/Black
Fuel Oil Return	Fuel Oil Return	Yellow/Black
De-Ionized Water	De-Ionized Water	Green/White
Distilled Water	Distilled Water	Green/White
Oxygen	Oxygen	Green/White
Lawn Sprinkler	Non-Potable Water	Green/White

G. Arrows and lettering shall be black. Arrows shall point in the direction of flow. Locate downstream of pipe legend.

H. Arrows shall be of same color as bands and shall point in direction of flow. Locate downstream of pipe legend.

I. Valve Identification: Provide brass tags for all valves and steam traps with legend describing function of each valve and trap. Tag shall also indicate normally open or normally closed, where position is noted on the drawings.

J. Valve Tags: Brass tags shall be a minimum of 2" diameter or 3-1/2" oval, to accommodate 1" high numbers. Tag shall be equipped with a 3/16" X 6" long brass chain.

2.3 STENCILS

A. Prepared with letter sizes according to ASME A13.1 for piping; minimum letter height of 1-1/4” for ducts; and minimum letter height of ¾” for equipment and access door signs. Use alkyd paint. Use stencils only as directed herein.

PART 3 EXECUTION

3.1 EQUIPMENT IDENTIFICATION

A. Provide permanent, factory, operational data, nameplate on each item of power operated mechanical equipment, indicating manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data. Locate nameplates in an accessible location. Where manufacturer's nameplate is not stamped or engraved, provide additional heavy gauge, aluminum or brass, stamped or engraved nameplate. Do not remove manufacturer's nameplates. When manufacturer's nameplates are to be covered by insulation or other material, provide a separate nameplate for mounting on the exterior of the covering.

B. In addition to factory nameplate, provide an engraved plastic laminate (stenciled) identification sign for each major item of mechanical equipment and each operational device. Provide identification signs for the following general categories of equipment.

1. Main control and operating valves, including safety devices and hazardous units such as gas outlets.

2. Compressors, pumps, and similar motor-driven units.

3. Tanks and pressure vessels.

4. Strainers, filters, humidifiers, water treatment systems, and similar equipment.

5. Control panels.

6. Fuel burning units, such as boilers, furnaces, and heaters.

C. Provide engraved sign at each access door, indicating equipment or device to be accessed.

D. Coordinate names, abbreviations, and other designations used in equipment identification with corresponding designations shown, specified, scheduled, or as designated by the Owner's representative. Provide numbers, lettering, and wording as indicated or as directed by the Owner's representative. Owner shall set priority for lettering and graphics. Where multiple systems of the same generic name are shown and specified, provide identification which indicates individual system number as well as service (as examples; Boiler No. 3, AHU-1H, Standpipe G14).

E. Provide Ceiling Grid Labels for Equipment:

1. Letter Color: Black

2. Background Color: White

3. Minimum Label Size: Length may vary for required label content, but dimensions shall not be less than 2-1/2 by 3/4 inch.

4. Minimum Letter Size: 1/2 inch.

5. Self adhesive, compatible with label and with substrate.

6. Locate on ceiling grid or access door nearest access side of equipment.

3.2 PIPE IDENTIFICATION

A. Provide 1” thick molded fiberglass insulation with jacket under each plastic pipe marker to be installed on uninsulated pipes where fluid temperatures will be 125°F or greater. Insulation shall extend 4” beyond edges of marker.

B. Valve tags and steam traps shall be numbered as indicated on the valve listing provided to the Owner.

C. As a minimum, identification shall be applied to piping at the following locations:

1. Adjacent to each valve.

2. At each branch and riser take-off.

3. At each pipe passage through wall, floor, and ceiling construction.

4. At each pipe passage to underground.

5. At not more than forty feet spacing on straight pipe runs.

D. Place identification so it can be easily read. Arrows shall be applied to indicate direction of flow.

E. Underground Piping: During back-filling of each exterior underground piping system, install plastic line marker, located directly over buried line no deeper than 8” below finished grade. Where multiple small lines are buried in common trench and do not exceed overall width of 16”, install a single line marker.

END OF SECTION

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SECTION 22 0086
PIPING INSULATION

PART 1 - GENERAL

1.01. SUMMARY

A. Perform all Work required to provide and install piping insulation, jackets, and accessories indicated by the Contract Documents with supplementary items necessary for proper installation.

B. Insulation of Underground Piping is specified elsewhere and not work of this Section.

1.02. REFERENCE STANDARDS

A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.

B. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.

C. All materials, installation and Workmanship shall comply with the applicable requirements and standards addressed within the following references:

1. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.

2. ASTM C168 - Terminology Relating to Thermal Insulation Materials.

3. ASTM C177 - Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded- Hot-Plate Apparatus.

4. ASTM C195 - Mineral Fiber Thermal Insulating Cement.

5. ASTM C335 - Steady-State Heat Transfer Properties of Horizontal Pipe Insulation.

6. ASTM C449 - Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.

7. ASTM C518 - Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

8. ASTM C534 - Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.

9. ASTM C547 - Mineral Fiber Pipe Insulation.

10. ASTM C552 - Cellular Glass Thermal Insulation.

11. ASTM C578 - Rigid, Cellular Polystyrene Thermal Insulation.

12. ASTM C585 - Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System).

13. ASTM C591 - Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.

14. ASTM C450 - Thermal Insulating Fitting Covers for NPS Piping, and Vessel Lagging.

15. ASTM C610 - Molded Expanded Perlite Block and Pipe Thermal Insulation.

16. ASTM C921 - Jackets for Thermal Insulation.

17. ASTM C1126 - Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation.

18. ASTM D1056 - Flexible Cellular Materials - Sponge or Expanded Rubber.

19. ASTM D1667 - Flexible Cellular Materials – Poly (Vinyl Chloride) Foam (Closed-Cell).

20. ASTM D2842 - Water Absorption of Rigid Cellular Plastics.

21. ASTM C795 - Insulation For Use Over Austenitic Steel.

22. ASTM E84 - Surface Burning Characteristics of Building Materials.

23. ASTM E96 - Water Vapor Transmission of Materials.

24. NFPA 255 - Surface Burning Characteristics of Building Materials.

25. UL 723 - Surface Burning Characteristics of Building Materials.

26. ASTM D5590 - Standard Test Method for Determining the Resistance of Paint Films and Related Coatings to Fungal Defacement by Accelerated Four-Week Agar Plate Assay

1.03. DEFINITIONS

A. Concealed: Areas that cannot be seen by the building occupants.

B. Interior Exposed: Areas that are exposed to view by the building occupants, including underneath countertops, inside cabinets and closets, and all equipment rooms.

C. Interior: Areas inside the building exterior envelope that are not exposed to the outdoors.

D. Exterior: Areas outside the building exterior envelope that are exposed to the outdoors, including building crawl spaces and loading dock areas.

E. Unconditioned Space: Interior space that is not temperature-controlled by cooling and/or heating system. Includes attics, chases, unconditioned living spaces and non-conditioned equipment rooms.

1.04. QUALITY ASSURANCE

A. All piping requiring insulation shall be insulated as specified herein and as required for a complete system. In each case, the insulation shall be equivalent to that specified and materials applied and finished as described in these Specifications.

B. All insulation, jacket, adhesives, mastics, sealers, and accessories utilized in the fabrication of these systems shall meet NFPA for fire resistant ratings (maximum of 25 flame spread and 50 smoke developed ratings) and shall be approved by the insulation manufacturer for guaranteed performances when incorporated into their insulation system, unless a specific product is specified for a specific application and is stated as an exception to this requirement.

1. Certificates to this effect shall be submitted along with submittal data.

2. No material shall be used that, when tested by the ASTM E84-89 test method, is found to melt, drip or delaminate to such a degree that the continuity of the flame front is destroyed, thereby resulting in an artificially low flame spread rating.

C. Application Company Qualifications: Company performing the Work of this Section shall have minimum three (3) years experience specializing in the trade.

D. All insulation shall be applied by mechanics skilled in this particular Work and regularly engaged in such occupation.

E. All insulation shall be applied in strict accordance with these Specifications and with factory printed recommendations on items not herein mentioned. Unsightly, inadequate, damaged or water-soaked Work will not be acceptable.

F. Stainless Steel: Insulation applied on stainless steel shall meet requirements of ASTM C795 and NRC 1.36. These requirements are for prevention of external stress Corrosion Cracking (ESCC) for austenitic stainless steel.

1.05. SUBMITTALS

A. Prepare a schedule of piping insulation showing systems insulated. For each system, show insulation type, thickness, temperature rating, and special conditions where applicable.

B. Submit product data for each piping system. Product data shall include but not be limited to the following:

1. Manufacturer's name

2. Insulation material and thickness

3. Jacket

4. Adhesives

5. Fastening methods

6. Fitting materials

7. Manufacturer's data sheets indicating density, thermal characteristics, temperature ratings

8. Insulation installation details (manufacturer's installation instructions/details, Contractor's installation details, MICA plates where applicable)

9. Other appropriate data

C. Samples: When requested, submit three (3) samples of any representative size illustrating each insulation type.

D. Operation and Maintenance Data: Indicate procedures that ensure acceptable standards will be achieved. Submit certificates to this effect.

1.06. DELIVERY, STORAGE and HANDLING

A. Deliver materials to the Project Site in original factory packaging, labeled with manufacturer's identification including product thermal ratings and thickness.

B. Store insulation in original wrapping and protect from weather and construction traffic. Protect insulation against dirt, water, chemical, and mechanical damage.

C. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics and insulation cements.

PART 2 - PRODUCTS

2.01. GENERAL

A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

2.02. MANUFACTURERS

A. Insulation:

1. Owens-Corning

2. Certainteed Corporation

3. Johns Manville Corporation

4. Knauf Corporation

5. Armstrong/Armacell (Armaflex)

6. RBX Industries/Rubatex

7. FOAMGLAS (Cellular Glass) by Pittsburgh Corning

B. Jackets:

1. Childers Products Company

2. PABCO

3. RPR Products, Inc.

4. John Mansfield Speedline

5. Foamglas

C. Coatings, Sealants, and Adhesives:

1. Foster

2. Childers

2.03. INSULATION MATERIALS

A. Products shall not contain asbestos, lead, mercury, or mercury compounds.

B. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

C. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

D. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

E. Piping Insulation Type P1: Glass-Fiber, Preformed Pipe Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A with factory applied ASJ-SSL vapor barrier jacket with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I. Provide one of the following:

1. Owens Corning; Evolution Fiberglas Pipe Insulation.

2. Johns Manville; Micro-Lok Pipe Insulation.

3. Knauf; Earthwool 1000 degree Pipe Insulation.

F. Piping Insulation Type P2: Flexible Elastomeric Pipe Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials. Provide one of the following:

1. Armacell LLC; AP Armaflex

2. Aeroflex USA Inc; Aerocel

3. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.

G. Piping Insulation Type P3: Handicap Lavatory and Sink Piping Insulation Kit:

1. Handicap lavatory and sink drain piping, P-trap, cold and hot water assemblies and valves shall be insulated with fully molded insulation kit specifically designed for handicap lavatories and sinks. ADA conforming.

2. Material shall be 3/16" thick molded closed cell vinyl with nylon fasteners, white finish and be self-extinguishing per ASTM D635, with K value of 1.17 BTU/in./hr./sq. ft./deg. F.

H. Piping Insulation Type P4: Preformed Cellular Glass: Comply with ASTM C 585, ASTM C 450. Provide one of the following:

1. Pittsburgh Corning; Foamglas

2.04. FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in., in a Leno weave, for pipe. Provide one of the following:

1. Foster Brand, Specialty Construction Brands, Inc; Mast-A-Fab.

2. Vimasco Corporation; Elastafab 894.

2.05. FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. Piping Jacket Type J1: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; 40 mil thickness, roll stock ready for shop or field cutting and forming. Provide factory-fabricated fitting covers to match jacket. Provide one of the following

1. Johns Manville; Zeston.

2. Proto Corporation; LoSmoke

C. Piping Jacket Type J2: Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14. Provide factory-fabricated fitting covers or field fabricate covers only if factory-fabricated fitting covers are not available. Provide one of the following:

1. Provide Childers Brand Metal Jacketing Systems.

2. Provide shop fabricated smooth aluminum jacket 0.016".

2.06. TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Width: 3 inches.

2. Thickness: 11.5 mils.

3. Adhesion: 90 ounces force/inch in width.

4. Elongation: 2 percent.

5. Tensile Strength: 40 lbf/inch in width.

6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

1. Width: 2 inches.

2. Thickness: 6 mils.

3. Adhesion: 64 ounces force/inch in width.

4. Elongation: 500 percent.

5. Tensile Strength: 18 lbf/inch in width.

2.07. INSULATION INSERTS

A. Provide insert between support shield and piping on piping 1 1/2" diameter or larger. Inserts shall be factory fabricated of heavy density insulating material suitable for temperature. Insulation inserts shall not be less than the following lengths:

1. 1 1/2" to 2 1/2" pipe size 10" long

2. 3" to 6" pipe size 12" long

3. 8" to 10" pipe size 16" long

4. 12" and over 22" long

2.08. PIPE INSULATION ACCESSORIES

A. Vapor Retarder Lap Adhesive: Compatible with insulation.

B. Covering Adhesive Mastic: Compatible with insulation.

C. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12-inch centers.

D. Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement: ASTM C449/C449M.

E. Insulating Cement: ASTM C195; hydraulic setting on mineral wool.

F. Adhesives: Compatible with insulation.

G. Banding:

1. Aluminum bands, 3/4" x 0.02 inches

2. Stainless Steel, 304, 3/4" by 0.02 inches

PART 3 - EXECUTION

3.01. PREPARATION

A. Thoroughly clean all surfaces to be insulated as required to remove all oil, grease, loose scale, rust, and foreign matter. Piping shall be completely dry at the time of application. Insulating piping where condensate is occurring is unacceptable. Wet insulation is unacceptable and shall be removed and replaced before acceptance by the Owner.

B. Coordinate insulation installation with trade installing heat trace. Comply with requirements for heat tracing that apply to insulation.

C. Verify that piping has been tested for leakage before applying insulation.

3.02. GENERAL INSTALLATION REQUIREMENTS

A. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards, and shall conform to codes and ordinances of authorities having jurisdiction.

B. Installation of insulation and jacket materials shall be in accordance with manufacturer's published instructions.

C. Handle and install materials in accordance with manufacturer's instructions in the absence of specific instructions herein.

D. On exposed piping, locate insulation cover seams with the ridge of the lap joint is directed down.

E. Provide dams in insulation at intervals not to exceed 20 feet on cold piping systems to prevent migration of condensation or fluid leaks. Indicate visually where the dams are located for maintenance personnel to identify and also provide dams at butt joints of insulation at fittings, flanges, valves, and hangers.

F. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

G. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

H. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

I. Install insulation with longitudinal seams at top and bottom of horizontal runs.

J. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

K. Keep insulation materials dry during application and finishing.

L. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

M. Install insulation with least number of joints practical.

N. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.

2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.

3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

O. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

P. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.

2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive.

3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.

5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

Q. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

R. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

S. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere and seal patches similar to butt joints.

T. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.

2. Testing agency labels and stamps.

3. Nameplates and data plates.

4. Manholes.

5. Handholes.

6. Cleanouts.

3.03. PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.

2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.

4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.

2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.

4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions. Comply with requirements in Section 15050 for firestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.

2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 15050."

3.04. GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.

2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.

3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.

4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.

5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.

6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.

7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.

8. For services not specified to receive a field-applied jacket, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.

9. Stencil or label the outside insulation jacket where concealed unions, check valve or piping specialties are insulated. Provide descriptive label at device under the insulation. For example at each union stencil with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.

2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.

3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.

4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.

5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.05. INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.

2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.

3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.

4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.

2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.

2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.

3. Install insulation to flanges as specified for flange insulation application.

4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.06. INSTALLATION OF GLASS-FIBER PREFORMED PIPE INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.

2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.

3. For insulation with factory-applied jackets on below-ambient surfaces, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.

2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.

3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.

4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.

2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.

2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.

3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.

4. Install insulation to flanges as specified for flange insulation application.

3.07. FIELD-APPLIED JACKET INSTALLATION

A. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications. Seal with manufacturer's recommended adhesive. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

B. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.08. FINISHES

A. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

B. Do not field paint aluminum jackets.

3.09. PIPING SYSTEMS INSULATION SCHEDULE

PIPING SYSTEMS INSULATION TABLE T309.1									
SYSTEM	LOCATION			PIPE SIZE	INSULATION			CARRYING HVAC CONDENSATE	NOTES
					TYPE	THICKNESS	JACKET TYPE		
DOMESTIC COLD WATER	INTERIOR	CONDITIONED	CONCEALED	≤ 0.75"		0.5"	--	--	
				1.0" TO 2.0"		1.0"			
				≥ 2.5"		1.5"			
			EXPOSED	≤ 0.75"		0.5"	--	--	PAINT, COLOR PER ARCHITECT
				1.0" TO 2.0"		1.0"			
				≥ 2.5"		1.5"			
				≤ 0.75"		0.5"	J1	--	IN EQUIPMENT ROOMS, FROM 0ft TO 7ft AFF
				1.0" TO 2.0"	**P1**	1.0"	J1		
				≥ 2.5"		1.5"	J1		
		UNCONDITIONED	CONCEALED OR EXPOSED	≤ 0.75"		1.0"	--	--	
				1.0" TO 2.0"		1.5"			
				≥ 2.5"		2.0"			
	EXTERIOR		CONCEALED OR EXPOSED	≤ 0.75"		1.0"	J2	--	
				1.0" TO 2.0"		1.5"	J2		
				≥ 2.5"		2.0"	J2		

PIPING SYSTEMS INSULATION TABLE T309.2									
SYSTEM	LOCATION			PIPE SIZE	INSULATION			CARRYING HVAC CONDENSATE	NOTES
					TYPE	THICKNESS	JACKET TYPE		
DOMESTIC HOT WATER	INTERIOR	CONDITIONED	CONCEALED	≤ 0.75"		0.5"			
				1.0" TO 2.0"		1.0"	--	--	
				≥ 2.5"		1.5"			
			EXPOSED	≤ 0.75"		0.5"			
				1.0" TO 2.0"		1.0"	--	--	PAINT, COLOR PER ARCHITECT
				≥ 2.5"		1.5"			
				≤ 0.75"		0.5"	J1		
				1.0" TO 2.0"	**P1**	1.0"	J1	--	IN EQUIPMENT ROOMS, FROM 0ft TO 7ft AFF
				≥ 2.5"		1.5"	J1		
		UNCONDITIONED	CONCEALED OR EXPOSED	≤ 0.75"		1.0"			
				1.0" TO 2.0"		1.5"	--	--	
				≥ 2.5"		2.0"			
	EXTERIOR		CONCEALED OR EXPOSED	≤ 0.75"		1.0"	J2		
				1.0" TO 2.0"		1.5"	J2	--	
				≥ 2.5"		2.0"	J2		

PIPING SYSTEMS INSULATION TABLE T309.3

SYSTEM	LOCATION			PIPE SIZE	INSULATION			CARRYING HVAC CONDENSATE	NOTES
					TYPE	THICKNESS	JACKET TYPE		
COOLING COIL CONDENSATE	INTERIOR	CONDITIONED OR UNCONDITIONED	CONCEALED	≤ 3.0"		0.5"	--	YES	
				≥ 4.0"	**P2**	0.75"			
			EXPOSED	≤ 3.0"		0.5"	J1	YES	
				≥ 4.0"		0.75"			
SANITARY SEWER	INTERIOR	UNCONDITIONED	EXPOSED OR CONCEALED	≤ 3.0"	**P2**	0.5"	--	YES	
				≥ 4.0"		0.75"			
STORM DRAIN	INTERIOR	UNCONDITIONED	EXPOSED OR CONCEALED	≤ 3.0"		0.5"	--	YES	INSULATE FROM CONDENSATE DISCHARGE POINT TO FLOOR.
				≥ 4.0"	**P2**	0.75"			
	INTERIOR	CONDITIONED OR UNCONDITIONED	EXPOSED OR CONCEALED	≤ 3.0"		0.5"	--	--	HORIZONTAL PIPING FROM DRAIN TO VERTICAL RISER.
				≥ 4.0"		0.75"			
	INTERIOR	CONDITIONED OR UNCONDITIONED	EXPOSED OR CONCEALED	≤ 3.0"		0.5"	J1	--	IN EQUIPMENT ROOMS, FROM 0ft TO 7ft AFF
				≥ 4.0"		0.75"			

PIPING SYSTEMS INSULATION TABLE T309.4									
SYSTEM	LOCATION			PIPE SIZE	INSULATION			CARRYING HVAC CONDENSATE	NOTES
					TYPE	THICKNESS	JACKET TYPE		
WATER AND DRAIN	INTERIOR	--	EXPOSED	--	P3	--	--	--	AT HANDICAP LAVATORIES

END OF SECTION 22 0086

SECTION 22 0090
SUPPORTS, HANGERS AND ANCHORS

PART 1 GENERAL

1.01. WORK INCLUDED

A. Inserts, Anchors, and Upper Attachments

B. Pipe Hangers, Rods, Supports, and Accessories

C. Fabricated Steel Support

1.02. QUALITY ASSURANCE

A. Design of pipe supporting elements shall be in accordance with ANSI B31.1

B. Fabrication and installation of pipe hangers and supports shall be in accordance with the following Manufacturers Standardization Society (MSS) Standards:

1. SP-58 Pipe Hangers and Supports: Materials, Design and Manufacture.

2. SP-69 Pipe Hangers and Supports: Selection and Application.

3. SP-89 Pipe Hangers and Supports: Fabrication and Installation Practices.

C. Steel angles, channels and plate shall be in accordance with ASTM A36, red primed or hot dipped galvanized for interior applications and hot galvanized for exterior applications.

D. Bolts, including nuts and washers, used for fabricating steel members shall be in accordance with ASTM A325 and shall be stainless steel or plated for corrosion protection. Plain steel components are unacceptable.

E. Welding of steel members shall be in accordance with AWS D1.1.

F. Steel supports for ducts, pipe anchors, pipe guides, and piping supported from below shall be fabricated in accordance with AISC Specification for the Design, Fabrication and Erection of Structural Steel for buildings. If required, the Contractor shall include the cost of the services of a structural engineer to design or review the system.

1.03. APPLICABLE PUBLICATIONS

A. Applicable sections of the publications listed below form a part of this Section. The publications are referenced by the basic designation only.

1. American Institute of Steel Construction (AISC)

2. American National Standards Institute (ANSI)

3. American Society for Testing and Materials (ASTM)

4. American Welding Society (AWS)

5. The Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS)

6. National Fire Protection Agency (NFPA)

7. Sheet Metal and Air Conditioning Contractor's National Association, Inc. (SMACNA)

1.04. SUBMITTALS

A. Submit schedule indicating type of hanger to be used by system and pipe size. Include rod size for each hanger size.

B. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.

C. Provide shop drawings for fabricated steel supports.

PART 2 PRODUCTS

2.01. ACCEPTABLE MANUFACTURERS

A. Inserts, Anchors, and Upper Attachments:

1. Anvil International, Inc.

2. Carpenter Paterson, Inc.

3. Cooper B-Line, Inc.

4. Elecen Metal Products

5. Hilti

6. Unistrut

7. ITW Red Head

B. Pipe Hangers, Rods, Supports and Accessories:

1. Anvil International, Inc.

2. Carpenter Paterson, Inc.

3. Cooper B-Line, Inc.

4. Elcen Metal Products

5. Hilti

6. Unistrut

C. Fabricated Steel Support: As indicated on Drawings.

2.02. DESIGN REQUIREMENTS

A. Supports capable of supporting the pipe for all service and testing conditions. Provide 4-to-1 safety factor.

B. Allow free expansion and contraction of the piping to prevent excessive stress resulting from service and testing conditions or from weight transferred from the piping or attached equipment.

C. Design supports and hangers to allow for proper pitch of pipes.

D. For chemical and waste piping, design, materials of construction, and installation of pipe hangers, supports, guides, restraints, and anchors:

1. ASME B31.3.

2. MSS SP-58 and MSS SP-69.

3. Except where modified by this Specification.

E. For steam and hot and cold water piping, design, materials of construction and installation pipe hangers, supports, guides, restraints and anchors:

1. ASME B31.1

2. MSS SP-58 and MSS SP-69.

F. Check all physical clearances between piping, support system, and structure. Provide for vertical adjustment after erection.

G. Support vertical pipe runs in pipe chases at base of riser. Support pipes for lateral movement with clamps or brackets.

H. Place hangers on outside of pipe insulation. Use a pipe covering protection saddle for insulated pipe at support point.

I. Fabricated Steel Supports: As detailed on the drawings.

2.03. INSERTS AND ANCHORS

A. Inserts: MSS Type 18; malleable iron body and nut, galvanized finish, opening in top of insert for reinforcing rod, lateral adjustable.

B. Anchors: Steel shell and expander plug, snap off end fastener

2.04. HORIZONTAL PIPING HANGERS AND SUPPORTS

A. Select size of hangers and supports to exactly fit pipe size for bare piping, and around piping insulation with saddle or shield for insulated piping.

B. For suspension of non-insulated or insulated stationary pipe lines: Adjustable steel clevices, MSS Type I.

C. For suspension of non-insulated stationary pipe lines: Adjustable band hangers, MSS Type 7 or 9; or split pipe rings, MSS Type II.

D. For support of piping where horizontal movement due to expansion and contraction may occur, and where a low coefficient of friction is desired: Pipe slides and slide plates, MSS Type 35, including guided plate mounted on a concrete pedestal or structural steel support.

E. For support from floor stanchion, using floor flange to secure stanchion to floor: Adjustable pipe stanchion saddles, MSS Type 37 or 38, including steel pipe base support and cast-iron floor flange.

F. For suspension of pipe from two (2) rods where longitudinal movement due to expansion and contraction may occur: Adjustable roller hangers, MSS Type 43.

G. For suspension of pipe from a single rod where horizontal movement due to expansion and contraction may occur: Adjustable roller hangers, MSS Type 43.

H. For support of pipe from a single rod where vertical adjustment is not necessary: Pipe roll stands, MSS Type 45.

I. For support of pipe where small horizontal movement due to expansion and contraction may occur, but vertical adjustment is not necessary: Pipe rolls and plates, MSS Type 45.

J. For support of pipe lines where vertical and lateral adjustment during installation may be required in addition to provision for expansion and contraction: Adjustment pipe rolls stands, MSS Type 46.

2.05. VERTICAL PIPING CLAMPS

A. Select size of vertical piping clamps to exactly fit size of bare pipe.

B. For support and steadying of pipe risers: Two-bolt riser clamps, MSS Type 8 or 42.

2.06. HANGER ROD ATTACHMENTS

A. Select size of hanger rod attachments to suit hanger rods.

B. For adjustment up to six (6) inches for heavy loads: Steel turnbuckles, MSS Type 13.

C. For use on high temperature piping installations: Steel clevices, MSS Type 14.

D. For use with split pipe rings, MSS Type II: Swivel turnbuckles, MSS Type15.

E. For attaching hanger rod to various types of building attachments: Malleable iron sockets, MSS Type 16 or 17.

F. Rods:

1. Size 3/8" and up: All thread steel rod electro galvanized. Sizing for pipe or equipment support as follows:

Copper Tube, Plastic	Steel, Cast Iron

Pipe Size (Copper, Plastic)	Pipe Size (Steel, Cast Iron)	Rod Size	Max. Equip. Load
1/4" to 2"	1/4" to 2"	3/8"	730 lbs.
2-1/2" to 4"	2-1/2" to 3"	1/2"	1,350 lbs.
6"	4"	5/8"	2,160 lbs.
8" to 12"	6"	3/4"	3,230 lbs.
14"	8" to 12"	7/8"	4,480 lbs.
16"	14" to 16"	1"	5,900 lbs.
18" to 20"	18" to 20"	1-1/4"	9,500 lbs.
22" to 42"	22" to 42"	1-1/2"	13,800 lbs.

2. Rods may be reduced one size for double rod hangers with 3/8" minimum diameter, or when other paragraphs require a minimum of 2 hangers per section, provided the minimum diameter of 3/8" is maintained.

G. For upper attachment for suspending pipe hangers from concrete: Concrete inserts MSS Type 18.

H. For attachment to top flange of structural shape: Top beam C-clamps, MSS Type 19.

I. For attachment to bottom flange of structural shape: Side beam or channel clamps, MSS Type 20 or 27.

J. For attachment to center of bottom flange of beams: Center beam clamps, MSS Type 21.

K. For attachment to bottom of beams where heavy loads are encountered and hanger rod sizes are large: Welded attachments, MSS Type 22.

L. For attachment to structural shapes: C-clamps, MSS Type 23.

M. For attachment to top of beams when hanger rod is required tangent to edge of flange: Top I-beams clamps, MSS Type 25.

N. For attachment to bottom of steel I-beams for heavy loads: Steel I-beam/WF-beam clamps with eye nut, MSS Type 28 or 29.

O. Steel brackets, for indicated loading:

1. Light duty, 750 pounds, MSS Type 31.

2. Medium duty, 1,500 pounds, MSS Type 32.

3. Heavy duty, 3,000 pounds, MSS Type 33.

P. For use on sides of steel beams: Side beam brackets, MSS Type 34.

2.07. SPRING HANGERS AND SUPPORTS

A. Select spring hangers and supports to suit pipe size and loading.

B. For control of piping movement: Restraint control devices, MSS Type 47.

C. For light loads where vertical movement does not exceed 1-1/4 inch: Springs cushion hangers,

MSS Type 48.

D. For equipping Type 41 roll hanger with springs: Spring cushion roll hangers, MSS Type 49.

E. For retardation of sway or thermal expansion in piping systems: Spring way braces, MSS Type 50.

F. For absorbing expansion and contraction of piping system from hanger: Variable spring hangers, MSS Type 51; preset to indicated load and limit variability factor to 25%.

G. For absorbing expansion and contraction of piping system from base support: Variable spring base supports, MSS Type 52; preset to indicated load and limit variability factor to 25%; include flange.

H. For absorbing expansion and contraction of piping system from trapeze support: Variable spring trapeze hangers, MSS Type 53; preset to indicated load and limit variability factor to 25%.

I. Constant supports: Provide one of the following types, selected to suit piping system. Include auxiliary stops for erection and hydrostatic test, and field load-adjustment capability.

1. Horizontal Type: MSS Type 54.

2. Vertical Type: MSS Type 55.

3. Trapeze Type: MSS Type 56.

2.08. SUPPLEMENTARY SUPPORTS

A. Where support spacing is more frequent than distance between structural members, provide steel angles, channels or beams sized to provide a deflection of less than 1/240 of span when fully loaded, to transfer pipe support loads to structural members.

B. Where deflection of center of trapeze support exceeds 1/240 of distance between hanger rods, provide additional hanger rods.

C. Where multiple risers are supported within shafts, provide steel angles, channels or beams, sized to provide a deflection of less than 1/240 of span when fully loaded, to transfer loads to the concrete floor slab. Anchor supplemental supports to the slab, and provide resilient element where required by other Sections of this Division.

2.09. ACCESSORIES

A. Protective Shields, MSS Type 40: Carbon steel, galvanized minimum of 12" length sized for required insulation.

B. Protective Saddles, MSS Type 39: Carbon steel plate, minimum of 12" length, sized for required insulation.

C. Steel Turnbuckle, MSS Type 13: Forged steel, galvanized finish with locknuts. Rated at a minimum of 730 lbs. at 3/8" size.

D. Steel Clevis, MSS Type 1: Forged steel, galvanized finish with steel pin and cotter pin. Rated for a minimum of 730 lbs. at 3/8" size.

E. Weldless Eye Nut, MSS Type 17: Forges steel, galvanized finish. Rated for a minimum of 730 lbs. at 3/8" size.

2.10. PIPE INSULATION HANGER SHIELDS

A. Where hangers are placed outside the jackets of pipe insulation, provide shields equal to "Thermal Hanger Shields" as manufactured by Pipe Shields, Inc. or equivalent by Elcen Metal Products Company.

B. Shields shall consist of a 360-degree insert of high-density, 100 psi, waterproof calcium silicate, encased in a 360-degree galvanized sheet steel shield. Insert shall be same thickness as adjoining pipe insulation, and shall extend 1 inch beyond sheet metal shield in each direction on cold lines. Shield lengths and minimum sheet metal gauges shall be as directed below:

PIPE SIZE	SHIELD LENGTH	MINIMUM GAUGE
1/2" to 1-1/2"	4"	26
2" to 6"	6"	20
8" to 10"	9"	16
12" to 18"	12"	16
20" & Larger	18"	16

C. Shields shall be Model CS-CW, except for pipe roller applications: then provide Model CSX-CW.

D. At the Contractor's option, shop-fabricated galvanized metal shields may be provided based on approved shop drawings. Length and gauge of sheet metal shall be as specified above.

E. For all insulated piping 4” and larger, provide insulation insert at a minimum of 12” long. Insert shall extend a minimum of one inch beyond shield. Insulation inserts shall be minimum 12” long section of foam glass insulation.

2.11. METAL FRAMING: Provide products compliant with NEMA ML-1.

2.12. STEEL PLATES, SHAPES AND BARS: Provide products compliant with ANSI/ASTM A-36.

2.13. PIPE GUIDES: Provide factory-fabricated guides, of cast semi-steel or heavy fabricated steel, consisting of a bolted two-section outer cylinder and base, with a two-section guiding spider bolted tight to pipe or as shown on Drawings. Size guides and spiders to clear pipe, cylinder and insulation, if any. Provide guides of length recommended by manufacturer to allow indicated travel.

PART 3 EXECUTION

3.01. GENERAL REQUIREMENTS

A. Where applicable, install in accordance with the manufacturer's written installation instructions.

B. Where supports are in contact with copper pipe, provide copper plated support.

C. Where supports are in contact with glass, aluminum or brass pipe, provide plastic coating on supports.

D. Interior hangers, supports, including attachments, that are plain steel shall be primed and painted.

E. Hangers and supports, including attachments, exposed to weather or located in utility tunnels or accessible utility trenches or subject to spillage shall be hot dip galvanized after fabrication.

F. Fabricated steel supports exposed to weather or located in utility tunnels and accessible utility trenches or subject to spillage shall be primed and painted. Cut, welded, drilled or otherwise damaged surfaces of coating shall be repaired.

3.02. PREPARATION

A. Proceed with installation of hangers, supports and anchors only after required building structural work has been completed in areas where the work is to be installed. Correct inadequacies including but not limited to proper placement of inserts, anchors and other building structural attachments.

3.03. INSTALLATION OF HANGERS AND SUPPORTS

A. Install hangers, supports, clamps and attachments to support piping properly from building structure in compliance with MSS SP-69. Arrange for grouping of parallel runs of horizontal piping to be supported together in trapeze-type hangers where possible. Install supports with maximum spacing as specified in this Section. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for small diameter pipe. Do no use wire or perforated metal to support piping, and do not support piping from other piping.

B. Install hangers and supports complete with necessary bolts, rods, nuts, washers, and other accessories. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of same type and style as installed for adjacent similar piping.

C. Support fire protection water piping independently of other piping

D. The location of hangers and supports shall be coordinated with the structural work to ensure that the structural members will support the intended load.

E. Provide hex head nut on rod at top and bottom of clevis hanger yoke, and at each rod connection to intermediate und upper attachment. Rod nuts shall be securely locked in place.

F. Hanger rods shall be subject to tensile loading only. Where lateral or axial movement is anticipated, use suitable linkage in hanger rod to permit swing.

G. Hangers shall be fabricated to permit adequate adjustment after erection while still supporting the load. Turnbuckles shall be provided where required for vertical adjustment of the piping.

H. Supports for vertical piping shall be located at each floor or at intervals of not more than 15 feet and at intervals of not more than 8 feet from end of risers. Where supports are provided on intermediate floors spaced 15 feet or less between floors, no additional supports are required other than those specified for end of risers.

I. A hanger or support shall be provided adjacent to each piece of equipment to ensure that none of the pipe weight is supported from the equipment.

J. Provide protective shields on all piping required to be insulated.

K. Provide protective saddles sized to match insulation thickness on all hot piping required to be insulated. Fill void between saddle and pipe with insulation as specified.

L. Provide turnbuckles on all hangers that require leveling or aligning.

M. Provide steel clevis where detailed and/or required.

N. Provide weldless eye nuts on hanger terminations where disassembly or swing may be required.

Use in combination with steel clevis.

O. Supports

1. Provide additional supports at:

a. Changes in direction.

b. Branch piping and runouts over 5 feet.

c. Concentrated loads due to valves, strainers and similar items.

d. At valves 4 inches and larger in horizontal piping.

e. Support piping on each side of valve.

f. Brace hubless piping to prevent horizontal and vertical movement.

g. Where number of grooved couplings exceeds 3 between supports or provide continuous steel between supports.

2. Sanitary waste and vent, roof drains per UPC Section 316: Vertical supports are not required within 2.5 feet of wall penetrations for pipes 8 inches in diameter and smaller, and not more than 3 feet for 10 inches and larger.

3. Other piping support spacing shall be as scheduled on Drawing or as required by referenced standard.

3.04. HANGER SPACING

A. The maximum spacing between pipe supports for straight runs shall be in accordance with the following chart. If any deviation from the table exists within the manufacturer's written installation instruction, whichever spacing reflecting the smaller centerline to centerline dimension shall be used.

MAXIMUM HORIZONTAL PIPE HANGER AND SUPPORT SPACING TABLE

1. Steel Pipe (Schedule 40 & 80):
Up to 1" ..... 7 ft. on center
1-1/4" and greater ..... 10 ft. on center

2. Copper Pipe (Types L, K and M):
Up to 1" size: ..... 5 ft. on center
1-1/4" to 2-1/2" ..... 7 ft. on center
3" and larger..... 10 ft. on center

3. Ductile Iron and Cast Iron: Two hangers per section length.

4. Polyvinyl Chloride (PVC):
Up to 1-1/2" ..... 3 ft. on center
2" to 4" ..... 4 ft. on center
5" to 8" ..... 5 ft. on center
10" and larger..... 6 ft. on center

5. Sprinkler and Standpipe: Pipe hangers to be as per NFPA-13 and NFPA-14 standards.

B. Hanger centerline spacing shall be reduced by 50% in areas of concentrated valves and/or

fittings, also no more than a maximum distance of 12 inches from valves, fittings and/or couplings, or 24 inches from a change in direction.

3.05. ATTACHMENT TO STRUCTURE

A. For plain steel devices, prime and paint.

B. Adjust attachment location for proper alignment and no more than 4 degrees offset from a perpendicular alignment.

C. If proper alignment cannot be achieved from the existing building structure, provide a trapeze type support sized to handle the design load with a minimum safety factor of 5.

3.06. INSERTS

A. Contractor shall have inserts at site and dimensional location drawings ready at the beginning of the involved concrete work.

B. Install inserts by securing to concrete forms and inserting reinforcing rod through the opening provided in the insert in accordance with shop drawings.

C. Provide necessary supervision while concrete is being poured to correct any misalignment caused by the concrete.

3.07. INSTALLATION OF ANCHORS

A. Install anchors at proper locations to prevent stresses from exceeding those permitted by ANSI B-31, and to prevent transfer of loading and stresses to connected equipment.

B. Fabricate and install anchor by welding steel shapes, plates and bards to piping and to structure. Comply with ANSI B-31, with AWS standards, and with the Details shown on the drawings.

C. Where expansion compensators are indicated, install anchors in accordance with expansion unit manufacturer's written instructions to limit movement of piping and forces to maximums recommended by manufacturer for each unit.

D. Anchor Spacing: Where not otherwise indicated, install anchors at ends of principal pipe runs and at intermediate points in pipe runs between expansion loops and bends. Make provisions for preset of anchors as required, accommodating both expansion and contraction of piping.

E. Size anchor shell length to assure a minimum of 1" solid concrete remaining from shell and to concrete face.

3.08. INSTALLATION OF TRAPEZES OR PIPE RACKS

A. Light/Medium Duty: Assemble from standard manufactured metal framing systems, in accordance with manufacturer's recommendations.

B. Heavy Duty: Fabricate from structural steel shapes selected for loads required. Weld steel in accordance with AWS standards.

3.09. AUXILIARY STEEL

A. Furnish all miscellaneous structural members necessary to hang or support ductwork, piping, and mechanical equipment.

B. Notify Engineer of any adjustment necessary in main structural system for proper support of major equipment.

C. Fabricated Steel Supports: Steel for supports shall be saw cut, with sharp edges ground smooth. After fabrication, remove all foreign material, including welding slag and spatter, and leave ready for painting.

END OF SECTION

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SECTION 22 01 10
BASIC VALVES

PART 1 - GENERAL

1.01 Valves specified in this section are for general use. See specifications for specific systems and special valves.

1.02 SUBMITTALS

A. Product Data: Provide for each type of valve indicated. Include body, seating, and trim materials; valve design; pressure and temperature classifications; end connections; arrangement; dimensions; and required clearances. Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories. Provide valve schedule with product data listing valves used for each service application.

1.03 QUALITY ASSURANCE:

A. Single Source Responsibility: Where possible valves shall be by the same manufacturer.

B. MSS Standard Practices: Comply with the MSS standards for valves specified.

C. ASME: Comply with ASME B31.1 for power piping valves and ASME B31.9 for building services piping valves.

D. NSF: Comply with NSF 61 for valve materials for potable water service.

1.04 DELIVERY, STORAGE, AND HANDLING:

A. Preparation for Transport:

1. Ensure valves are dry and internally protected against rusting and galvanic corrosion.

2. Protect valve ends against mechanical damage to threads, flange faces, and weld end preps.

3. Set valves in best position for handling. Globe and gate valves shall be closed to prevent rattling; plug valves shall be open to minimize exposure of functional surfaces; butterfly valves shall be shipped closed or slightly open; and swing check valves shall be blocked in either closed or open position.

B. Storage:

1. Do not remove valve end protectors unless necessary for inspection; reinstall for storage.

2. Protect valves against weather. Where practical store valves indoors. Maintain valve temperature higher than the ambient dew point temperature. If outdoor storage is necessary, support valves off the ground or pavement and protect in watertight enclosures.

C. Handling: Valves whose size requires handling by crane or lift shall be slung or rigged to avoid damage to exposed valve parts. Handwheels and stems, in particular, shall not be used as lifting or rigging points.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering valves which may be incorporated in the work include the following. For majority of valves, Milwaukee has been used as basis of design. Equal valves of other manufacturers may be submitted without substitution requests.

1. APCO
2. Apollo
3. CPV
4. Crane
5. DeZurick
6. Grinnell
7. Hammond
8. Jamesbury
9. Jenkins
10. Keflex
11. Metraflex
12. Milwaukee
13. Mueller
14. Nibco
15. Nordstrom
16. Powell
17. Stockham
18. Walworth
19. Watts

2.02 VALVE FEATURES:

A. Valve Design: Valves shall have rising stem, or rising outside screw and yoke stems; except, non-rising stem valves may be used where headroom prevents full extension of rising stems.

B. Pressure and Temperature Ratings: Not less than indicated and required to suit system pressures and temperatures.

C. Sizes: Unless otherwise indicated, provide valves of same size as upstream pipe size.

D. Operators: Provide the following special operator features:

1. Handwheels, fastened to valve stem, for valves other than quarter turn.

2. Lever handle on quarter-turn valves 4 inch and smaller, except for plug valves. Provide one wrench for every 10 plug valves.

3. Chain-wheel operators for valves 2-1/2 inch and larger installed 72 inches or higher above finished floor elevation. Extend chains to an elevation of 5'-0" above finished floor elevation.

4. Gear drive operators on quarter-turn valves 6 inches and larger.

E. Extended Stems: Where insulation is indicated or specified, provide extended stems arranged to receive insulation.

F. Bypass and Drain Connections: Provide bypass and drain connections required by manufacturer and as indicated on the drawings.

G. End Connections: As specified in the individual valve specifications.

1. Threads: Comply with ANSI B1.20.1.

2. Flanges: Comply with ANSI B16.1 for cast iron, ANSI B16.5 for steel, and ANSI B16.24 for bronze valves.

H. Valves for Domestic Hot Water and Cold Water.

1. Gate Valves:

a. 2 inch and Smaller: Class 125, body and bonnet of ASTM B62 cast bronze, threaded ends, solid disc, copper-silicon alloy stem, brass packing gland, and malleable iron handwheel. Class 150 valves meeting the above shall be used where pressure requires. Milwaukee #105.

b. 2-1/2 Inch and Larger: Class 125 iron body, bronze mounted, with body and bonnet conforming to ASTM A 126 Class B, flanged ends, and packing gland assembly. Milwaukee #F-2885A.

2. Ball Valves:

a. Valves 2 Inches and Smaller: Threaded ends, rated for 400 psi WOG pressure; 3 piece construction, bronze body conforming to ASTM B 62, full port, chrome-plated brass ball, replaceable “Teflon” or “TFE” seats and seals, blowout proof stem, and vinyl-covered steel handle. Provide insulator type handle for chilled water and condensate drain. Milwaukee BA-300.

3. Plug Valves:

a. 2 Inch and Smaller: 150 psi WOG, bronze body, straightaway pattern, square head, threaded ends. Lunkenheimer 454.

b. 2-1/2 Inch and Larger: 175 psi, lubricated plug type, semi-steel body, single gland, wrench operated, flanged ends. Nordstrom 143.

4. Globe Valves:

a. 2 Inch and Smaller: Class 125, body and screwed bonnet of ASTM B 62 cast bronze, threaded ends, brass or replaceable composition disc, copper-silicon alloy stem, brass packing gland, and malleable iron handwheel. Class 150 valves meeting the above shall be used where pressure requires. Milwaukee #502T.

b. 2-1/2 Inch and Larger: Class 125 iron body and bolted bonnet conforming to ASTM A 126, Class B; outside screw and yoke, bronze mounted, flanged ends, and packing gland assembly. Milwaukee F2981A.

5. Butterfly Valves: 2-1/2 Inch and Larger: 200 psi, cast iron body conforming to ASTM A 126, Class B. Valves shall have field replaceable EPDM sleeve, with nickel-plated ductile iron disc (except valves installed in condenser water piping which shall have aluminum bronze disc), stainless steel stem, and EPDM O-ring stem seals. Valves shall have gear operator with extended wheel handle and position indicator. Valves shall be lug type, drilled and tapped. Valves shall be suitable for dead end service, Class I, tight shut off. Milwaukee CL 223E.

6. Check Valves:

a. Swing Check Valves:

1. 2 Inch and Smaller: Class 125, cast bronze body and cap conforming to ASTM B 62, horizontal swing, Y-pattern, with a bronze disc, and having threaded ends. Valve shall be capable of being reground while the valve remains in the line. Class 150 valves meeting the above specifications may be used where pressure requires or Class 125 are not available. Milwaukee #509.

2. 2-1/2 Inch and Larger: Class 125 (Class 175 FM approved for fire protection piping systems), cast iron body and bolted cap conforming to ASTM A 126, Class B; horizontal swing, with a bronze disc or cast iron disc with bronze disc ring, and flanged ends. Valve shall be capable of being refitted while the valve remains in the line. Milwaukee #F2974A.

b. Spring Loaded (Non-Slam Check Valves for Pumps: Valves shall be iron body, globe typed silent check valves, bronze mounted, stainless steel spring with flanged (125-pounds drilling) end connections for installation between ASA 150 lbs. flat face steel slip on weld flanges. Valves shall be comparable to Mueller #105-AP, APCO Series 600, CPV Globe Type Silent Check Valve, Kelflex K-Check Silent Check Valve, or Metraflex Globe Style Silent Check Valve.

PART 3 – EXECUTION

3.01 EXAMINATION:

A. Examine piping systems for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Examine valve interior, threads, and flanges for cleanliness, and signs of damage or corrosion. Remove all shipping materials.

C. Actuate valve through an open-close cycle to determine if operation is proper.

D. Examine the piping for cleanliness and alignment.

E. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gaskets are of proper size, that material composition is suitable for service, and are free from defect.

F. Do not attempt to repair a defective valve. Replace all defective valves with new valves.

3.02 VALVE SELECTION:

A. Selection of Valve Ends (Pipe Connections): Except as otherwise indicated, select valves with the following ends or types of pipe/tube connections:

1. Copper Tube Size 2 Inch and Smaller: Threaded ends.

2. Steel Pipe Sizes 2 Inch and Smaller: Threaded ends.

3. Steel Pipe Sizes 2-1/2 Inch and Larger: Flanged.

B. Ball valves may be used in lieu of gate valves for piping 2" and smaller except in steam and condensate return systems. Use gate valves for piping 2-1/2" and larger in size.

3.03 VALVE INSTALLATIONS:

A. General Application: Use gate, ball, and butterfly valves for shut-off duty; globe and butterfly for throttling duty. Refer to piping system specification sections for specific valve applications and arrangements.

B. Valves shall be located in an accessible position or made accessible through access panel.

C. Where several valves are related as to function, they shall be grouped in a battery.

D. Install valves and unions for each fixture and item of equipment in a manner to allow equipment removal without system shutdown. Unions are not required on flanged devices.

E. Install a valved bypass around each pressure reducing valve using a globe valve for throttling.

F. Installation of check valves:

1. Swing Check Valves: Install in horizontal position with hinge pin level.

2. Wafer Check Valves: Install between two flanges in horizontal or vertical position.

3. Lift Check Valves: Install in piping with stem upright and plumb.

G. No valve shall be installed with stem below horizontal position without prior approval.

H. Provide special handles or operators as required or as indicated on the drawings.

I. Valves specified under specific systems shall take precedence over those as specified herein.

J. Valves in copper pipe shall have threaded ends (except where size dictates flanged ends), use copper to MPT adapters as required.

K. Provide non-slam type check valves at pumps.

3.04 FIELD QUALITY CONTROL:

A. Testing: After piping systems have been tested and put into service but before final adjusting and balancing, inspect each valve for leaks. Adjust or replace packing to stop leaks; replace valve if leak persists.

3.05 ADJUSTING AND CLEANING:

A. Cleaning: Clean mill scale, grease, and protective coatings from exterior of valves and prepare to receive finish painting or insulation.

3.06 VALVE BOXES

A. Valves located below slabs or grade shall be housed in cast iron boxes and covers. Covers shall be properly identified as to service controlled by the valves.

B. Furnish Owner with proper key or valve operator extension.

END OF SECTION

SECTION 22 0120
PIPING SPECIALTIES

PART 1 - GENERAL

1.01 Specific requirements for specialties indicated on drawings or in other sections of these specifications shall take precedence over items as specified in this section.

1.02 Submit brochures and other supportive product data for all items.

1.03 Ranges for thermometer, gages, or similar instruments shall be selected so that normal operation will be near center of scale. Range shall not be longer than required. Use compound gage where vacuum may be encountered.

1.04 Combination instruments for thermometers and gages will not be acceptable.

PART 2 - PRODUCTS

2.01 THERMOMETERS:

A. Thermometers shall be equal to Trerice Series BX9, 9-inch, adjustable type. Stem length shall be a minimum of 3/4 of the pipe diameter, plus well extension length. Use 12-inch stem length in tanks.

B. Provide brass wells and stems.

2.02 THERMOMETER WELLS:

A. Provide wells with extension neck for insulated piping.

B. Wells shall be Trerice Series 138 type.

C. Test wells to be Trerice Series 169 type with cap and chain.

2.03 GAGES:

A. Gages shall be equal to Trerice Series 800, 3-1/2-inch size.

B. Provide snubber and cock for each gage.

C. Provide coil syphon and cock for each steam gage.

D. Gauges shall be liquid filled.

2.04 TEST PLUGS:

A. Test plugs shall be equal to Peterson Engineering Company #110, 1/4" size, with brass body, dust cap and "Nordel" valve core material.

2.05 STRAINER:

A. "Y" Type (Haywood, Muessco, or Sarco):

1. 1/2" through 2": Haywood Model 80, bronze, 300 lb. WP, 500 lb. WOG or Haywood Model 80 iron body, 250 lb. WP, 900 lb. WOG. Provide Monel or stainless steel screen, blow-off outlet, screwed ends.

2. 2-1/2" through 12": Haywood Model 80 iron body, 125 lb. SWP, 175 lb. WOG, brass screen, blow-off outlet, flanged ends.

B. Screens - Steam:

1. Monel or stainless steel.

2. Perforations - .057 diameter, 144 per sq. in.

C. Screens - Water:

1. Brass.

2. Perforations: Up to 2" - 1/10" diameter, 49 per sq. in.; 2-1/2" to 4" - 1/8" diameter, 32 per sq. in.; 5" up - 1/4" diameter, 8 per sq. in.

2.06 FLEXIBLE CONNECTORS:

A. Pumps and Chillers: Bellows Type 3, equal to Keflex #151-TR-1250, with 150 lb. flanges and tie rods. 150 psig maximum working pressure. 304 stainless steel. Bellows welded to flanges. Tie rods with chatter proof spacers. Unit rated at 800°F.

B. Coils, Valves, And Miscellaneous Equipment: Stainless steel braided hose type.

2.07 ELECTRICAL HEAT TAPE:

A. Heat tape shall be equal to Emerson Chromalox.

B. Electrical heat tape shall be installed where indicated on the drawings to prevent pipe freezing.

C. Heat tape shall be approved for use in hazardous areas as indicated and U.L. listed.

2.08 CALIBRATED BALANCE VALVE:

A. For valves 2” and smaller:

1. Bronze body.

2. Ball or globe type.

3. 250 psig at 250° F rating.

4. Threaded ends.

5. Calibrated orifice or venturi.

6. Meter connections with integral seals.

7. Memory stop.

B. For valves 2-1/2” and larger:

1. Iron or steel body.

2. Ball or globe type.

3. 125 psig at 250° F rating.

4. Flanged connection.

5. Calibrated orifice or venturi.

6. Meter connections with integral seals.

7. Memory stop.

C. Acceptable manufacturers:

1. Flow Design

2. Bell and Gossett

3. Taco

4. Armstrong

5. Nibco

PART 3 - EXECUTION

3.01 GAGES, THERMOMETERS, AND TEST PLUGS:

A. Provide thermometers in inlet and outlet piping of chillers, boilers, water heaters, air handling unit coils, and elsewhere as indicated on the drawings.

B. Provide gages on inlet and outlet piping of all pumps, except domestic hot water circulators, steam gages on boiler headers, and elsewhere as indicated on the drawings.

C. Arrange thermometers and gages so they might be read standing in a normal position on the floor.

D. Provide test plugs on inlet and outlet piping of all heat exchanger equipment not equipped with thermometers. This includes all heating and cooling coils in air handling units, fan coil units, and other terminal devices with coils.

E. Locate gages, thermometers, and test plugs as close as possible to equipment being monitored.

3.02 FLEXIBLE PIPE CONNECTORS:

A. Install flexible pipe connectors where indicated on the drawings.

B. Install connectors as close as possible to equipment inlets and outlets.

C. Support pipe work independently of flexible connectors. Brace and anchor piping as required to prevent movement of piping ends of flexible connectors and align all equipment, pipe work, and flanges so that no flexible connectors shall be misaligned and/or stressed beyond the manufacturer's recommended maximum limits.

3.03 HEAT TAPE:

A. Install the heat tape below the pipe insulation in a uniform distribution to obtain the watts/linear foot as indicated.

B. Wiring installation shall be done in accordance with the NEC and the manufacturer's requirements.

C. Power for heat tape shall come from an emergency circuit. If no emergency circuit is available, the power shall come from a dedicated circuit, marked heat tape in the panel.

D. Unless indicated otherwise on the plans, install heat tape with a minimum capacity of 5 watts/foot.

E. Heat tape shall be thermostatically controlled and shall be preset to energize before freezing. An indicator light shall energize when the heat tape is "on."

END OF SECTION

SECTION 22140
DOMESTIC WATER PIPING

PART 1 - GENERAL

1.01 SCOPE

A. This section contains specifications for pipe and pipe fittings.

1.02 REFERENCE STANDARDS

A. ANSI A21.4

B. ANSI A21.11

C. ANSI A21.51

D. ANSI B16.3 Malleable Iron Threaded Fittings

E. ANSI B16.4 Cast Iron Threaded Fittings

F. ANSI B16.5 Pipe Flanges and Flanged Fittings

G. ANSI B16.22 Wrought Copper and Wrought Copper Alloy Solder Joint Pressure Fittings

H. ANSI B16.29 Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings–DWV

I. ASTM A53 Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless

J. ASTM A105 Forgings, Carbon Steel, for Piping Components

K. ASTM A126 Gray Cast Iron Castings for Valves, Flanges, and Pipe Fittings

L. ASTM A234 Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures

M. ASTM A536 Ductile Iron Castings

N. ASTM B32 Solder Metal

O. ASTM B88 Seamless Copper Water Tube

P. ASTM B280 Seamless Copper Tube for Air Conditioning and Refrigeration Field Service

Q. ASTM B813 Liquid and Paste Fluxes for Soldering Applications of Copper and Copper Alloy Tube

R. ASTM D1785 Poly Vinyl Chloride (PVC) Plastic Pipe

S. ASTM D2241 Poly Vinyl Chloride (PVC) Pressure-Rated Pipe (SDR Series)

T. ASTM D2464 Threaded Poly Vinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80

U. ASTM D2466 Poly Vinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 40

V. ASTM D2513 Thermoplastic Gas Pressure Pipe, Tubing, and Fittings

W. ASTM D2564 Solvent Cements for Poly Vinyl Chloride (PVC) Plastic Pipe and Fittings

X. ASTM D2657 Heat Fusion Joining of Polyolefin Pipe and Fittings

Y. ASTM D2774 Recommended Practice for Underground Installation of Thermoplastic Pressure Piping

Z. ASTM D2855 Making Solvent Cemented Joints with Poly Vinyl Chloride (PVC) Pipe and Fittings

AA. ASTM D3139 Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals

BB. ASTM D3222 Unmodified Poly Vinylidene Fluoride (PVDF) Molding Extrusion and Coating Materials

CC. ASTM D4101 Propylene Plastic Injection and Extrusion Materials

DD. ASTM F437 Threaded Chlorinated Poly Vinyl Chloride (CPVC) Plastic Pipe Fittings, Schedule 80

EE. ASTM F438 Socket Type Chlorinated Poly Vinyl Chloride (CPVC) Plastic Pipe Fittings, Schedule 40

FF. ASTM F441 Chlorinated Poly Vinyl Chloride (CPVC Plastic Pipe, Schedules 40 and 80

GG. ASTM F493 Solvent Cements for Chlorinated Poly Vinyl Chloride (CPVC) Plastic Pipe and Fittings

HH. ASTM F656 Primers for Use in Solvent Cement Joints of Poly Vinyl Chloride (PVC) Plastic Pipe and Fittings

II. ASTM F1476 Performance of Gasketed Mechanical Couplings for Use in Piping Applications

JJ. AWS A5.8 Brazing Filler Metal

KK. AWWA C104 Cement Mortar Lining for Ductile Iron Pipe and Fittings for Water

LL. AWWA C105 Polyethylene Encasement for Ductile Iron Piping for Water

MM. AWWA C110 Ductile Iron and Gray Iron Fittings, 3 In. Through 48 In., for Water and Other Liquids

NN. AWWA C111 Rubber Gasket Joints for Ductile Iron and Gray Iron Pressure Pipe and Fittings

OO. AWWA C151 Ductile Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds for Water or Other Liquids

PP. AWWA C153 Ductile Iron Compact Fittings, 3 In. Through 48 In., for Water and Other Liquids

QQ. AWWA C600 Installation of Ductile Iron Water Mains and Their Appurtenances

RR. AWWA C606 Grooved and Shouldered Joints

SS. AWWA C651 Disinfecting Water Mains

TT. AWWA C900 Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In., for Water Distribution

1.03 SUBMITTALS

A. Provide schedule indicating the ASTM or AWWA specification number of the pipe being proposed along with its type and grade, and sufficient information to indicate the type and rating of fittings for each service.

B. Provide statement from manufacturer that pipe furnished meets the ASTM or specification contained in this section.

C. Grooved joint couplings and fittings shall be shown on product submittals, and shall be specifically identified with the applicable style or series designation.

1.04 QUALITY ASSURANCE

A. Pipe materials shall bear label, stamp, or other markings of specific testing agency.

B. All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.

C. All castings used for coupling housings, fittings, and valve bodies shall be date stamped for quality assurance and traceability.

D. Any installed material not meeting the specification requirements must be replaced with material that meets these specifications without additional cost to the Owner.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Promptly inspect shipments to ensure that the material is undamaged and complies with specifications.

B. Cover pipe to prevent corrosion or deterioration while allowing sufficient ventilation to avoid condensation. Do not store materials directly on grade. Protect pipe, tube, and fitting ends so they are not damaged. Where end caps are provided or specified, take precautions so the caps remain in place. Protect fittings, flanges, and unions by storage inside or by durable, waterproof, above ground packaging.

C. Offsite storage agreements will not relieve the contractor from using proper storage techniques.

D. Storage and protection methods must allow inspection to verify products.

1.06 SYSTEM CRITERIA

A. Use only new material, free of defects, rust and scale, and meeting the latest revision of ASTM or AWWA specifications as listed in this specification.

B. Construct all piping for the highest pressures and temperatures in the respective system.

C. Where weld fittings or mechanical grooved fittings are used, use only long radius elbows having a centerline radius of 1.5 pipe diameters.

D. Where ASTM A53 type F pipe is specified, grade A type E or S, or grade B type E or S may be substituted at Contractor's option. Where the grade or type is not specified, Contractor may choose from those commercially available.

E. Where ASTM B88, type L H (drawn) temper copper tubing is specified, ASTM B88, type K H (drawn) temper copper tubing may be substituted at Contractor's option.

PART 2 - PRODUCTS

2.01 DOMESTIC WATER

A. ABOVE GROUND:

1. Type L copper water tube, H (drawn) temper, ASTM B88;

a. Solder joint; wrought copper ASME B16.22 pressure fittings; lead free (<.2%) solder, ASTM B32; flux, ASTM B813; copper phosphorous brazing alloy, AWS A5.8 BCuP.

b. Press-connect; ASME B16.51 cast copper alloy, wrought copper, and wrought copper alloy press-connect pressure fittings, EPDM O-rings.

2. (Water Service Entrance) Ductile iron pipe, thickness Class 53, AWWA C151/C115; with standard thickness cement mortar lining, AWWA C104; ductile iron mechanical grooved cement mortar lined fittings and couplings on cut grooved pipe, Class 350 12" and below, Class 250 above 12", AWWA C606; ductile iron or gray iron flanged cement mortar lined fittings, Class 250, AWWA C110; rubber gasket joints with non-toxic gasket lubricant, AWWA C111.

B. BELOW GROUND 2-1/2" AND SMALLER: Type K copper water tube, O (annealed) temper, ASTM B88; with cast copper pressure fittings, ASME B16.18; wrought copper pressure fittings, ASME B16.22; lead free (<.2%) solder, ASTM B32; flux, ASTM B813; or cast copper flared pressure fittings, ASME B16.26.

C. BELOW GROUND 3" AND LARGER:

1. Ductile iron pipe, mechanical or push on joint, thickness Class 52, AWWA C151; with standard thickness cement mortar lining, AWWA C104; ductile iron or gray iron mechanical joint cement mortar lined fittings, Class 250, AWWA C110; ductile iron mechanical joint compact fittings, Class 350, AWWA C153; rubber gasket joints with non-toxic gasket lubricant, AWWA C111. Provide 8 mil tube or sheet polyethylene encasement of iron pipe and pipe fittings, AWWA C105.

2. PVC pressure pipe, DR 18, Class 150, AWWA C900 and C905; with integral bell and elastomeric gaskets, ASTM D3139. Fittings and fitting polyethylene encasement to be same as noted above for ductile iron.

D. THRUST RESTRAINTS FOR UNDERGROUND PIPING: Asphaltic or epoxy coated ductile iron follower gland mechanical joint restraint with gripping wedge restraints and

torque limiting twist-off nuts around the pipe circumference, low alloy steel T-bolts and UL listing or Factory Mutual approval. For PVC pipe joint bells, use epoxy or primer coated ductile iron bell and serrated ring restraints or gripping wedge restraints and torque limiting twist-off nuts around the pipe circumference with low alloy steel tie bolts. Restraint to have minimum pressure rating and safety factor equal to or greater than pressure rating and safety factor of pipe and be designed specifically for the pipe material it is applied on.

2.02 DIELECTRIC UNIONS AND FLANGES

A. Watts Regulator Company, Lochinvar, Wilkins or EPCO Sales, Inc., dielectric unions 2" and smaller; dielectric flanges 2" and larger; with iron female pipe thread to copper solder joint or brass female pipe thread end connections, non-asbestos gaskets, having a pressure rating of not less than 175 psig at 180 degrees.

B. Victaulic Series 47, dielectric waterway fittings to 8”, threaded or grooved ends, electroplated steel or ductile iron casing, with inert thermosplastic lining having a pressure rating to 300 psig at 230 degrees F.

2.03 UNIONS AND FLANGES

A. Unions, flanges and gasket materials to have a pressure rating of not less than 150 psig at 180 degrees. Gasket material for flanges and flanged fittings shall be Teflon type. Treated paper gaskets are not acceptable.

B. 2" AND SMALLER STEEL:

1. ASTM A197/ANSI B16.3 malleable iron unions with brass seats. Use black malleable iron on black steel piping and galvanized malleable iron on galvanized steel piping.

2. 2" AND SMALLER COPPER: ANSI B16.18 cast bronze union coupling or ANSI B15.24 Class 150 cast bronze flanges.

C. 2-1/2" AND LARGER STEEL: ASTM A181 or A105, grade 1 hot forged steel flanges of threaded, welding neck, or slip-on pattern on black steel and threaded only on galvanized steel. Use raised face flanges ANSI B16.5 for mating with other raised face flanges or equipment with flat ring or full-face gaskets. Use ANSI B16.1 flat face flanges with full face Teflon gaskets for mating with other flat face flanges on equipment. Gaskets shall be teflon type.

D. 2-1/2" AND LARGER COPPER: ANSI B15.24 Class 150 cast bronze flanges with full face teflon gaskets.

E. Fittings used on galvanized steel pipe to be ductile iron A536, with galvanized finish, ASTM A153. Fittings used on ductile iron pipe to be cement mortar lined ductile iron with coal tar coating, ASTM A536; conforming to requirements of AWWA C110/C153 and AWWA C606. Fittings used on copper tube to be copper tube dimensioned wrought copper ANSI B16.22 or cast bronze ASNI B16.18. Fittings used on stainless steel shall be ASTM A403 or factory fabricated ASTM A312.

F. Gaskets to be EPDM, ASTM D1330. Gaskets for hot water systems and dry pipe systems to be flush seal design. Heat treated carbon track bolts and nuts, ASTM A183, with zinc

electroplated finish ASTM B633, or stainless steel ASTM F593.

G. Gaskets used on potable water systems shall be UL classified in accordance with ANSI/NSF-61 for potable water service.

H. Flange adapters to be ductile iron, ASTM A536; except at lug type butterfly valves where standard threaded flanges shall be used. Victaulic Style 741 (steel pipe), 341 (AWWA ductile iron pipe) or 641 (copper tubing).

PART 3 - EXECUTION

3.01 PREPARATION

A. Cut pipe ends square. Ream ends of piping to remove burrs. Clean scale and dirt from interior and exterior of each section of pipe and fitting prior to assembly.

3.02 INSTALLATION

A. Install all piping parallel to building walls and ceilings and at heights which do not obstruct any portion of a window, doorway, stairway, or passageway. Where interferences develop in the field, offset or reroute piping as required to clear such interferences. Coordinate locations of plumbing piping with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. In all cases, consult drawings for exact location of pipe spaces, ceiling heights, door and window openings, or other architectural details before installing piping. All piping shall be concealed in areas with ceilings.

B. Where copper or steel piping is embedded in masonry or concrete, provide protective sleeve covering of elastomeric pipe insulation.

C. Install underground warning tape 6"-12" below finished grade above all exterior below ground piping. Where existing underground warning tape is encountered, repair and replace.

D. Maintain piping in clean condition internally during construction.

E. Provide clearance for installation of insulation, access to valves and piping specialties.

F. Provide anchors, expansion joints, swing joints and/or expansion loops so that piping may expand and contract without damage to itself, equipment, or building.

1. For water systems, use adequate numbers of Victaulic Style 77 flexible couplings in header piping to accommodate thermal growth and contraction, and for the elimination of expansion loops. (In accordance with Victaulic instructions and as approved by the Engineer). Where expansion loops are required, use Victaulic Style 77 couplings on the loops.

G. Do not route piping through transformer vaults or above transformers, panelboards, or switchboards, including the required service space for this equipment, unless the piping is serving this equipment

H. Install all valves and piping specialties, including items furnished by others, as specified and/or detailed. Provide access to valves and specialties for maintenance. Make connections to all equipment, fixtures and systems installed by others where same

requires the piping services indicated in this section.

3.03 COPPER PIPE JOINTS

A. Remove all slivers and burrs remaining from the cutting operation by reaming and filing both pipe surfaces. Clean fitting and tube with metal brush, emery cloth or sandpaper. Remove residue from the cleaning operation, apply flux and assemble joint to socket stop. Apply flame to fitting until solder melts when placed at joint. Remove flame and feed solder into joint until full penetration of cup and ring of solder appears. Wipe excess solder and flux from joint.

B. Grooved joints for copper tubing shall be made at copper tube dimensions. (Flaring of tube ends to accommodate alternate sized couplings is not permitted).

C. Join copper tube and press connect fittings with tools recommended by fitting manufacturer.

3.04 THREADED PIPE JOINTS

A. Use a thread lubricant or Teflon tape when making joints; no hard setting pipe thread cement or caulking will be allowed.

3.05 MECHANICAL JOINT PIPE CONNECTIONS

A. Comply with AWWA C600/C605 installation requirements. Clean pipe end and socket. Clean and lubricate pipe end, socket and gasket with soapy water or gasket lubricant. Place gland and gasket, properly oriented, on pipe end. Insert pipe end fully into socket and press gasket evenly into recess keeping joint straight. Press gland evenly against gasket, insert bolts and hand tighten nuts. Make joint deflection prior to tightening bolts. Evenly tighten bolts in sequence to recommended torque.

3.06 PUSH-ON GASKETED PIPE CONNECTIONS

A. Clean pipe end, bell, gasket seat and gasket of dirt or debris. Coat end of pipe and gasket with gasket lubricant. Ensure pipe is supported off the ground so lubricant does not pick up dirt. Push spigot end into gasket bell with levered pipe joining tool recommended by pipe manufacturer. Large diameter exterior mains may be joined by pushing end of pipe section with backhoe against wood blocking over pipe end. Insert to fully seated position or to reference mark on pipe.

3.07 DOMESTIC WATER

A. Maintain piping system in clean condition during installation. Remove dirt and debris from assembly of piping as work progresses. Cap open pipe ends where left unattended or subject to contamination.

B. Install exterior water piping below predicted frost level in accordance with State Plumbing Code, but in no case less than 3' bury depth to top of pipe. Maintain minimum of 8' horizontal distance between 2-1/2" and larger water piping and sanitary sewer piping. Maintain minimum of 30" horizontal and 12" vertical distance, water on top, between 2" and smaller water piping and sanitary sewer piping. Where water piping crosses a sanitary sewer, provide minimum 18" vertical clearance and waterproof PVC

water pipe sleeve (reference sanitary sewer materials) sealed at both ends for distance of 10' from sewer in both directions.

C. Provide thrust restraints for 3" and larger exterior water piping joints, hydrants, caps, plugs, fittings and bends of 22-1/2 degrees or more. Field apply continuous anti-corrosion coating to rodded restraint components. Protect mechanical joints, nuts and bolts from concrete cover. Cover with 8 mil sheet or tube polyethylene material sleeve.

D. Install interior water piping with drain valves where indicated and at low points of system to allow complete drainage. Install shutoff valves where indicated and at the base of risers to allow isolation of portions of system for repair. Do not install water piping within exterior walls.

E. Prior to use, isolate and fill system with potable water. Allow to stand 24 hours. Flush each outlet proceeding from the service entrance to the furthest outlet for minimum of 1 minute and until water appears clear. Fill system with a solution of water and chlorine containing at least 50 parts per million of chlorine and allow to stand for 24 hours. Alternately a solution containing at least 200 parts per million of chlorine may be used and allowed to stand for 3 hours. Flush system with potable water until chlorine concentration is no higher than source water level.

F. Wait 24 hours after final flushing. Take samples of water for lab testing. The number and location of samples shall be representative of the system size and configuration and are subject to approval by Engineer. Test shall show the absence of coliform bacteria. If test fails, repeat disinfection and testing procedures until no coliform bacteria are detected. Submit test report indicating date and time of test along with test results.

3.08 DIELECTRIC UNIONS AND FLANGES

A. Install dielectric unions, waterway fittings, or flanges at each point where a copper-to-steel pipe connection is required in domestic water systems.

3.09 UNIONS AND FLANGES

A. Install a union or flange at each connection to each piece of equipment and at other items which may require removal for maintenance, repair, or replacement. Where a valve is located at a piece of equipment, locate the flange or union connection on the equipment side of the valve. Concealed unions or flanges are not acceptable.

B. Union and flanges for disconnect and servicing area not required in installations using grooved mechanical joint couplings. (The couplings shall serve as unions and disconnect points).

3.10 PIPING SYSTEM LEAK TESTS

A. Isolate or remove components from system which are not rated for test pressure. Perform final testing for medical and lab gas with all system components in place. Test piping in sections or entire system as required by sequence of construction. Do not insulate or conceal pipe until it has been successfully tested.

B. If required for the additional pressure load under test, provide temporary restraints at fittings or expansion joints. Backfill underground water mains prior to testing with the exception of thrust restrained valves which may be exposed to isolate potential leaks.

C. For hydrostatic tests, use clean water and remove all air from the piping being tested by means of air vents or loosening of flanges/unions. Measure and record test pressure at the high point in the system.

D. For air or nitrogen tests, gradually increase the pressure to not more than one half of the test pressure; then increase the pressure in steps of approximately one-tenth of the test pressure until the required test pressure is reached. Examine all joints and connections with a soap bubble solution or equivalent method. System will not be approved until it can be demonstrated that there is no measurable loss of test pressure during the test period.

E. Inspect system for leaks. Where leaks occur, repair the area with new materials and repeat the test; caulking will not be acceptable.

F. Entire test must be witnessed by the Owner's representative. All pressure tests are to be documented.

System	Test Medium	Initial Test Pressure Duration	Final Test Pressure Duration
Below Ground Domestic Water	Water	N/A	200 psig 2 Hour
Above Ground Domestic Water	Water	N/A	100 psig 8 Hour
Above Ground Non-Potable Water	Water	N/A	100 psig 8 Hour
Below Ground Non-Potable Water	Water	N/A	100 psig 8 Hour

END OF SECTION

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SECTION 22150
SANITARY WASTE AND VENT

PART 1 - GENERAL

1.01 SCOPE

A. This section contains specifications for sanitary waste and vent plumbing pipe and pipe fittings.

1.02 REFERENCE STANDARDS

ANSI A21.4

ANSI A21.11

ANSI A21.51

ANSI B16.3 Malleable Iron Threaded Fittings

ANSI B16.4 Cast Iron Threaded Fittings

ANSI B16.5 Pipe Flanges and Flanged Fittings

ANSI B16.22 Wrought Copper and Wrought Copper Alloy Solder Joint Pressure Fittings

ANSI B16.29 Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV

ASTM A53 Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless

ASTM A74 Cast Iron Soil Pipe and Fittings

ASTM A105 Forgings, Carbon Steel, for Piping Components

ASTM A126 Gray Cast Iron Castings for Valves, Flanges, and Pipe Fittings

ASTM A234 Pipe Fittings-Wrought Carbon Steel & Alloy Steel for Moderate & Elevated Temperatures

ASTM A861 High Silicon Iron Pipe and Fittings

ASTM A888 Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications

ASTM B32 Solder Metal

ASTM B88 Seamless Copper Water Tube

ASTM B280 Seamless Copper Tube for Air Conditioning and Refrigeration Field Service

ASTM B306 Copper Drainage Tube (DWV)

ASTM B813 Liquid and Paste Fluxes for Soldering Applications of Copper and Copper Alloy Tube

ASTM C76 Reinforced Concrete Culvert, Storm Drain and Sanitary Pipe

ASTM C564 Rubber Gaskets for Cast Iron Soil Pipe and Fittings

ASTM D1785 Poly Vinyl Chloride (PVC) Plastic Pipe

ASTM D2241 Poly Vinyl Chloride (PVC) Pressure-Rated Pipe (SDR Series)

ASTM D2466 Poly Vinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 40

ASTM D2564 Solvent Cements for Poly Vinyl Chloride (PVC) Plastic Pipe and Fittings

ASTM D2665 Poly Vinyl Chloride (PVC) Plastic Drain, Waste and Vent Pipe and Fittings

ASTM D2729 Poly Vinyl Chloride (PVC) Sewer Pipe and Fittings

ASTM D2774 Recommended Practice for Underground Installation of Thermoplastic Pressure Piping

ASTM D2855 Making Solvent Cemented Joints with Poly Vinyl Chloride (PVC) Pipe and Fittings

ASTM D3034 Type PSM Poly Vinyl Chloride (PVC) Sewer Pipe and Fittings

ASTM D3139 Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals

ASTM D3212 Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals

ASTM D3222 Unmodified Poly Vinylidene Fluoride (PVDF) Molding Extrusion and Coating Materials

ASTM D3311 Drain, Waste and Vent (DWV) Plastic Fitting Patterns

ASTM F2618 Standard Specification for Chlorinated Poly Vinyl Chloride (CPVC) Pipe and Fittings for Chemical Waste Drainage Systems.

AWS A5.8 Brazing Filler Metal

PART 2 - PRODUCTS

2.01 SANITARY WASTE AND VENT

A. INTERIOR ABOVE GROUND:

1. Hubless cast iron soil pipe and fittings, ASTM A888; ASTM A74. Provide heavy duty, shielded stainless steel bands and tightening devices with ASTM Standard C564 rubber sleeve, ANACO/HUSKY SD 4000 / IDEAL TRIDON Heavy Duty.

2. Solid Wall SCH 40 PVC pipe and fittings.

3. Type M copper water tube, H (drawn) temper, ASTM B88; with cast copper drainage fittings (DWV), ANSI B16.23; wrought copper drainage fittings (DWV), ANSI B16.29; lead free (<.2%) solder, ASTM B32; flux, ASTM B813; copper phosphorous brazing alloy, AWS A5.8 BCuP.

B. INTERIOR BELOW GROUND:

1. Solid Wall SCH 40 PVC or Cast iron soil pipe and fittings, hub and spigot, service weight, ASTM A74; with neoprene rubber compression gaskets, ASTM C564.

2. Use PVC for areas with acidic soil, eg Fayetteville

C. EXTERIOR BELOW GROUND 15" AND SMALLER:

1. Solid Wall SCH 40 PVC or Cast iron soil pipe and fittings, ASTM A74; with neoprene rubber compression gaskets, ASTM C564.

2.02 SUBMITTALS

A. Provide schedule indicating the ASTM specification number of the pipe being proposed along with its type and grade, and sufficient information to indicate the type and rating of fittings for each service.

B. Provide statement from manufacturer that pipe furnished meets the ASTM specification contained in this section.

2.03 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specific testing agencies.

B. Any installed material not meeting the specification requirements must be replaced with material that meets these specifications without additional cost to the Owner.

2.04 DELIVERY, STORAGE, AND HANDLING

A. Promptly inspect shipments to ensure that the material is undamaged and complies with specifications.

B. Cover pipe to prevent corrosion or deterioration while allowing sufficient ventilation to avoid condensation. Do not store materials directly on grade. Protect pipe, tube, and fitting ends so they are not damaged. Where end caps are provided or specified, take precautions so the caps remain in place. Protect fittings, flanges, and unions by storage inside or by durable, waterproof, above ground packaging.

C. Offsite storage agreements will not relieve the contractor from using proper storage techniques.

D. Storage and protection methods must allow inspection to verify products.

2.05 SYSTEM CRITERIA

A. Use only new material, free of defects, rust and scale, and meeting the latest revision of ASTM as listed in this specification.

B. Construct all piping for the highest pressures and temperatures in the respective system.

C. Non-metallic piping will be acceptable only for the services indicated. It will not be acceptable in ventilation plenum spaces, including plenum ceilings.

D. Where weld fittings or mechanical grooved fittings are used, use only long radius elbows having a centerline radius of 1.5 pipe diameters.

E. Where ASTM A53 type F pipe is specified, grade A type E or S, or grade B type E or S may be substituted at Contractor's option. Where the grade or type is not specified, Contractor may choose from those commercially available.

F. Where ASTM B88, type L H (drawn) temper copper tubing is specified, ASTM B88, type K H (drawn) temper copper tubing may be substituted at Contractor's option.

PART 3 - EXECUTION

3.01 GENERAL

A. Install pipe and fittings in accordance with reference standards, manufacturer’s recommendations and recognized industry practices.

3.02 PREPARATION

A. Cut pipe ends square. Ream ends of piping to remove burrs. Clean scale and dirt from interior and exterior of each section of pipe and fitting prior to assembly.

3.03 INSTALLATION

A. Install all piping parallel to building walls and ceilings and at heights which do not obstruct any portion of a window, doorway, stairway, or passageway. Where interferences develop in the field, offset or reroute piping as required to clear such interferences. Coordinate locations of plumbing piping with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. In all cases, consult drawings for exact location of pipe spaces, ceiling heights, door and window openings, or other architectural details before installing piping.

B. Where copper or steel piping is embedded in masonry or concrete, provide protective sleeve covering of elastomeric pipe insulation.

C. Install underground warning tape 6"-12" below finished grade above all exterior below ground piping. Where existing underground warning tape is encountered, repair and replace.

D. Maintain piping in clean condition internally during construction.

E. Provide clearance for installation of insulation, access to valves and piping specialties.

F. Provide anchors, expansion joints, swing joints and/or expansion loops so that piping may expand and contract without damage to itself, equipment, or building.

G. Do not route piping through transformer vaults or above transformers, panel boards, or switchboards, including the required service space for this equipment, unless the piping is serving this equipment.

H. Install all valves and piping specialties, including items furnished by others, as specified and/or detailed. Provide access to valves and specialties for maintenance. Make connections to all equipment, fixtures and systems installed by others where same requires the piping services indicated in this section.

3.04 COPPER PIPE JOINTS

A. Remove all slivers and burrs remaining from the cutting operation by reaming and filing both pipe surfaces. Clean fitting and tube with metal brush, emery cloth or sandpaper. Remove residue from the cleaning operation, apply flux and assemble joint to socket stop. Apply flame to fitting until solder melts when placed at joint. Remove flame and feed solder into joint until full penetration of cup and ring of solder appears. Wipe excess solder and flux from joint.

3.05 THREADED PIPE JOINTS

A. Use a thread lubricant or Teflon tape when making joints; no hard setting pipe thread cement or caulking will be allowed.

3.06 MECHANICAL HUBLESS PIPE CONNECTIONS

A. Place the gasket on the end of one pipe or fitting and the clamp assembly on the end of the other pipe or fitting. Firmly seat the pipe or fitting ends against the integrally molded shoulder inside the neoprene gasket. Slide the clamp assembly into position over the gasket. Tighten fasteners to manufacturer's recommended torque.

3.07 PUSH-ON GASKETED PIPE CONNECTIONS

A. Clean pipe end, bell, gasket seat and gasket of dirt or debris. Coat end of pipe and gasket with gasket lubricant. Ensure pipe is supported off the ground so lubricant does not pick up dirt. Push spigot end into gasket bell with levered pipe joining tool recommended by pipe manufacturer. Large diameter exterior mains may be joined by pushing end of pipe section with backhoe against wood blocking over pipe end. Insert to fully seated position or to reference mark on pipe.

3.08 SANITARY WASTE AND VENT

A. Verify invert elevations and building elevations prior to installation. Install exterior piping pitched to drain at indicated elevations and slope. Install interior piping pitched to drain at minimum slope of 1/4" per foot for 2” and smaller piping and 1/8" per foot for piping 3" and larger.

B. Install exterior piping below predicted frost level and not less than 3 feet bury depth to top of pipe wherever possible.

C. Flush piping inlets (floor drains, hub drains, mop basins, fixtures, etc.) with high flow of water at completion of project to demonstrate full flow capacity. Remove blockages and make necessary repairs where flow is found to be impeded.

3.09 PIPING SYSTEM LEAK TESTS

A. Isolate or remove components from system which are not rated for test pressure. Test piping in sections or entire system as required by sequence of construction. Do not insulate or conceal pipe until it has been successfully tested.

B. If required for the additional pressure load under test, provide temporary restraints at fittings or expansion joints. Backfill underground water mains prior to testing with the exception of thrust restrained valves which may be exposed to isolate potential leaks.

C. For hydrostatic tests, use clean water and remove all air from the piping being tested by means of air vents or loosening of flanges/unions. Measure and record test pressure at the

high point in the system.

D. For air or nitrogen tests, gradually increase the pressure to not more than one half of the test pressure; then increase the pressure in steps of approximately one-tenth of the test pressure until the required test pressure is reached. Examine all joints and connections with a soap bubble solution or equivalent method. System will not be approved until it can be demonstrated that there is no measurable loss of test pressure during the test period.

E. Inspect system for leaks. Where leaks occur, repair the area with new materials and repeat the test; caulking will not be acceptable.

F. Entire test must be witnessed by the local authority having jurisdiction. All pressure tests are to be documented.

System	Test Medium	Initial Test Pressure Duration	Final Test Pressure Duration
Sanitary Waste & Vent	Water	N/A	10’ Water 2 Hour

END OF SECTION

SECTION 220155
STORM DRAIN PIPING

PART 1 - GENERAL

1.01 SCOPE

A. This section contains specifications for storm drain piping.

1.02 REFERENCE STANDARDS

ANSI A21.4

ANSI A21.11

ANSI A21.51

ANSI B16.3 Malleable Iron Threaded Fittings

ANSI B16.4 Cast Iron Threaded Fittings

ANSI B16.5 Pipe Flanges and Flanged Fittings

ANSI B16.22 Wrought Copper and Wrought Copper Alloy Solder Joint Pressure Fittings

ANSI B16.29 Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV

STM A53 Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless

ASTM A74 Cast Iron Soil Pipe and Fittings

ASTM A105 Forgings, Carbon Steel, for Piping Components

ASTM A126 Gray Cast Iron Castings for Valves, Flanges, and Pipe Fittings

ASTM A234 Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures

ASTM A861 High Silicon Iron Pipe and Fittings

ASTM A888 Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications

ASTM B32 Solder Metal

ASTM B88 Seamless Copper Water Tube

ASTM B306 Copper Drainage Tube (DWV)

ASTM B813 Liquid and Paste Fluxes for Soldering Applications of Copper and Copper Alloy Tube

ASTM C76 Reinforced Concrete Culvert, Storm Drain and Sanitary Pipe

ASTM C443 Joints for Circular Concrete Pipe Sewer and Culvert Pipe Using Rubber Gaskets

ASTM C564 Rubber Gaskets for Cast Iron Soil Pipe and Fittings

ASTM D1785 Poly Vinyl Chloride (PVC) Plastic Pipe

ASTM D2321 Underground Installation of Flexible Thermoplastic Sewer Pipe

ASTM D2241 Poly Vinyl Chloride (PVC) Pressure-Rated Pipe (SDR Series)

ASTM D2464 Threaded Poly Vinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80

ASTM D2466 Poly Vinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 40

ASTM D2513 Thermoplastic Gas Pressure Pipe, Tubing, and Fittings

ASTM D2564 Solvent Cements for Poly Vinyl Chloride (PVC) Plastic Pipe and Fittings

ASTM D2657 Heat Fusion Joining of Polyolefin Pipe and Fittings

ASTM D2665 Poly Vinyl Chloride (PVC) Plastic Drain, Waste and Vent Pipe and Fittings

ASTM D2729 Poly Vinyl Chloride (PVC) Sewer Pipe and Fittings

ASTM D2774 Recommended Practice for Underground Installation of Thermoplastic Pressure Piping

ASTM D2855 Making Solvent Cemented Joints with Poly Vinyl Chloride (PVC) Pipe and Fittings

ASTM D3034 Type PSM Poly Vinyl Chloride (PVC) Sewer Pipe and Fittings

ASTM D3139 Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals

ASTM D3212 Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals

ASTM D3311 Drain, Waste and Vent (DWV) Plastic Fitting Patterns

ASTM D4101 Propylene Plastic Injection and Extrusion Materials

ASTM F405 Corrugated Polyethylene (PE) Tubing and Fittings

ASTM F437 Threaded Chlorinated Poly Vinyl Chloride (CPVC) Plastic Pipe Fittings, Schedule 80

ASTM F438 Socket Type Chlorinated Poly Vinyl Chloride (CPVC) Plastic Pipe Fittings, Schedule 40

ASTM F441 Chlorinated Poly Vinyl Chloride (CPVC Plastic Pipe, Schedules 40 and 80

ASTM F656 Primers for Use in Solvent Cement Joints of Poly Vinyl Chloride (PVC) Plastic Pipe and Fittings

1.03 SUBMITTALS

A. Provide schedule indicating the ASTM or AWWA specification number of the pipe being proposed along with its type and grade, and sufficient information to indicate the type and rating of fittings for each service.

B. Statement from manufacturer that pipe furnished meets the ASTM or AWWA specification contained in this section.

1.04 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specific testing agency.

B. Any installed material not meeting the specification requirements must be replaced with material that meets these specifications without additional cost to the Owner.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Promptly inspect shipments to insure that the material is undamaged and complies with specifications.

B. Cover pipe to prevent corrosion or deterioration while allowing sufficient ventilation to avoid condensation. Do not store materials directly on grade. Protect pipe, tube, and fitting ends so they are not damaged. Where end caps are provided or specified, take precautions so the caps remain in place. Protect fittings, flanges, and unions by storage inside or by durable, waterproof, above ground packaging.

C. Offsite storage agreements will not relieve the contractor from using proper storage techniques.

D. Storage and protection methods must allow inspection to verify products.

1.06 SYSTEM CRITERIA

A. Use only new material, free of defects, rust and scale, and meeting the latest revision of ASTM or AWWA specifications as listed in this specification.

B. Construct all piping for the highest pressures and temperatures in the respective system.

C. Where weld fittings or mechanical grooved fittings are used, use only long radius elbows having a centerline radius of 1.5 pipe diameters.

D. Where ASTM A53 type F pipe is specified, grade A type E or S, or grade B type E or S may be substituted at Contractor's option. Where the grade or type is not specified, Contractor may choose from those commercially available.

E. Where ASTM B88, type L H (drawn) temper copper tubing is specified, ASTM B88, type K H (drawn) temper copper tubing may be substituted at Contractor's option.

PART 2 - PRODUCTS

2.01 STORM AND CLEARWATER WASTE

A. Interior Above Ground:

1. Hubless cast iron soil pipe and fittings, ASTM A888; ASTM A74. Provide heavy duty, shielded stainless steel bands and tightening devices with ASTM Standard C564 rubber sleeve, ANACO/HUSKY SD 4000 / IDEAL TRIDON Heavy Duty.

2. Type M copper water tube, H (drawn) temper, ASTM B88; with cast copper drainage fittings (DWV), ANSI B16.23; wrought copper drainage fittings (DWV), ANSI B16.29; lead free (<.2%) solder, ASTM B32; flux, ASTM B813; copper phosphorous brazing alloy, AWS A5.8 BCuP. Mechanically formed brazed tee connections may be used in lieu of specified tee fittings for clearwater

waste vent branch takeoffs up to one-half (1/2) the diameter of the main.

3. Copper drainage tube (DWV), ASTM B306; with cast copper drainage fittings (DWV), ANSI B16.23; wrought copper drainage fittings (DWV), ANSI B16.29; lead free (<.2%) solder, ASTM B32; flux, ASTM B813; copper phosphorous brazing alloy, AWS A5.8 BCuP. Mechanically formed brazed tee connections may be used in lieu of specified tee fittings for clearwater waste vent branch takeoffs up to one-half (1/2) the diameter of the main.

B. Interior Below Ground 15" and Smaller:

1. Cast iron soil pipe and fittings, hub and spigot, service weight, ASTM A74; with neoprene rubber compression gaskets, ASTM C564.

2. PVC plastic pipe, Schedule 40, class 12454-B (PVC 1120), ASTM D1785; PVC plastic drain, waste and vent pipe and fittings, ASTM D2665; fitting patterns, ASTM D3311; primer, ASTM F656; solvent cement, ASTM D2564.

C. Exterior Below Ground 15" and Smaller:

1. Cast iron soil pipe and fittings, hub and spigot, service weight, ASTM A74; with neoprene compression rubber gaskets, ASTM C564.

2. PVC plastic pipe, Schedule 40, class 12454-B (PVC 1120), ASTM D1785; PVC plastic drain, waste and vent pipe and fittings, ASTM D2665; fitting patterns, ASTM D3311; primer, ASTM F656; solvent cement, ASTM D2564.

3. Type PSM PVC sewer pipe and fittings, SDR 35, Class 12454-B (PVC 1120), ASTM D3034; primer, ASTM F656; solvent cement, ASTM D2564; or integral bell and flexible elastomeric seal, ASTM D3212.

PART 3 - EXECUTION

3.01 GENERAL

A. Install pipe and fittings in accordance with reference standards, manufacturer’s recommendations and recognized industry practices.

3.02 PREPARATION

A. Cut pipe ends square. Ream ends of piping to remove burrs. Clean scale and dirt from interior and exterior of each section of pipe and fitting prior to assembly.

3.03 INSTALLATION

A. Install all piping parallel to building walls and ceilings and at heights which do not obstruct any portion of a window, doorway, stairway, or passageway. Where interferences develop in the field, offset or reroute piping as required to clear such interferences. Coordinate locations of plumbing piping with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. In all cases, consult drawings for exact location of pipe spaces, ceiling heights, door and window openings, or other architectural details before installing piping.

B. Where copper or steel piping is embedded in masonry or concrete, provide protective sleeve covering of elastomeric pipe insulation.

C. Install underground warning tape 6"-12" below finished grade above all exterior below ground piping. Where existing underground warning tape is encountered, repair and replace.

D. Maintain piping in clean condition internally during construction.

E. Provide clearance for installation of insulation, access to valves and piping specialties.

F. Provide anchors, expansion joints, swing joints and/or expansion loops so that piping may expand and contract without damage to itself, equipment, or building.

G. Do not route piping through transformer vaults or above transformers, panel boards, or switchboards, including the required service space for this equipment, unless the piping is serving this equipment

H. Install all valves and piping specialties, including items furnished by others, as specified and/or detailed. Provide access to valves and specialties for maintenance. Make connections to all equipment, fixtures and systems installed by others where same requires the piping services indicated in this section.

3.04 COPPER PIPE JOINTS

A. Remove all slivers and burrs remaining from the cutting operation by reaming and filing both pipe surfaces. Clean fitting and tube with metal brush, emery cloth or sandpaper. Remove residue from the cleaning operation, apply flux and assemble joint to socket stop. Apply flame to fitting until solder melts when placed at joint. Remove flame and feed solder into joint until full penetration of cup and ring of solder appears. Wipe excess solder and flux from joint.

3.05 THREADED PIPE JOINTS

A. Use a thread lubricant or Teflon tape when making joints; no hard setting pipe thread cement or caulking will be allowed.

3.06 SOLVENT WELDED PIPE JOINTS

A. Install in accordance with ASTM D2855 "Making Solvent Cemented Joints With PVC Pipe and Fittings". Saw cut piping square and smooth. Tube cutters may be used if they are fitted with wheels designed for use with PVC/CPVC pipe that do not leave a raised bead on pipe exterior. Support and restrain pipe during cutting to prevent nicks and scratches. Bevel ends 10-15 degrees and deburr interior. Remove dust, drips, moisture, grease and other superfluous materials from pipe interior and exterior. Check dry fit of pipe and fittings. Reject materials which are out of round or do not fit within close tolerance. Use heavy body solvent cement for large diameter fittings.

B. Maintain pipe, fittings, primer and cement between 40 and 100 degrees during application and curing. Apply primer and solvent using separate daubers (3" and smaller piping only) or clean natural bristle brushes about 1/2 the size of the pipe diameter. Apply primer to the fitting socket and pipe surface with a scrubbing motion. Check for penetration and reapply as needed to dissolve surface to a depth of 4-5 thousandths.

Apply solvent cement to the fitting socket and pipe in an amount greater than needed to fill any gap. While both surfaces are wet, insert pipe into socket fitting with a quarter turn to the bottom of the socket. Solvent cement application and insertion must be completed in less than 1 minute. Minimum of 2 installers is required on piping 4" and larger. Hold joint for 30 seconds or until set. Reference manufacturers recommendations for initial set time before handling and for full curing time before pressure testing. Cold weather solvent/cement may be utilized only under unusual circumstances and when specifically approved by the Architect/Engineer.

C. Solvent cement and primer shall be compliant with California South Coast Air Quality Management District (SCAQMD) Rule 1168 and Ozone Transport Commission (OTC) regulations for Volatile Organic Compound emissions levels.

3.07 MECHANICAL HUBLESS PIPE CONNECTIONS

A. Place the gasket on the end of one pipe or fitting and the clamp assembly on the end of the other pipe or fitting. Firmly seat the pipe or fitting ends against the integrally molded shoulder inside the neoprene gasket. Slide the clamp assembly into position over the gasket. Tighten fasteners to manufacturers recommended torque.

3.08 PUSH ON GASKETED PIPE CONNECTIONS

A. Clean pipe end, bell, gasket seat and gasket of dirt or debris. Coat end of pipe and gasket with gasket lubricant. Ensure pipe is supported off the ground so lubricant does not pick up dirt. Push spigot end into gasket bell with levered pipe joining tool recommended by pipe manufacturer. Large diameter exterior mains may be joined by pushing end of pipe section with backhoe against wood blocking over pipe end. Insert to fully seated position or to reference mark on pipe.

3.09 STORM AND CLEARWATER WASTE

A. Verify invert elevations and building elevations prior to installation. Install exterior piping pitched to drain at indicated elevations and slope. Install interior piping pitched to drain at minimum slope of 1/8" per foot where possible and in no case less than 1/16" per foot for piping 3" and larger.

B. Install exterior piping below predicted frost level and not less than 3 feet bury depth to top of pipe wherever possible.

3.10 PIPING SYSTEM LEAK TESTS

A. Isolate or remove components from system which are not rated for test pressure. Test piping in sections or entire system as required by sequence of construction. Do not insulate or conceal pipe until it has been successfully tested.

B. If required for the additional pressure load under test, provide temporary restraints at fittings or expansion joints. Backfill underground water mains prior to testing with the exception of thrust restrained valves which may be exposed to isolate potential leaks.

C. For hydrostatic tests, use clean water and remove all air from the piping being tested by means of air vents or loosening of flanges/unions. Measure and record test pressure at the high point in the system.

D. For air or nitrogen tests, gradually increase the pressure to not more than one half of the test pressure; then increase the pressure in steps of approximately one-tenth of the test pressure until the required test pressure is reached. Examine all joints and connections with a soap bubble solution or equivalent method. System will not be approved until it can be demonstrated that there is no measurable loss of test pressure during the test period.

E. Inspect system for leaks. Where leaks occur, repair the area with new materials and repeat the test; caulking will not be acceptable.

F. Entire test must be witnessed by the local authority having jurisdiction. All pressure tests are to be documented.

System	Test Medium	Initial Test Pressure Duration	Final Test Pressure Duration
Clear Water Waste &Vent	Water	N/A	10’ Water 2 Hour
Storm & Clear Water Waste	Water	N/A	10’ Water 2 Hour

END OF SECTION

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SECTION 220160
NATURAL GAS SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. This section covers the complete natural gas system installation, within and to five (5) feet beyond building perimeter unless noted otherwise on Contract Drawings, including but not limited to piping, regulators, unions, valves, installation, testing and other normal parts that make the systems complete, operable, code compliant and acceptable to the authorities having jurisdiction.

1.2 REFERENCE STANDARDS

A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.

B. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.

C. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within the following references:

D. 2018 Edition of the International Fuel Gas Code.

E. Latest Edition of NFPA 54, National Fuel Gas Code.

1.3 QUALITY ASSURANCE

A. All materials, equipment and Work shall meet or exceed all applicable federal, state and local requirements and conform to codes and ordinances of authorities having jurisdiction.

B. Valves: Manufacturer’s name, size, standards compliance and pressure rating clearly marked on outside of valve body.

C. Welding Materials and Procedures: Conform to ASME Code and applicable state labor regulations.

1.4 SUBMITTALS

A. Product Data:

B. Provide code and standards compliance verification, manufacturer's product data and ratings on pipe materials, pipe fittings, regulators, valves and accessories.

1.5 DELIVERY, STORAGE and HANDLING

A. Accept valves on Site in shipping containers with labeling in place, inspect for damage and store with a minimum of handling. Store plastic piping under cover out of direct sunlight. Do not store materials directly on the ground.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work and isolating parts of completed system.

1.6 EXTRA MATERIALS

A. Provide one (1) plug valve wrench for every ten (10) plug valves sized 2 inches and smaller, minimum of one. Provide each plug valve sized 2-1/2 inches and larger with a wrench incorporating a setscrew.

PART 2 - PRODUCTS

2.1 GENERAL

A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

B. Natural gas pressures shall not exceed five (5) pounds per square inch gauge on Owner's side of the meter.

C. Pipe joint compound shall be lead-free, non-toxic, non-hardening, insoluble in the presence of natural gas and compliant with ANSI/NSF 61 and Federal Specification TT-S-1732. Temperature service range of -15 degrees F to +400 degrees F, manufactured by Hercules "MegaLoc" or approved equal by Rectorseal, La-Co or Oatey.

2.2 PIPING

A. Buried Piping Outside of Building:

1. Polyethylene, SDR-11, ASTM D2513 pipe and fittings with heat fusion socket joints.

2. Polyethylene pipe and fitting materials shall be compatible and by same manufacturer to ensure uniform melting and a proper bond. Fabricated fittings shall not be used.

3. Provide connection between buried plastic gas service piping and metallic riser in accordance with the gas code. Provide metallic riser consisting of HDPE fused coating on steel pipe for connection to above ground building distribution piping. Underground horizontal metallic portion of riser shall be at least twenty four inches in length before connecting to the plastic service pipe. An approved transition fitting or adaptor meeting design pressure rating and plastic pipe manufacturers recommendations shall be used where the plastic joins the metallic riser.

B. Above Ground Piping Outside of Building (Including roof):

1. Piping 2 inches and smaller shall be seamless Schedule 40 black steel, ASTM A106 or ASTM A53 Type "S", Grade A or B, with Class 150 black malleable iron threaded fittings conforming to ASME B16.3.

2. Piping 2½ inches and larger shall be Type "S" seamless or Type "E" electric resistance welded Schedule 40 black steel, ASTM A53, Grade A or B, with Schedule 40 wrought carbon steel fittings, ASTM A 234 and butt weld joints.

3. Provide factory-applied, three-layer coating of epoxy, adhesive, and PE or field applied primer and epoxy paint coating on all pipe and fittings. Field applied coating is restricted to fittings and short sections of pipe necessarily stripped for threading or welding. Field coating shall be manufactured by Amercoat Type 240 or approved equal and applied in accordance with manufacturer's recommendations. Galvanizing shall not be considered adequate protection.

C. Above Ground Piping Inside of Building:

1. Piping 2 inches and smaller shall be seamless Schedule 40 black steel, ASTM A106 or ASTM A53 Type "S", Grade A or B, with Class 150 black malleable iron threaded fittings conforming to ASME B16.3.

2. Piping 2½ inches and larger shall be Type "S" seamless or Type "E" electric resistance welded Schedule 40 black steel, ASTM A53, Grade A or B, with Schedule 40 wrought carbon steel fittings, ASTM A 234 and butt weld joints.

D. Above Ground Piping Concealed Inside of Building ("Concealed Piping" as defined by the International Fuel Gas Code, 2018):

1. Piping 2 inches and smaller shall be seamless Schedule 40 black steel, ASTM A106 or ASTM A53 Type "S", Grade A or B, with welded joints with Schedule 40 socket welded forged steel fittings conforming to ASME B16.11.

2. Piping 2½ inches and larger shall be Type "S" seamless or Type "E" electric resistance welded Schedule 40 black steel, ASTM A53, Grade A or B, with Schedule 40 wrought carbon steel fittings, ASTM A 234 and butt weld joints.

3. Piping above ceilings 2 inches and smaller may be installed as threaded in lieu of welded provided that all piping is encased within steel sleeve vented to the exterior of the building. Sleeve piping shall be Schedule 10 black steel pipe conforming to ASTM A53, Grade A or B, electric resistance welded or seamless, with roll-grooved ends. Sleeve pipe couplings shall be Victaulic Style 75 with Grade T nitrile gasket. Sleeve fittings shall be Victaulic grooved malleable or steel. Sleeve piping and fittings must be two pipe sizes, but not less than 1 inch larger than encased gas piping.

2.3 underground warning tape

A. Minimum 3 inch wide polyethylene detectable type marking tape. The tape shall be resistant to alkalis, acids and other destructive agents found in soil and impregnated with metal so that it can be readily recognized after burial by standard locating equipment.

B. Lamination bond of one (1) layer of Minimum 0.35 mils thick aluminum foil between two (2) layers of minimum 4.3 mils thick inert plastic film.

C. Minimum tensile strength: 63 LBS per 3 IN width.

D. Minimum elongation: 500 percent.

E. Provide continuous yellow with black letter printed message repeated every 16 to 36 inches warning of pipe buried below (e.g.: "CAUTION GAS LINE BURIED BELOW").

F. Manufactured by Reef Industries "Terra Tape" or approved equal.

2.4 Valves

A. All valves shall be designed, manufactured and approved for natural gas service.

B. Line Shut-off Valves sizes 2 inches and smaller shall be iron body lubricated plug valve conforming to ASTM-A-126, U.L. Listed and A.G.A. Approved for natural gas service with threaded ends, wrench operation, rated for 200 WOG service pressure and –20 to 200 degrees F., manufactured by Resun Model R-1430, Nordstrom Model 142, or approved equal.

C. Line Shut-off Valves sizes 2½ inches and larger shall be iron body lubricated plug valve conforming to ASTM-A-126, U.L. Listed and A.G.A. Approved for natural gas service with flanged ends, wrench operation, rated for 200 WOG service pressure and –20 to 200 degrees F., manufactured by Resun Model R-143, Nordstrom Model 143, or approved equal.

D. Appliance/Equipment Shut-off Valves at local connections sizes 2 inches and smaller shall be bronze body, full port ball or butterfly type, U.L. Listed and A.G.A. Approved for natural gas service with threaded ends, quarter turn lever handle operation, rated for 175 W.O.G. service pressure and 30 to 275 degrees F., manufactured by Nibco Model T585-70-UL, Model T580-70-UL, Milwaukee Model BB2-100, or approved equal.

E. Manual Emergency Shut-off Valves sizes 2 inches and smaller shall be bronze body, full port ball or butterfly type, U.L. Listed and A.G.A. Approved for natural gas service with threaded ends, quarter turn lever handle operation, rated for 175 W.O.G. service pressure and 30 to 275 degrees F., manufactured by Nibco Model T585-70-UL, Model T580-70-UL, Milwaukee Model BB2-100, or approved equal.

F. Automatic Emergency Shut-off Valves shall be U.L. Listed F.M. Approved for natural gas service, 2-way electrically tripped solenoid type; fail safe closed; manual reset; Type 1 solenoid enclosure; NBR seals and disc; stainless steel core tube and springs; copper coil; manufactured by ASCO Red Hat Series 8044, or approved equal.

2.5 PRESSURE REGULATORS

A. All pressure regulators shall be designed, manufactured and approved for natural gas service.

B. Pressure regulators for individual service lines shall be capable of reducing distribution line pressure to pressures required for users. Pressure relief shall be set at a lower pressure than would cause unsafe operation of any connected user. Regulator shall have a single port with orifice diameter no greater than that recommended by manufacturer for the maximum gas pressure at the regulator inlet. Regulator vent valve shall be of resilient materials designed to withstand flow conditions when pressed against valve port. Regulator shall be capable of limiting build-up of pressure under no-flow conditions to 50 percent or less of the discharge pressure maintained under flow conditions. Commercial grade diaphragm type with internal relief valve, vent valve, cast iron body, Buna-N diaphragm. Manufactured by Rockwell or Fisher.

C. Install pressure gauge adjacent to and downstream of each line pressure regulator.

2.6 UNIONS

A. Unions in 2 inches and smaller in ferrous lines shall be right and left hand nipple/coupling assembly, or ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends, 2-1/2 inches and larger shall be ground flange unions. Companion flanges on lines at various items of equipment, machines and pieces of apparatus may serve as unions to permit disconnection of piping.

B. Unions connecting ferrous pipe to copper or brass pipe shall be dielectric type.

C. Above grade flexible stainless steel appliance/equipment connectors shall conform with AGA under the ANSI Z21.69 Standard. Hose shall be braided stainless steel with a polyolefin heat-shrink tubing with high flame-retardant qualities. Hose shall be equipped with malleable iron unions and spring loaded brass quick-link couplings. An easily accessible manual shut-off valve shall be installed ahead of all hose connections. Specify T&S Brass "Safe-T-Link" or approved equal.

2.7 FLANGES

A. All 150 lb. and 300 lb. ANSI flanges shall be domestically manufactured, weld neck forged carbon steel, conforming to ANSI B16.5 and ASTM A-181 Grade I or II or A-105-71. Slip on flanges shall not be used. Each fitting shall be stamped as specified by ANSI B16.9 and, in addition, shall have the laboratory control number stenciled on each fitting for ready reference as to physical properties and chemical composition of the material. Flanges shall have the manufacturer’s trademark permanently identified in accordance with MSS SP-25. Bolts used shall be carbon steel bolts with semi-finished hexagon nuts of American Standard Heavy dimensions. Bolts shall have a tensile strength of 60,000 psi and an elastic limit of 30,000 psi. Flat-faced flanges shall be required to match flanges on check valves, strainers, and other valves and devices. Only one manufacturer of weld flanges will be approved.

B. All flanges shall be gasketed. Contractor shall place gasket between flanges of flanged joints. Gaskets shall fit within the bolt circle on raised face flanges and shall be full face on flat face flanges. Gaskets shall be cut from 1/16 inch thick, non metallic, non asbestos gasket material suitable for operating temperatures from -150 degrees F to +75 degrees F, Klingersil C-4400, Manville Style 60 service sheet packing, or equal.

PART 3 - EXECUTION

3.1 PREPARATION

A. Ream pipe ends and remove cutting burrs. Bevel plain end ferrous pipe.

B. Remove cutting oil, scale and dirt, on inside and outside of piping, before assembly.

3.2 Equipment connections

A. Provide specified connections, shutoff valves, regulators and unions at each and every appliance and piece of equipment requiring natural gas.

B. Provide and install union type connections at all equipment to permit removal of service piping.

C. Gas service connections shall have a diameter at least one pipe size larger than that of the inlet connection to the equipment as provided by the manufacturer and be of adequate size to provide the total input demand of the connected equipment.

D. Provide listed and labeled appliance connectors complying with ANSI Z21.69 and listed for use with food service equipment having casters, or that is otherwise subject to movement for cleaning, and other large movable equipment. Connectors shall have listed and labeled quick-disconnect devices and shall have retaining cables attached to structures and equipment. Connectors shall not be concealed within or extended through wall, floor or partition and shall be located entirely in the same room as the connected equipment. Provide an accessible shut-off valve not less than the nominal size of the equipment connector, immediately ahead of the connector.

E. Rigid metallic pipe and fittings shall be used at service connections to all stationary equipment.

3.3 INSTALLATION

A. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.

B. All installation shall be in accordance with manufacturer's published recommendations.

C. Provide support for and connections to natural gas service meter in accordance with requirements of the utility company, when so indicated on the Drawings.

D. All installation shall be in accordance with manufacturer's published recommendations.

E. Distribution piping shall be as short and as direct as practicable between the point of delivery and the outlets.

F. Do not install underground piping when bedding is wet or frozen.

G. Bury all underground piping at least 3 feet below finished grade. Provide a continuous detectable warning tape on tamped backfill, 12 inches above all buried non-metallic gas lines.

H. Do not install gas piping in the same trench with other utilities. The minimum horizontal clearance between gas pipe and parallel utility pipe shall be 2 feet. Do not install gas pipe through catch basins, vaults, manholes or similar underground structures.

I. Install and support all polyethylene piping in accordance with manufacturer's recommendations. All heat fusion welds shall be performed by welders qualified to the manufacturer's procedures.

J. Polyethylene piping shall not be installed above ground.

K. Provide connection between buried plastic gas piping and metallic riser in accordance with the gas code.

L. All above ground gas piping shall be electrically continuous and bonded to electrical system ground conductor in accordance with NFPA 70.

M. Provide and install union type fittings at proper points to permit dismantling or removal of pipe. No unions will be required in welded lines except at equipment connections. Where union type fittings are necessary for piping dismantling purposes, right and left nipples and couplings shall be used. Flanges, ground-joint unions or approved flexible appliance connectors may be used at exposed fixture, appliance or equipment connections.

N. Provide dielectric isolation device where copper lines connect to ferrous lines or equipment, such as dielectric coupling or dielectric flange fitting.

O. Valves, regulators, flanges, union type fittings and similar appurtenances shall be accessible for operation and servicing and shall not be located above ceilings, within chases, walls/partitions, spaces utilized as return air plenums or non-accessible locations.

P. Route piping in orderly manner and maintain gradient. Install piping to conserve building space. Group piping whenever practical at common elevations.

Q. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

R. Make service connections at the top of the main, whenever the depth of the main is sufficient to allow top connections. When service connections cannot be made at the top of the main, they shall be made on the side of the main no lower than the horizontal midpoint of the gas main.

S. Close nipples, bushing and cross type fittings shall not be installed in any gas piping system.

T. Slope piping and arrange to drain at low points. Install drip/sediment traps at points where condensate and debris may collect. Locate drip/sediment traps where readily accessible for cleaning and emptying. Do not install where condensate would be subject to freezing. Construct drip/sediment traps using tee fitting with capped nipple connected to bottom outlet. Use minimum-length nipple of 3 pipe diameters, but not less than 4 inches long, and same size as connected pipe. Cap shall be screwed pattern, black, standard weight, malleable iron. Install with adequate space for removal of cap.

U. Install valves for shut off and to isolate equipment, parts of systems, or vertical risers. All valves shall be located such that servicing and operation is possible. All flanged valves shown in horizontal lines with the valve stem shall be positioned so that the valve stem is inclined one bolt hole above the horizontal position. Screw pattern valves placed in horizontal lines shall be installed with their valve stems inclined at an angle of a minimum of 30 degrees above the horizontal position. All valves must be true and straight at the time the system is tested and inspected for final acceptance.

V. Install line shut-off valve at each branch connection to riser.

W. Provide adequate clearance for access to and operation of all valves.

X. Install valves with stems upright or horizontal, not inverted unless required otherwise by the valve manufacturer.

Y. Pipe vents from gas pressure reducing valves and pipe casing sleeves to the exterior of the building and terminated with outlet turned down and capped with corrosion resistant insect screen. Vent terminations shall be at least seven feet above grade or pedestrian traffic and a minimum three (3) feet above or twenty-five (25) feet horizontally from all air intakes or building openings.

Z. Above ground horizontal natural gas and encasement piping shall be supported at intervals of no greater than 6 foot for 1/2 inch piping, 8 foot for 3/4 inch and 1 inch piping and 10 foot for 1-1/4 inches and larger piping. Vertical piping shall be supported at each floor level and at intervals as specified for horizontal piping.

AA. Extension bars shall not be used for supporting gas or encasement piping. Gas or encasement piping shall not be used to support any other piping or component.

BB. Provide piping and valve identification in accordance with Project Specification Section 20 05 53.

3.4 INSTALLATION OF WELDED PIPING

A. Welding of pipe in normally occupied buildings is prohibited. Off-Site welding is acceptable. Should welding be required in a normally occupied building for connecting to an existing welded system, obtain written approval from the Owner and comply with Owner's fire and life safety requirements.

B. Piping and fittings shall be welded and fabricated in accordance with ASME/ANSI the latest editions of Standard B32.1 for all systems from the Code for Pressure Piping. Machine beveling in shop is preferred. Field beveling may be done by flame cutting to recognized standards.

C. Ensure complete penetration of deposited metal with base metal. Provide filler metal suitable for use with base metal. Maintain inside of fittings free from globules of weld metal. All welded pipe joints shall be made by the fusion welding process, employing a metallic arc or gas welding process. All pipes shall have the ends beveled 37-½ inch degrees and all joints shall be aligned true before welding. Except as specified otherwise, all changes in direction, intersection of lines, reduction in pipe size and the like shall be made with factory-fabricated welding fittings. Mitering of pipe to form elbows, notching of straight runs to form tees, or any similar construction will not be permitted.

D. Align piping and equipment so that no part is offset more than 1/16 inch. Set all fittings and joints square and true and preserve alignment during welding operation. Use of alignment rods inside pipe is prohibited.

E. Contractor shall not permit any weld to project within the pipe so as to restrict it. Tack welds, if used, must be of the same material and made by the same procedure as the completed weld. Otherwise, remove tack welded during welding operation.

F. Do not split, bend, flatten or otherwise damage piping before, during or after installation.

G. Remove dirt, scale and other foreign matter from the inside of piping, by swabbing or flushing, prior to the connection of other piping sections, fittings, valves or equipment.

H. In no cases shall Schedule 40 pipe be welded with less than three passes including one stringer/root, one filler and one lacer. Schedule 80 pipe shall be welded with not less than four passes including one stringer/root, two filler and one lacer. In all cases, however, the weld must be filled before the cap weld is added.

3.5 TESTING

A. All natural gas systems shall be inspected, tested, purged and placed into operation in accordance with NFPA 54 and as required herein.

B. All necessary apparatus for conducting tests shall be furnished by the Contractor and comply with the requirements of NFPA 54.

C. All new rough-in distribution piping and affected portions of existing systems connected to, shall be subjected to a pneumatic test pressure utilizing clean, dry air and must be demonstrated to be absolutely tight when subjected to the pressures and time durations listed herein. All equipment and components designed for operating pressures of less than the test pressure shall not be connected to the piping system during test.

D. Systems on which the normal operating pressure is less than 0.5 pounds per square inch gauge (psig), the test pressure shall be 5.0 psig and the time interval shall be 30 minutes.

E. Systems on which the normal operating pressure is between 0.5 psig and 5.0 psig, the test pressure shall be 1.5 times the normal operating pressure or 5.0 psig, whichever is greater, and the time interval shall be 30 minutes.

F. Systems on which the normal operating pressure is 5.0 psig or greater, the test pressure shall be 1.5 times the normal operating pressure, and the time interval shall be one (1) hour.

G. After testing is complete, the entire gas system shall be purged with dry nitrogen to eliminate all air, debris and moisture from the piping before natural gas is introduced into the system.

H. After successful results of pressure test and purging have been completed, a leakage test shall be performed in accordance with NFPA 54 Appendix D.

I. Connect, inspect and purge gas utilization equipment, lab hook-ups and outlets, and place into operation only after successful results of pressure test, leakage test and purging have been completed and accepted.

J. Testing operations shall be repeated until gas-piping systems are absolutely tight at the pneumatic test pressures indicated above.

K. Pressure test gas piping sleeve system with clean, dry compressed air at 15 psig by temporarily sealing all openings between gas carrier pipe and sleeve and vent openings. Sleeve systems must be demonstrated to be absolutely tight when subjected to this pressure for a period of four hours.

END OF SECTION

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SECTION 22 05 00
COMMON WORK RESULTS FOR PLUMBING

PART 1 GENERAL

1.1 SUMMARY

A. The intent of these specifications and the accompanying drawings is to provide complete and workable systems as shown, specified and required by applicable codes.

1.2 CODES

A. All material and equipment provided and installed as part of these construction documents shall be in compliance with the latest edition of the adopted codes and applicable standards by the State in which the work is performed.

1.3 RESPONSIBILITY

A. The Construction Manager/General Contractor (CM/GC) shall be responsible for all work included in Division 22. The delegation of work to the contractors shall not relieve him of this responsibility. Contractors who perform work under this Division shall be responsible to the CM/GC.

1.4 PERMITS

A. Obtain and pay for permits, fees, certificates of inspection and approval, etc. required for this work. Furnish Owner with certificates of final inspection and approval prior to final acceptance of the work.
B. Laws and regulations which bear upon or affect the work shall be complied with.

1.5 SITE VISIT

A. Prior to preparing the bid, the mechanical plumbing subcontractor shall visit the site and become familiar with all existing conditions. Make all necessary investigations as to locations of utilities and all other matters which can affect the work. No additional compensation will be made to the contractor as a result of his failure to familiarize himself with the existing conditions under which the work must be performed.

1.6 OUTAGES

A. For all work requiring an outage, the plumbing contractor shall submit an outage request to the Architect / Owner.
B. The existing plumbing system shall remain operational unless coordinated with the Architect / Owner during the construction of the project.
C. Unless otherwise specified, outages of any services required for the performance of this contract and affecting areas other than the immediate work area shall be scheduled at least ten business days (10) days in advance. Outages shall be performed so as to minimize disruption to the owner. If necessary, some outage work may be performed outside normal hours if approved by Owner.
D. All plumbing outages which will interfere with the normal use of the building in any manner shall be done at such times as shall be mutually agreed upon by the contractor and the Owner.

E. The plumbing contractor shall include in his price the cost of all premium time required for outages and other work which interferes with the normal use of the building, which will be performed, in most cases, during other than normal work time and at the convenience of the Owner.

1.7 REQUESTS FOR INFORMATION

A. Submit all questions, requests for information (RFIs) and similar queries through the formally established RFI process for the project that has been accepted by the Owner's Representative, Design Professionals, CM/GC, and subcontractors.

1.8 SUBMITTALS

A. Provide submittals for all material, equipment and supports as specified in Division 22 and where indicated on the drawings and details. At a minimum the following submittals shall be provided as required by the project unless otherwise noted:
   1. Pipe, fittings and accessories
   2. Valves, strainers and unions
   3. Insulation
   4. Hangers and supports
   5. Plumbing fixtures and trim
   6. Safety fixtures and equipment
   7. Backflow preventers
   8. Identification labels and tags
   9. Floor drains
   10. Roof drains
   11. Hot water heating equipment
   12. Trap priming system
   13. Plumbing pumps
   14. RO/DI equipment and pipe
   15. Laboratory compressed air system
   16. Laboratory vacuum system
   17. Laboratory gas outlets

B. Warranties and maintenance instructions shall be included in the O & M Manual only. Do not include this data in the Product Submittals.

C. The Contractor shall provide to the Architect for review electronic copies of required submittals, in PDF format, unless noted otherwise. All Catalog Data, Shop Drawings, Calculations, and Certificates of Compliance shall be submitted as a single package. Failure of the contractor to provide a complete submittal package may result in delay in processing time. All such delays to the job resulting from the contractor's failure to provide submittals at one time will be the responsibility of the Contractor. Submittals shall clearly identify the contract documents specification section or drawing referenced, identifying and highlighting each item to be reviewed.

D. Submittals provided for review shall clearly and completely describe the specific product(s) they represent. Where differences exist between the item specified and that submitted for review, the submittal shall be highlighted.

E. Submittals shall bear the review stamp of the Contractor. The review stamp of the Contractor shall be affixed to shop drawings to indicate:

1. The Contractor has coordinated the electrical characteristics of the equipment.

2. The Contractor has verified that the equipment submitted will physically fit into the space allocated with adequate clearances for maintenance, access, and egress requirements.

3. The Contractor shall bear all associated costs that may accrue due to failure to completely represent a given product.

F. Material and equipment shown on the drawings or specified herein shall not be incorporated in the work of this Contract until shop drawings, engineering data, and catalog information have been reviewed and accepted by the Engineer.

G. The installing contractor shall maintain as-built drawings; and, shall provide the complete set at the time of final close out. As-built drawings are to be provided, in PDF format on compact disk or DVD.

1.9 VARIANCES

A. Where variances occur between the drawings and specifications or within either document itself, the item or arrangement of better quality, greater quantity or higher cost shall be included in the contract price. The Engineer shall decide on the item and manner in which the work shall be provided.

1.10 PERFORMANCE REQUIREMENTS

A. Contract drawings are generally diagrammatic and do not indicate all offsets, fittings, transitions, access panels and other specialties required. Furnish and install all items as may be required to fit the work to the conditions encountered. Install all new work in such manner as to conform to the structure, avoid obstructions, provide required service clearances and preserve headroom. Do not scale from drawings, all measurements should be taken in the field.

B. Arrange plumbing piping, equipment and other work generally as shown on the contract drawings, providing proper clearances and access.

C. Coordinate all work with all other contractors and installers in addition to existing building obstructions and install accordingly. Comply with requirements of architectural drawings

including but not limited to mounting height and locations. Fully research peculiarities and limitations of space available for installation of work with materials being provided. Work around material lead times to not extend project schedule.

1.11 QUALITY ASSURANCE

A. Contractor shall have a minimum five (5) years' experience in the installation of systems similar to the systems specified. Contractor, if requested, shall demonstrate his ability to perform all work to be included under the contract. Assurance if requested, shall be in the form of a list of past projects of similar size and complexity and a list of six (6) references pertaining to those projects. Failure to demonstrate these quality assurances shall be taken as a statement of the contractor's inability to perform.

1.12 WARRANTY / GUARANTEE

A. Provide a warranty/guarantee in written form as part of O&M manual stating that all work, materials, equipment and parts are warranted to be free of defect for a minimum period of one year from the date of Substantial Completion. Warranty period and requirements may be expanded in drawings or subsequent specification sections. Repair or replace (owner's option) any defects or failures at no cost to the owner within the warranty period. Issues arising within warranty period must be attended to in a timely manner and in no case exceed four (4) working days. State this in writing as part of O&M manual. Replace defective items to the satisfaction of the Owner's Representative and the Design Professional.

PART 2 PRODUCTS

2.1 GENERAL

A. The listed manufacturers represent the basis for design and identify the minimum level of quality for materials and equipment, specified in this Division, that are acceptable. Contractors may submit material and equipment by non-listed manufacturers provided submittals meet the requirements of these specifications. All submitted materials and equipment are subject to approval by the Engineer.

B. Provide materials that are new, full weight, and of the best quality. Obtain equipment, components and materials from single manufacturer for products of the same kind or category. Provide materials that are listed and labeled and marked for intended location and application.

C. The equipment layouts and the related mechanical and electrical service connections, access space and supports indicated on the construction documents represent equipment provided by the specified basis of design manufacturer and model number. When the successful bidder chooses to provide equipment by another approved manufacturer, the bidder shall be responsible for providing all adjustments and modifications to the services necessary to make connections to the equipment, the bidder shall be responsible for installing the equipment such that all required clear access space is maintained, and the bidder shall be responsible for providing all adjustments and modifications to the equipment mounting and supports. All adjustments and modifications shall be provided by the bidder and appropriate subcontractors at no additional cost to the project.

PART 3 EXECUTION

3.1 GENERAL

A. Unless specifically indicated, provide all specified and drawn work as required to render all equipment and systems fully operational, including all ancillary, accessory, and support work. Install equipment and materials in strict accordance with manufacturer's written instructions.
B. In cases where products or materials are furnished by Owner or others, provide the following services: receive, transport and securely store materials on site; remove materials and components from packaging; assemble all materials and components per factory instructions; install, wire and connect materials and components as recommended by manufacturer for a fully operational installation.
C. Examine surfaces to receive products for suitable mounting conditions and verify compliance with installation tolerances and other conditions affecting performance of the work. Proceed with installation only after unsatisfactory conditions have been corrected.
D. Equipment shall be installed in accordance with manufacturer’s installation recommendations. Provide and maintain service, maintenance and operating clearances as required by the manufacturer.
E. Workmanship throughout shall conform to the standards of best practice and all labor employed must be competent and qualified to do all the work required.

3.2 COORDINATION ITEMS

A. Coordinate sizes and locations of concrete housekeeping pads with architectural and structural elements. Concrete housekeeping pads shall be provided with all equipment provided. Concrete shall be 3,500 psi twenty-eight (28) day compressive strength concrete with reinforcement bars as specified in the architectural specifications.

B. Cut and drill all openings in roofs, walls, and floors required for the installation. Neatly patch all openings cut. Hold cutting and patching to a minimum by arranging with other contractors for all sleeves and openings before construction is started. When drilling/cutting concrete slabs, utilize ground penetrating radar (GPR) and/or X-ray scanning equipment to verify the location is free from obstructions, including but not limited to: structural rebar/strands/tendons, electrical conduit/wiring, and/or piping/ductwork.

3.3 DELIVERY, STORAGE, HANDLING, AND PROTECTION

A. Receive, inspect, store and protect all materials required for new work. Do not accept or install any product damaged in any way.
B. Comply with all manufacturer guidelines and requirements for movement, storage, and protection of new work. All new work must be stored in a clean, dry place protected from weather and construction traffic. Maintain acceptable temperature and humidity per manufacturer recommendations.
C. Prior to installation, all products shall have the ability to be returned to the supplier or manufacturer after purchase and charged a reasonable restocking fee equal to a small portion of the cost.

D. Protect all new work through construction from damage. Take safeguards necessary to protect from damage. Items damaged during construction will not be accepted and shall be replaced with new.
E. Remove and replace all materials that have been installed improperly, physically damaged, moisture or water damaged, or mold damaged.
F. Protect drains throughout all phases of construction to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
G. Place plugs in ends of uncompleted piping at end of each day or when work stops.

3.4 EXCAVATING AND BACKFILLING

A. Perform all excavation and backfilling required for admittance of work. Execute work safely providing slope sides, shoring and bracing as required for stability.
B. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by excavation operations. Properly restore streets, sidewalks, concrete and blacktop surfaces that were broken during the excavation process.
C. Underground drainage piping shall be laid on a 6” of well-tamped bedding course of a sand/gravel mix with a maximum 3/8” particle size. Bedding shall be scooped out at the bells or couplings to ensure the piping is well supported throughout its entire length. Sand/gravel mix should be firmly compacted under, around, and above the pipe in 6” lifts to grade. Compaction should be a minimum of 95 percent of standard proctor according to ASTM D698.
D. Underground piping installations shall conform with ASTM D2321/F1668 and CISPI 301.
E. Install piping materials in accordance with the manufacturer’s requirements and in conjunction with the standards referenced in this specification. Installation methods shall comply with the more restrictive standards.

3.5 STARTUP, TESTING, AND ADJUSTMENTS

A. Adjust fixtures, equipment, accessories, and moving parts to function smoothly and lubricate as recommended by manufacturer.
B. Provide necessary power to fixtures, equipment, and accessories to ensure proper functionality.
C. Complete installation and startup checks according to manufacturer's written instructions.

3.6 CLEANING EQUIPMENT AND PREMISES

A. Vacuum, clean and wipe down all new work and equipment inside and out. Exposed parts which are to be painted shall be cleaned of all foreign objects and prepped for paint.
B. During the progress of work, clean up and leave the premises and portions of the building in which work has occurred in a clean and safe condition. Provide this cleaning on a per-shift basis.

3.7 DEMONSTRATION / TRAINING

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain equipment.

END OF SECTION

SECTION 220548
VIBRATION ISOLATION AND SEISMIC RESTRAINT FOR PLUMBING COMPONENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

The work under this section is subject to the requirements of the Contract Documents, including General and Supplementary Conditions and Division 01 General Requirements.

Specifications throughout all Divisions are directly applicable to this Section, and this Section is directly applicable to them. In the event that this section conflicts with the requirements of other Sections, the more stringent criteria shall apply.

1.2 DESCRIPTION

This section includes requirements for vibration isolation and seismic restraint of nonstructural components in Risk Category I, II, III, & IV structures, including, but not limited to:

Plumbing Components: Gas piping; water piping; waste or vent piping; water heaters, etc.

Work in this section includes the restraint design and/or equipment/product certifications to be submitted for review by the registered design professional.

1.3 DEFINITIONS

Active Equipment: Equipment with dynamic moving or rotating parts or parts that are energized.

Attachments / Anchorage: Means by which nonstructural components or supports for nonstructural components are secured or connected to the seismic-force resisting system of the structure. Such attachments may include anchor bolts, welded connections, mechanical fasteners or other approved attachment devices. Friction attachments do not constitute positive attachments.

Bracing: Struts, braces, cables, anchors or other structural elements providing restraint for nonstructural components to prevent excessive movement.

Certificate of Compliance: A certificate, supplied by the component manufacturer, stating that materials and products meet specified standards and project specific requirements.

Component Importance Factor (I_p): Factor applied to a component that defines the criticality of that component. This factor can be 1.0 or 1.5 in accordance with ASCE 7, Section 13.1.3.

Consequential Damage: Failure of an essential component caused by the failure of a separate essential or non-essential component due to the functional and physical interrelationship of the components, their supports, and their effect on each other.

Designated Seismic System: Those nonstructural components that require design in accordance with Chapter 13 of ASCE 7, for which the Component Importance Factor (Ip) is

1.5 in accordance with Section 13.1.3 of ASCE 7.

Special Seismic Certification: A certificate of compliance, supplied by the manufacturer of Active Designated Seismic Systems, which certifies that the equipment will remain operable during the design seismic event. Components with hazardous contents shall be certified as maintaining containment following the design seismic event.

Structure: The load-bearing building elements designed by the Structural Engineer of Record. Non-load bearing partition walls, unreinforced slabs or other building elements that do not provide direct load transfer to the load-bearing building elements shall not be defined as part of the Structure and cannot be used for attachment of seismic restraints.

Supports: Those members, assemblies of members, or manufactured elements, including braces, frames, legs, snubbers, curbs, rails, hangers, saddles or struts, and associated fasteners that transmit loads between non-structural components and their attachments to the structure.

1.4 REGULATORY REQUIREMENTS

Comply with the 2015 International Building Code (IBC) and applicable local adopted amendments, and the 2010 Edition on ASCE 7 (ASCE 7-10).

1.5 DESIGN PERFORMANCE CRITERIA

Provide seismic restraint of components to withstand seismic forces and displacements without displacing or overturning. Design of seismic restraint shall be performed in accordance with the 2015 International Building Code and ASCE 7-10, as follows.

1. Seismic forces shall be determined in accordance with Chapter 13 of ASCE 7-10. The seismic design parameters shall be as noted in the project Structural drawing. The assigned Component Importance Factors (Ip) for each component, shall be as noted on the project drawings and/or specifications.

2. For components installed on the exterior of the building, wind forces shall be determined in accordance with Chapter 29 of ASCE 7-10, except that the uplift forces per Equation 29.5-3 shall be considered regardless of the building height. Reference the Structural drawings for wind design criteria.

3. In addition to seismic and wind loads, consideration shall be given to other loads, including but not limited to dead, live, snow, etc., as applicable. All restraint design shall be based on the "worst case" combination of the applicable loads as prescribed by the referenced code and standards.

4. Consideration shall also be given to thermal stresses and expansion. Where thermal expansion applies, seismic restraint design shall be in accordance with the requirements of ASME B31.1 in addition to ASCE 7.

1.6 SUBMITTALS

Submit under the provisions of Division 1. Submittals shall include Product Data, Shop Drawings and the required Certificates of Compliance as described below.

Shop drawings shall be prepared and sealed by a professional engineer licensed in the state of the project, with a minimum of 5 years of experience in the design of vibration isolation and seismic restraint.

Vibration Isolation: submit the following, at a minimum, as applicable.

1. Detailed schedules of equipment requiring isolation, including clearly identified equipment identification or tag and equipment weight, and corresponding isolator type, manufacturer and model number.
2. Detailed drawings showing equipment, isolator bases and isolator spacing.
3. Descriptive data or cut sheets for each type of isolation mounting, including:
    a. Dimensional data
    b. Materials and finish
    c. Rated loads
    d. Rated deflection
    e. Isolator free and operating heights
    f. Detailed installations instructions

Seismic Restraint: submit the following, at a minimum, as applicable.

4. Catalog cut or data sheets on specific restraints detailing compliance with the project drawings and specifications.
5. Detailed schedules of components, showing seismic restraints by referencing numbered descriptive drawings.
6. Description, layout and location of items to be restrained with anchorage or brace points noted and dimensioned.
7. Details of anchorage or bracing at large scale with all members, parts brackets shown, together with all connections, fasteners, bolts, welds etc. clearly identified and specified.
8. Numerical value of design seismic restraint loads, or controlling loads if different than load combinations with seismic, with all supporting calculations.
9. Detailed installation instructions for seismic restraints.
10. Acceptable attachment methods of seismic restraints to structural members.
11. Fabrication details for equipment bases including dimensions, structural member sizes and support point locations.
12. Details for housekeeping pads for base-mounted equipment, including reinforcing and

doweling requirements to the building structure.

13. Documentation verifying seismic prequalification for anchors in concrete per ACI 318 Appendix D.

14. Additional information as required to substantiate adequate design and installation of seismic restraints.

15. Manufacturer's Seismic Certificate of Compliance: Each manufacturer of a Designated Seismic System (with a Component Importance Factor, Ip = 1.5) shall submit a ***Certificate of Compliance*** for review and acceptance by the design professional in responsible charge and the authority having jurisdiction, prior to installation.

PART 2 - PRODUCTS

2.1 GENERAL

All materials and devices shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

Refer to the "Selection Guide" table in Section 4 to correlate the specification references listed below with the appropriate components.

2.2 MANUFACTURERS

Isolators and seismic restraints shall be from the following manufacturers, or approved equals. Unless otherwise noted, the isolators and seismic restraint systems listed in the following sections are as manufactured by Gripple and California Dynamics.

1. Gripple
2. California Dynamics
3. The VMC Group
4. Mason Industries
5. Kinetics Noise Control
6. Cooper B-Line
7. CADDY
8. Hilti
9. Twin City Hose
10. Imperial Metals

2.3 EQUIPMENT BASES

Specification B-1 (Integral Structural Steel Base): Vibration isolation manufacturer shall furnish integral structural steel bases. Rectangular bases are preferred for all equipment. Pump bases for split case pumps shall be large enough to support suction and discharge elbows. All perimeter members shall be steel beams with a minimum depth equal to 1/10 of the longest dimension of the base. Height saving brackets shall be employed in all mounting locations to provide a base clearance of 1". Bases shall be type XW as manufactured by California Dynamics Corporation or approved equal.

Specification B-2 (Wide Flange Structural Steel Base): Vibration isolation manufacturer shall furnish integral structural steel bases. Rectangular bases are preferred for all equipment. Pump bases for split case pumps shall be large enough to support suction and discharge elbows. All perimeter members shall be steel beams with a minimum depth equal to 1/10 of the longest dimension of the base. Height saving brackets shall be employed in all mounting locations to provide a base clearance of 1". Bases shall be type XW as manufactured by California Dynamics Corporation or approved equal.

Specification B-3 (Concrete Inertia Base): Rectangular steel concrete pouring forms for floating concrete frames. Bases shall be a minimum of 1/12 of the longest dimension of the base but not less than 6". The base depth need not exceed 12" unless specifically recommended by the base manufacturer for mass or rigidity. Forms shall include minimum concrete reinforcing consisting of 1/2" bars welded in place on 12" centers running both ways in a layer 1 1/2" above the bottom. Height saving brackets shall be employed in all mounting locations to maintain a 1" clearance below the base. Base shall be type CW as manufactured by California Dynamics Corporation or approved equal

Specification B-4 (Non-Isolated Curbs): Non isolated seismically rated rooftop curb system that is flashed into roofing membrane. Air and watertight curb shall have a neoprene sponge seal at the top and be rigid enough to provide continuous perimeter support for rooftop unit. Curb must provide means to positively anchored to concrete deck, or bolted or welded directly to structural steel to withstand seismic loading. Curb shall provide a means by which contractor supplied insulation may be installed for thermal insulation and acoustic attenuation. Curbs shall accommodate roof pitch shown on drawings. **Curb shall use minimum 18 gage galvanized steel and shall be designed with crossbracing required to withstand the greater of calculated seismic forces and /or wind loading per local building code**. Design must be certified by registered professional engineer.

Specification B-5 (Isolated Curbs): Seismically rated rooftop isolation curb system that is flashed into roofing membrane. Standard unit curb will not be used. Air and watertight upper curb shall have a neoprene sponge seal at the top and be rigid enough to provide continuous perimeter support for rooftop unit. The upper curb shall be supported by Spec SV-1 isolators welded or bolted to concrete deck to the structure to withstand seismic loading. An EPDM nylon reinforced air tight weatherproof seal shall consolidate the upper and lower curbs. The lower curb shall be weatherproof and provide a base that the roofing system may be flashed to. Weatherproof access panel shall be provided at each isolator to allow isolator adjustment. Isolation curb shall provide a means by which contractor supplied insulation may be installed for thermal insulation and acoustic attenuation. Curbs shall accommodate roof pitch shown on drawings**. Isolation curb shall be designed to withstand the greater of calculated seismic forces and / or wind loading per local building code**. Design must be certified by registered professional engineer.

Specification B-6 (Non-Isolated Rails): Non isolated seismically rated rooftop rail system that provides equipment support in one roof flashed assembly with all features as described for Non-Isolated Curbs.

Specification B-7 (Isolated Rails): Vibration isolation manufacturer shall provide steel members welded to height saving brackets to cradle equipment having legs or bases that do not require a complete supplementary base. Members shall have sufficient rigidity to prevent misalignment of equipment. Structural steel rails shall be type, WW as manufactured by California Dynamics Corporation or approved equal.

2.4 VIBRATION ISOLATION

Specification V-1 (Pad Type Elastomer Isolator): A pad type mounting consisting of two layers of ribbed elastomeric pads with a 1" sandwich pad in between. Where the equipment foot is less than 80 percent of the surface of the pad a load distribution plate must be added to the top of the pad. Pads shall be VT as manufactured by California Dynamics Corporation or approved equal.

Specification V-2 (Neoprene Mounting): Elastomeric mounts single or double-deflection type, oil-resistant rubber or Neoprene isolator element with factory-drilled, bonded in place top plate for bolting to equipment and factory drilled base plate for bolting to structure. Color-coded or otherwise identify to indicate capacity range. Mount shall be type RM/RMD as manufactured by California Dynamics Corporation or approved equal.

Specification V-3 (Spring Isolator, Free Standing): Spring isolators shall be free standing and laterally stable without any housing and complete with a Neoprene acoustical pad between the base plate and the spring support. All mountings shall have load transfer bolts that must be rigidly bolted to the equipment. Installed and operating heights shall be equal. The ratio of the spring diameter divided by the compressed spring height shall be no less than 0.8. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. Mountings shall be type SSL/K, as manufactured by California Dynamics Corporation or approved equal.

Specification V-4 (Elastomer Hanger Isolator): Hanger shall consist of a rigid steel frame and up to ½"deflection of a molded Neoprene element projecting thru the steel box so that no metal-to-metal contact occurs. Hanger shall be type RH/RHD as manufactured by California Dynamics Corporation or approved equal.

Specification V-5 (Spring Hanger Isolator): Hanger shall consist of a rigid steel frame containing a steel spring with a Neoprene sleeve to prevent steel to steel contact. Hanger shall be type CH as manufactured by California Dynamics Corporation or approved equal

Specification V-6 (Combination Spring/Elastomer Hanger Isolator): Hangers shall consist of rigid steel frames containing double deflection Neoprene element at the top and a steel spring and a Neoprene sleeve on bottom to position spring and prevent steel to steel contact. Spring diameters and hanger box lower hole sizes shall be large enough to permit the hanger rod to swing through a 30° arc from side to side. Hangers shall be type HH30 as manufactured by California Dynamics Corporation or approved equal.

2.5 VIBRATION ISOLATION WITH SEISMIC RESTRAINT

Specification SV-1 (Seismically Restrained Spring Isolator): Restrained spring isolators shall be free standing, laterally stable, springs with seismic restraints. A steel housing with

cushioned lateral and vertical limit stops to restrict spring extension due to wind loads, or when weight is removed. The housing shall be Zinc plated. A clearance of ¼" maximum shall be maintained around restraining bolts and between the housing and the spring so as not to interfere with the spring action. Limit stops shall be out of contact during normal operation. Outside spring diameter not less than 80 percent of the compressed height of the spring at rated load. Minimum additional travel 50 percent of the required deflection at rated load. Isolator/Restraint shall be CQA as manufactured by California Dynamics Corporation or approved equal. This product is an OSHPD/ DSA approved product. Product tested for IBS.

Specification SV-2 (Seismically Restrained Spring Isolator): Restrained spring isolators shall be free standing, laterally stable, springs with seismic restraints. A welded housing with cushioned lateral and vertical limit stops to restrict spring extension due to wind loads, or when weight is removed. A clearance of ¼" maximum shall be maintained around restraining bolts and between the housing and the spring so as not to interfere with the spring action. Limit stops shall be out of contact during normal operation. Outside spring diameter not less than 80 percent of the compressed height of the spring at rated load. Minimum additional travel 50 percent of the required deflection at rated load. Isolator/Restraint shall be DLK as manufactured by California Dynamics Corporation or approved equal.

Specification SV-3 (Neoprene Mounting with Seismic Snubber) JQTQN Restrained Neoprene isolators shall be free standing, with a rated static defection of .5". A steel housing with cushioned lateral and vertical limit stops to restrict extension due to wind loads, or when weight is removed. The housing shall be hot-dipped galvanized or zinc plated. Hot-Dipped zinc coating shall be not less than 2 ounces per square foot complying with ASTM A123. A clearance of ¼ "maximum shall be maintained around restraining bolts and between the housing and the Neoprene so as not to interfere with the isolator action. Limit stops shall be out of contact during normal operation. Isolator/Restraint shall be JQTQN as manufactured by California Dynamics Corporation.

2.6 SEISMIC RESTRAINTS

Specification S-1 (Seismic Snubbers): All directional seismic restraints shall consist of interlocking steel members. Neoprene shall have a minimum thickness of ¼". Incorporate a minimum air gap of 1/8", and a maximum air gap of ¼" in the design, before contact is made between the rigid and resilient surfaces. Provide removable end plate to allow inspection of internal clearances. Restraints shall be type RL-A/ RL-C as manufactured by California Dynamics Corporation.

Specification S-2 (Seismic Cable Restraints): A restraint assembly for suspended equipment, piping or ductwork consisting of high strength galvanized steel aircraft cable. Cable Restraints shall be listed with any one of following evaluation agencies with certified break strength and shall be color-coded or include a tag for easy field verification.

1. IAPMO-UES

2. ICC-ES

3. OSHPD

4. Underwriters Laboratories (UL)

Secure cable to structure and braced component through bracket or stake eye specifically

designed to meet or exceed cable restraint rated capacity. Cable must be manufactured to meet or exceed minimum materials and standard requirements per ASTM A1023 or EN-12385 or other approved equivalent. Cables shall be installed to prevent excessive seismic motion and so arranged that they do not engage during normal operation. Restraint shall be Gripple Inc. GS series.

Specification S-3 (Rigid Brace Restraints): A restraint assembly for suspended equipment, piping or ductwork consisting of steel angles or channels. Rigid braces and connecting elements shall be sized for the applied seismic loads. Connecting elements shall be steel assemblies that swivel to the final installation angle and utilize two anchor bolts to provide proper attachment. Restraint shall be CADDY Strut Seismic Hinge.

2.7 FLEXIBLE PIPE CONNECTIONS

Specification F-1 (Water Service Flexible Connection):

1. For flanged connections – A double sphere arch rubber expansion joint constructed of molded reinforced neoprene with integral steel floating flanges, and designed to be suitable for pressures up to 225 PSI (4 to 1 safety factor) and temperatures up to 225 degrees F. Connectors shall have minimum movement capabilities of 1.77" compression, 1.18" lateral and 1.18" extension. Connectors shall provide a minimum 35 degree angular movement up to 6", minimum 30 degree up to 12" and minimum 20 degree up to 24". Spring loaded control units shall be furnished to limit movement to within allowables. Flex connector shall be Twin City Hose Type MS2.

2. For threaded type – A double spherical rubber hose connector, minimum 8" long, constructed of molded neoprene, nylon cord reinforced, with female pipe unions each end. Connectors shall have a minimum movement capability of 7/8" compression, 7/8" lateral, ¼" extension and 20 degree angular through 1-1/4", 13 degree through 2", and 9 degree through 3". Connectors shall be suitable for a maximum working pressure (4 to 1 safety factor) of 150 psi and 225 degree F. Connectors shall have cable control units to limit extension to ¼". Flex connector shall be Twin City Hose Type MSFU.

Specification F-2 (Steam and Condensate Service):

3. For flanged connection – A metal hose connector constructed of stainless steel hose and braid with carbon steel plate flanges. Live lengths shall conform to hose minimum length to absorb thermal and dynamic movement. Hose axis must be perpendicular to pipe movement. Flex connector shall be Twin City Hose Type TCHS-FLG.

4. For threaded connections – A metal hose connector constructed of stainless steel hose and braid with carbon steel NPT threaded end fittings. Flex connector shall be Twin City Hose Type TCHS-MMT.

PART 3 - EXECUTION

3.1 EXAMINATION

All areas that will receive components requiring vibration isolation and seismic restraint shall be thoroughly examined for deficiencies that will affect the installation or performance of the installed devices. Such deficiencies shall be corrected prior to the installation.

3.2 INSTALLATION, GENERAL

Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.

All installation shall be in accordance with the requirements set forth in the project drawings and specifications, as well as the manufacturer's published instructions and all approved submittal data.

Do not anchor components to gypsum wallboard, plaster or other wall or ceiling finish that has not been engineered to resist imposed loads.

3.3 SEISMIC RELATIVE DISPLACEMENTS

Provide joints with sufficient flexibility capable of accommodating seismic relative displacements as follows.

1. Vertical ductwork, piping, etc. that pass between floors of the building,
2. Components that pass through a building seismic or expansion joint,
3. Rigidly supported components that connect to other components.

3.4 POST-INSTALLED ANCHORS:

Install all anchors in accordance with the manufacturer's written instructions for seismic applications.

Post-installed anchors in concrete shall be seismically prequalified for use in cracked concrete based on seismic testing in accordance with ACI 355.2 for mechanical anchors or ACI 355.4 for adhesive anchors.

3.5 HOUSEKEEPING PADS

Housekeeping pads shall be designed by the seismic restraint vendor with adequate reinforcing and doweling to the building structure, so as to withstand calculated seismic or wind forces. Frictional resistance due to the effects of gravity shall be neglected.

The size & thickness of the housekeeping pad shall be determined to ensure adequate edge distances & embedment depths in order to obtain the desired equipment anchor capacities.

1. If cast-in-place anchors are used, the housekeeping pads shall be sized to accommodate the ACI requirements for bolt coverage and embedment.
2. If post-installed anchors are used, the minimum edge distances, embedment depths and concrete/masonry member thicknesses specified by the anchor manufacturer shall be maintained.

3.6 PLUMBING COMPONENTS

Floor and base-mounted components, vibration isolated equipment and associated system vibration and seismic controls for connections.

1. Design equipment anchorage to resist seismic design force in any direction.
2. Design vibration and seismic controls for equipment to include base and isolator requirements.
3. Provide flexible connections between equipment and interconnected piping to account for seismic relative displacements.
4. Where equipment is mounted on vibration isolators, use isolators designed for amplified code forces per ASCE 7 and with demonstrated ability to resist required forces including gravity, operational and seismic forces.
5. Provide supplemental steel or concrete base as required for mounting equipment on isolators. Where equipment is not designed to be point loaded, provide base capable of transferring gravity and seismic demands from equipment to isolator base plate anchorage.
6. Where concrete floor thickness is less than required for expansion anchor installation per ICC-ESR, install through bolt in lieu of expansion anchor. Where timber/wood floor or other substrate is inadequate for installation of lag bolts, screws or other mechanical fasteners, furnish and install supplemental framing or blocking to transfer loads to structural elements.
7. Housekeeping pads shall be coordinated with the seismic restraint vendor based on the equipment anchorage specified in the seismic design.

Suspended plumbing equipment

8. Design support and bracing to resist seismic design force in any direction.
9. Provide flexible connections between equipment and interconnected piping to account for seismic relative displacements.
10. Brace equipment hung from spring mounts using cable or other bracing that will not transmit vibration to the structure.

Wall-mounted plumbing equipment

11. Design attachments to resist seismic design force in any direction.
12. Install backing plates or blocking as required to deliver load to primary wall framing members. Do not anchor to gypsum wallboard, plaster or other wall finish that has not been engineered to resist imposed loads.

Piping

13. Provide supports, braces and anchors to resist gravity and seismic design forces.

14. Design piping and piping risers to accommodate interstory drift. Provide flexible connections wherever relative differential movements could damage pipe in an earthquake.

15. Brace every run (5' or more in length) with two transverse and one longitudinal bracing locations. For pipes and connections constructed of ductile materials (copper, ductile iron, steel or aluminum and brazed, welded or screwed connections) provide transverse bracing at not more than 40 feet on center and longitudinal bracing at spacing not more than 80 feet on center. For pipes and their connections constructed of nonductile materials (cast iron, no-hub pipe and plastic or non-UL listed grooved coupling pipe), provide transverse bracing at not more than 20 feet on center and longitudinal bracing at spacing not more than 40 feet on center.

16. Provide lateral restraint for risers at not more than 30 feet on center or as required for horizontal runs, whichever is less.

17. Where piping is explicitly exempt from seismic bracing requirements,

    a. Install piping such that swinging of the pipes will not cause damaging impact with adjacent components. This will be considered satisfied if there is horizontal clear distance of at least 2/3 the hanger length between subject components.

    b. Provide flexible connections between piping and connected equipment, including in-line devices such as VAV boxes and reheat coils.

3.7 QUALITY CONTROL

Do not install vibration isolators or seismic restraints until submittals have been reviewed and approved by the registered design professional in responsible charge.

Verify that multiple systems installed in the same vicinity can be installed without conflict.

Verify tolerances between installed items to confirm that unbraced components will not come into contact with restrained equipment or structural members during an earthquake. When contact is possible, provide seismic restraint or provide justification to the satisfaction of the registered design professional in responsible charge of the project that contact will not cause unacceptable damage to the components in contact, their supports, finishes or other elements that are contacted.

Coordinate with the Structural Engineer of Record for confirming that the structure is capable of supporting the loads imposed by nonstructural components.

No work shall be concealed by the Contractor prior to the required inspections being performed and all discrepancies resolved. The Contractor shall be responsible for all repairs required to uncover uninspected or unapproved work.

Where Special Inspections are required per Sections 1704 and 1705 of the 2015 International Building Code, the owner shall engage a qualified agency to perform the required inspections for components listed in the project-specific Statement of Special Inspections.

The seismic vendor responsible for supplying the restraint devices and parts shall provide periodic on-site observations and provide a signed letter confirming that the seismic restraints are installed in general accordance with the approved submittals.

PART 4 - EQUIPMENT ISOLATION AND SEISMIC RESTRAINT SCHEDULE

PLUMBING EQUIPMENT

EQUIPMENT TAG	Ip (Note 4)	ISOLATION SPEC.	ISOLATION DEFL.	SEISMIC REST. SPEC. (NOTE 1)
GAS PIPING	1.5	NONE	N/A	SPEC S-2
GAS WATER HEATERS	1.5	NONE	N/A	NOTE 2
STEAM WATER HEATERS	1.5	NONE	N/A	NOTE 2
ELECTRIC WATER HEATERS	1.0	NONE	N/A	NOTE 2
VACUUM PUMPS	1.0	N/A	N/A	NOTE 2
DOMESTIC WATER	1.0	NOTE 3	N/A	SPEC S-2
WASTE, VENT PIPING	1.0	NONE	N/A	SPEC S-2
STORM DRAIN PIPING	1.0	NONE	N/A	SPEC S-2
COMPRESSED AIR PIPING	1.5	NOTE 3	N/A	SPEC S-2
AIR COMPRESSORS	1.5	N/A	N/A	NOTE 2

NOTES

1. Provide seismic restraint per table or as directed by seismic engineer stamped drawings.
2. Anchor bolts for non-isolated and internally isolated equipment shall be sized by the seismic engineer. If required, Spec. S-1 snubbers or Spec. S-2 cable kits shall be provided.
3. Provide Type V-6 isolator for the first three hangers from all equipment specified with spring isolation.
4. All components in a Risk Category IV building are assigned a Component Importance Factor I_p equal to 1.5.

END OF SECTION

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SECTION 23 00 10 - MECHANICAL GENERAL

PART 1 - GENERAL

1.01. CONTRACT DOCUMENTS

A. Drawings are diagrammatic, due to scale, and indicate the general arrangements and geometric relationships of equipment, systems, and services. They are not intended to show or indicate every offset, sequence, device, option, fitting, valve, or accessory. Plan work around building details and other crafts. Do not scale drawings for exact sizes and locations.

B. Contractor shall base all his measurements, both horizontal and vertical, from established benchmarks. All work shall agree with these established lines and levels. Contractor shall verify all measurements at site and check correctness as related to the work.

C. In case of interferences between trades, Engineer will decide which work is to take precedence regardless of work that might be installed.

1.02. CODES, ORDINANCES, INSPECTIONS AND PERMITS

A. Work is to be executed and inspected in accordance with local and State codes, laws, ordinances, rules and regulations applicable to particular class of work, including the State Mechanical Code, State Plumbing Code, State Gas Code, and State Fire Code. Associated fees shall be paid by the Contractor.

B. Should any part of drawings or specifications be found to be in conflict with applicable codes or ordinances, notify the Engineer, in writing, within 72 hours prior to bid deadline for review and/or correction of bid documents. After project bidding is closed, any discovery of code violations shall be promptly reported to the Engineer. Any work performed in violation of applicable codes or ordinances shall be corrected without additional expense to the Owner or his representatives.

C. Pressure and heating vessels, including hot water storage containers, shall be constructed in compliance with the rules and regulations of the Boiler Inspection Division of the State. All installations of such equipment shall be made by a firm licensed and approved by the Boiler Inspection Division of the State.

D. Facilities shall be installed in compliance with the requirements of the current version of the Americans with Disabilities Act (ADA). Installation of mechanical and plumbing systems including fixtures and control mounting heights, clear knee space, and access clearances shall comply with ADA required dimensions, and as shown on details or schedules when shown.

E. Contractor shall arrange with County, City or State, if City has no ordinances covering work, for complete inspection, paying all charges required. Give proper authority requisite notice relating the work; afford Engineer and authorized inspectors adequate access to the Work for inspection; and be responsible for all violations of law. Upon completion of work, have work inspected, if required, obtaining certificates of inspection and approval from inspecting agency and deliver certificates to Engineer and Owner.

1.03. REVIEW OF CONTRACT DOCUMENTS AND SITE

A. With the submission of his bid, Contractor shall give written notice to the Engineer of any materials or apparatus believed inadequate or unsuitable, in violation of laws, ordinances, rules or regulations of Authorities having jurisdiction, and any necessary items of work omitted. In the absence of such written notice, it is mutually agreed that the Contractor has included the cost of all required items in his proposal for a complete project.

B. Contractor shall acknowledge that he has examined the Plans, Specifications, and Site, and that from his own investigation he has satisfied himself as to the nature and location of the work; the general and local conditions, particularly those bearing upon transportation, disposal, handling and storage or materials; availability of labor, water, electric power, roads and uncertainties of weather; the confirmation and condition of the ground; the characters, quality and quantity of subsurface materials to be encountered; the character of equipment and facilities needed preliminary to and during the execution of the Work, especially the prohibited use of Owner's permanent equipment, ductwork, and controls; all federal, state, county, township and municipal laws, ordinances, and regulations particularly those relating to employment of labor, wage rates, and construction methods; and all other matters which can in any way affect the Work or the associated cost of the Work under this Contract. Any failure by the Contractor to acquaint himself with the available information concerning these conditions will not relieve him from the responsibility for estimating properly the difficulty or cost of successfully performing the work.

C. If, during the performance of the work, the Contractor finds a conflict, error or discrepancy between or among one or more of the Sections or between or among one or more Sections and the Drawings, furnish the higher performance requirements. The higher performance requirement shall be considered the equipment, material, device or installation method which represents the most stringent option, the highest quality or the largest quantity.

1.04. USE OF THE OWNER'S EXISITNG AND NEW, PERMANENT HVAC SYSTEM DURING CONSTRUCTION

A. Use of the Owner's existing and currently being installed, permanent HVAC system during Construction is prohibited. Provide temporary means for heating and cooling required by construction activities for curing or drying completed installations or for protecting installed construction from adverse effects of temperature and humidity. Provide temporary dehumidification systems when required to reduce substrate moisture levels required to accommodate installation or application of finishes.

B. Maintain a minimum ambient temperature of 50 DEG. F. in areas where construction is in progress, unless indicated otherwise in the specifications.

C. Prevent dust, fumes, construction debris, and odors from entering existing and newly installed HVAC equipment, ductwork, and control system components. Prior to commencing work, isolate HVAC equipment. Where existing HVAC systems will be affected, isolate existing supply, return, and exhaust ducts by disconnecting ductwork at point where existing duct shall remain. Cover ends of existing ductwork securely with black plastic material.

D. Newly installed ductwork shall be thoroughly cleaned before installation. Each section that is installed at the end of the day shall have open ends securely covered with black plastic material.

E. Newly installed HVAC equipment shall be securely covered and protected with black plastic material or by other approved method. After installation of air moving equipment, duct connections shall be securely covered with black plastic material. Connections to duct systems shall not be made until final finishes have been installed, areas served are clean, and building is ready for HVAC equipment start-up and use.

F. Securely cover control system components to prevent damage from construction debris, dust, and dirt. Control systems shall not be energized for testing and adjusting until HVAC system start-up.

G. HVAC Equipment, Ductwork, and Control Components contaminated by construction debris, dirt, and construction dust shall not be acceptable and shall be replaced at no additional cost to the Owner. HVAC Equipment, Ductwork, and Control components shall be kept clean throughout construction. Cleaning after an HVAC system has been contaminated shall not be an acceptable alternate to replacement.

1.05. SHOP DRAWINGS AND SUBMITTALS

A. Submit manufacturer's catalog sheets and/or shop drawings covering all phases of work included in this Contract.

B. Arrange submittals in sets and bind in PDF format. Loose sheets are not acceptable. Indicate for each item the location, system, or position where it is to be used, arrange by equipment type and tab sections.

1. Individual submittal packages may be made for plumbing, HVAC, fire protection, test and balance, and controls. The Contractor may submit up to 5 different packages, but where practical provide all submittals in a single PDF.

2. Items which are required to be resubmitted shall come in a single PDF. Approved equipment is not required to be resubmitted.

3. The Contractor is responsible for verification that all items are submitted.

C. Submittals shall bear written certification to the effect that the Contractor has examined them and found them to include all items required to be submitted and to be in accordance with specifications.

D. Submittals are required even though equipment being furnished is exactly as specified.

E. Submittals shall include all data required in individual sections of these specifications.

F. Contractor is responsible for making all submittals required by the specifications for approval. If equipment is delivered or installed without an approved submittal, Contractor may be required to remove and replace equipment with specified and approved equipment, as directed by the Engineer, without additional cost to the project.

G. Exceptions for Submittals

1. Exceptions to the Specifications or Drawings shall be clearly defined in a separate section of each submittal package. The submittal shall contain the reason for the exception, the exact nature of the exception and the proposed substitution so that a proper evaluation may be made by the Engineer. The acceptability of any device or methodology submitted as an "or equal" or "exception" to the Specifications shall be at the sole discretion of the Engineer.

2. By noting the term "compliance", it shall be understood that the Contractor is in full compliance with the item specified and will provide exactly the same with no deviations.

3. By noting the term "deviation", it shall be understood that the Contractor prefers to provide a different component in lieu of the one specified and in so doing, takes full responsibility for making the equipment work as specified and will provide any and all ancillary components to make the equipment work at no extra cost to the Owner.

4. By noting the term "alternate", it shall be understood that the manufacturer proposes to provide the same operating function but prefers to do it in a different manner and in so doing, takes full responsibility for making the equipment work as specified and will provide necessary ancillary components to make the equipment work at no extra cost to the Owner. The alternate method shall be fully described with schematic diagrams and one-line diagrams as applicable.

1.06. SUBSTITUTION OF MATERIALS

A. Final decision as to whether or not a specific piece of equipment meets specifications shall rest with Engineer.

B. Substitution requests will not be accepted prior to bid.

C. Equipment and material manufacturers are referenced in the Plans and Specifications to establish the basis of design and required standards.

D. With each Substitution Request, submit technical data that will fully establish the equality of the proposed substitute product with that listed. Submit completed Substitution Request Form.

E. Substitution Process

1. The naming of a manufacturer's product with the words "basis of design" or the naming of a single manufacturer's product on a drawing equipment schedule, on other drawings, or in the specifications, establishes that specific product as the basis for design. In the absence of any other named acceptable manufacturer's product, provide the "basis of design" product. No substitutions will be accepted.

2. Where other manufacturer's names are listed on the drawings or in the specifications as acceptable in addition to the "basis of design" product, product acceptability for these manufacturers shall be verified via submittal review after

the project has bid. No other substitutions will be accepted.

3. Where the words “include but shall not be limited to” or “or equal” are used in addition to a manufacturer’s name or a list of manufacturer’s names, product acceptability for these manufacturers shall be verified via submittal review after the project has bid.

4. It is the responsibility of the Contractor to provide all of the data necessary to establish acceptability of the product.

5. The submittal for the substitution will be reviewed for conformance with the specifications and equality to the specified products. Full submittals will be required of all equipment. Substitution submittals will be reviewed and shall be rejected if the proposed equipment is found to be different than indicated on the Substitution Request Form, or is found deficient compared to scheduled performance/or specifications.

F. Any proposed substitutions of equipment shall be accompanied by product submittal and shop drawings showing revised equipment layouts, piping diagrams, ductwork drawings and/or wiring diagrams. Where substituted equipment furnished requires use of larger, more, or differently arranged connections, such connections shall be installed to the complete satisfaction of Engineer without additional cost to Owner.

G. The Contractor is responsible for full coordination of all changes required by substituted equipment, including dimensional clearance.

H. The Contractor is responsible for all additional costs of equipment installation, coordination and engineering which results from his substitution. This includes all aspects of the work including architectural, structural, civil, electrical, and mechanical. This also includes costs for the redesign time of Architects and Engineers.

I. Costs associated with dimensional, performance, or other deviations from the “basis of design” equipment, including engineering costs to evaluate such deviations, shall be paid by the Contractor. If a product other than the “basis of design” product is submitted and subsequently rejected during the submittal process, Contractor shall provide the “basis of design” product.

J. Should a substitution be accepted and subsequently proven unsatisfactory for the service intended within the warranty period, the Contractor shall provide the basis of design, or make corrections as directed by Engineer.

1.07. GUARANTY-WARRANTY

A. Guarantee shall include capacity and integrated performance of component parts of various systems in strict accord with the intent and purpose of these specifications. Conduct such tests as herein specified or as may be required by the Engineer to demonstrate capacity and performance ability of various systems to maintain specified conditions.

B. Compile and assemble the warranties specified in the mechanical division, tabulated and indexed for easy reference.

C. Provide complete warranty information for each item to include product or equipment; date of beginning of warranty or bond; duration of warranty or bond; and names, addresses, telephone numbers, and procedures for filing a claim and obtaining warranty services.

D. All materials and equipment shall carry a full year's warranty from time Owner accepts building or the date of substantial completion, whichever is earlier, regardless of start-up date of equipment, unless a longer warranty period is specified under other sections. Longer warranty periods for specific items shall be listed in other sections of these specifications.

PART 2 MATERIAL

2.01. MATERIAL AND EQUIPMENT

A. Equipment shall be new, undamaged, and of the same manufacturer except where indicated otherwise.

B. Deliver products to project properly identified with names, model numbers, types, grades, compliance labels, and similar information needed for distinct identifications; adequately packaged and protected to prevent damage during shipment, storage, and handling.

C. Store equipment and materials at the site, unless off-site storage is authorized in writing. Protect stored equipment and materials from damage.

D. Protect work and equipment at all times from damage, weather, and entrance of dirt and water. Close pipe and duct openings with caps or plugs during installation.

2.02. ELECTRICAL

A. Contractor shall carefully coordinate voltage and amperage requirements of equipment to be provided. Coordinate with Electrical Contractor prior to equipment order. Any change to electrical systems required by Contractor’s substitutions or uncoordinated equipment needs shall be made without cost to the project.

B. Provide all electrical interlock, control, and other wiring, not covered specifically under the electrical drawings and specifications, for proper operation and control of all equipment specified under this Division of the specifications.

C. Supervise and coordinate all electrical work in connection with mechanical systems.

D. Furnish all motor controllers and contactors, not furnished as part of a motor control center, or by Electrical Division for proper operation of all motors. Submit motor data with submittals.

2.03. ROOF AND FLASHINGS

A. A. Special care shall be taken on roofs to prevent damage. Promptly repair any damage at no additional expense to the Owner. Comply with bonding requirements of new and existing roofs.

B. B. Flashings are not covered by this section. Refer to Architectural Division.

2.04. ACCESS PANELS

A. Provide access panels in all floors, walls, and plaster and non-lay-in type ceilings as required or as indicated to service devices in piping requiring access, controls, devices in ductwork requiring access, and other system components requiring access for service or regular maintenance. Closely coordinate requirements for access doors before bidding.

B. Access doors shall be "Milcor" type appropriate for the construction involved.

C. Size and type shall be as required for proper service and/or as may be directed by the Engineer. Minimum size to be 24” x 24”.

2.05. ASBESTOS AND OTHER HAZARDOUS OR TOXIC MATERIALS

A. No Asbestos containing materials shall be used on this project.

B. Contractor is responsible for his own means and methods of safety where Hazardous or Toxic materials are use for the installation of his work. All work shall comply with state and federal regulations.

C. Contractor shall protect the Owner's facility and employees from conditions generated by his work.

D. In the event that a potentially hazardous material is discovered during the course of the work, Contractor shall stop work immediately, and provide for the safety of his employees and other occupants. He shall make proper notifications as required by his contract and by law.

2.06. CONCRETE

A. Concrete materials and installations indicated on the drawings for curbs, pads, and supports for mechanical equipment shall be provided as part of the contract.

B. Comply with other architectural and structural portions of the specifications for materials and methods.

C. Concrete.

1. Concrete shall be commercial grade containing Portland cement, aggregates, clean water, and mix ratios suitable for the loads, and site conditions.

2. Concrete shall be 3,000 psi class indoors and 3,500 psi class outdoors unless noted otherwise.

3. Comply with ACI standards for cold and hot weather applications.

D. Installation

1. Use rigid and smooth forms to prevent visible defects and deflections in the

work. Use form compound to prevent concrete bonding to the forms.

2. Provide chamfered corners on the tops of curbs.

3. Reinforce pads and curbs with steel reinforcing bars minimum size number 3, welded wire fabric, or as indicated on the drawings. Set the reinforcing depth within the concrete for optimum strength for the application.

4. Provide equipment pads of sizes indicated and at least large enough to extend past the mechanical equipment 6" on all sides. Minimum height 6” unless otherwise noted.

5. Pour pads integral with the floor slab, isolate from the floor slab, or dowel the pads, as indicated on the drawings.

6. Grout all voids with high strength grout mixture.

7. Installation of the pads shall be coordinated so that the concrete has set and the strength is suitable for installation of the equipment.

8. Set anchor bolts where indicated by either equipment manufacturer or Structural Engineer.

9. Brush-finish equipment pads.

2.07. LOCAL SITE CONDITIONS

A. Before bidding, make complete investigation at site in order to be informed as to location of utilities and as to conditions under which work is to be performed. Utility locations shown were obtained from surveys and/or local utility companies and are offered as a general guide only and are not to be assured accurate.

B. Make determination of soil conditions before bidding. These specifications and accompanying drawings in no way imply condition of soil to be encountered.

2.08. EXCAVATION, TRENCHING AND BACKFILLING

A. Excavation, trenching, and backfilling in connection with the mechanical system, to a point 5'-0" outside the building, is included as part of this Division, unless indicated otherwise.

B. Excavation required shall be done as part of the contract price regardless of any implied conditions on the drawings or in these specifications.

C. Excavation to have 12" minimum and 24" maximum clearance on all sides. Do not carry excavation below required level unless indicated otherwise on the drawings. Excess excavation below required level shall be backfilled at no expense to Owner with earth, sand, gravel, or concrete, as directed by Engineer and thoroughly compacted. Remove any unstable soil and replace with gravel, crushed stone, or clean sand and thoroughly compact. Engineer will determine the depth of removal of any unstable soil encountered. Grade ground adjacent to excavation to prevent water from running into excavation.

Remove accumulated water in the excavation.

D. Banks of trenches shall be vertical or as shown on the drawings. Width of trench shall be 5" minimum, 8" maximum on each side of pipe bell. Excavate bell holes accurately to size by hand. In rock, excavations shall be carried 8" below bottom of pipe. Use loose earth or gravel for backfill and tamp thoroughly.

E. Bracing, sheathing, and shoring shall be performed as necessary to complete and protect excavations indicated on the drawings, as required for safety, as directed by Engineer, and to conform to governing laws and state and federal regulations. Comply with OSHA Regulations.

F. After piping installation, inspection, testing, and approval by governing agency; backfill trenches with clean, stable soil free from stones. Place backfill in 4" layers, tamped under and around pipe and conduit to height of at least 2' above pipe. Tamping shall be done in such manner as not to disturb underlying work. Remainder of trenches and excavations shall be backfilled with clean, stable earth, deposited in 8" layers and brought up to rough grade, with each layer compacted to density of surrounding soil. Remove sheathing and shoring as backfill is placed and fill space with dry sand. Compaction tests may be required by the Engineer, with the costs paid by the Contractor.

G. Underground piping shall be marked with metallic marking tape inserted in the trench a minimum of 12" below grade and a minimum of 12" above mains.

H. Replace existing appurtenances removed or damaged in connection with work, and restore to original conditions, unless directed otherwise.

2.09. MECHANICAL INSTALLATIONS:

A. Coordinate mechanical equipment and material installation with other building components and other trades. Investigate each space in the structure through which mechanical equipment furnished under these specifications must pass to reach its final location. Coordinate shipping splits with the manufacturer to permit safe handling and passage through restricted areas in the structure.

B. Verify all dimensions by field measurements. By ordering equipment, Contractor assumes responsibility for the installation and orientation of equipment in the available space.

C. Arrange for chases, slots, and openings in other building components to allow for mechanical installations.

D. Coordinate the installation of required supporting devices and sleeves to be set in poured in place concrete and other structural components, as they are constructed.

E. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the work. Give particular attention to large equipment requiring positioning prior to closing-in the building.

F. Fit equipment, pipe, and duct into the available spaces in the building and introduce into the building, at a time, and in a manner, as not to damage the structure. Install ductwork

and piping to provide the maximum possible clear height underneath.

G. Coordinate the cutting and patching of building components to accommodate the installation of mechanical equipment and materials.

H. Where mounting heights are not detailed or dimensioned, install mechanical services and overhead equipment to provide the maximum headroom possible.

I. Install mechanical equipment to facilitate maintenance and repair or replacement of equipment components. Connect equipment for ease of disconnecting, with minimum of interference with other installations.

J. Coordinate the installation of mechanical materials and equipment above ceilings with suspension systems, light fixtures, and other installations.

K. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.

L. Do not support material or equipment of other trades from piping or ductwork.

M. Do not use equipment, piping, or ductwork as scaffolding, scaffolding support, or as other means to access the work. Damaged systems and components shall be repaired or replaced in accordance with the full satisfaction of the Owner and Engineer.

N. Core drill piping penetrations of concrete walls, floors, and other concrete structures.

O. Equipment locations shown on the drawings are approximate. Final locations shall be established and determined in the field to best utilize available space.

P. Replace architectural features removed or damaged during the course of the work.

Q. Maintain fire assembly ratings as dictated by authorities having jurisdiction. Seal around penetrations through UL rated assemblies, fire, and smoke walls.

R. Fully seal around duct or pipe routed through exterior walls.

2.10. EQUIPMENT CONNECTIONS

A. Each equipment item with drain connections shall be provided with a properly-sized drain run to the nearest floor drain or as directed.

B. Rough-in and make final required connections to equipment, furnished under other Divisions of the Specifications or by the Owner.

1. Provide necessary labor and materials for a complete installation. Trap and vent drainage connections as required.

2. If equipment or fixtures furnished by others are not delivered prior to final acceptance, services shall be capped or plugged at walls or floor as directed,

ready for future connection.

C. No equipment or fixture shall be "roughed-in" until proper rough-in drawings are provided to the installer.

D. Extend grease fittings to accessible locations.

2.11. CUTTING AND PATCHING

A. Provide cutting and patching required to perform the mechanical work, when alteration, repair, renovation, or addition, to existing construction is specified or required for new work.

B. Cutting of structural members will not be permitted except through explicit instructions from the Engineer. Reinforcing will be required where members are cut.

C. Do not endanger or damage installed work through procedures and processes of cutting and patching.

D. Arrange for repairs required to restore other work, because of damage caused as a result of mechanical installations.

E. No additional compensation will be authorized for cutting and patching work that is necessitated by ill-timed, defective, or non-conforming installations.

F. Perform cutting, fitting, and patching required to:

1. Uncover Work to provide for installation of ill-timed Work.

2. Remove and replace defective Work.

3. Remove and replace Work not confirming to requirements of the Contract Documents.

4. Remove samples of installed Work as specified for testing.

5. Upon written instructions from Engineer, uncover and restore Work to provide for Engineer observation of concealed Work.

2.12. GROUTING

A. Mix and install grout for mechanical equipment base bearing surfaces, base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

I. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.

2. Design Mix: 5,000-psi (34.5-MPa), 28-day compressive strength.

3. Packaging: Premixed and factory packaged.

2.13. SEISMIC

A. Mechanical systems shall be installed in conformance with the requirements of the state and federal codes and regulations for Seismic considerations, as specified and noted on the drawings.

B. All seismic restraining and snubbing devices shall be manufactured specifically for this duty. Devices constructed by the Contractor will not be accepted.

C. Contractor shall be responsible for the design and installation of the restraining and snubbing systems based on the criteria included on the drawings and in the specifications, and the actual equipment, and locations of installation.

2.14. START UP, TESTING, AND ADJUSTING

A. Contractor shall include adequate time in construction schedule for HVAC system start-up; testing, adjusting, and balancing; and control system installation, programming, testing, and commissioning.

B. Each and every phase of the plumbing, air conditioning, heating and ventilating systems shall be operated separately, or in conjunction, one with the other, for a sufficient period of time to demonstrate to the entire satisfaction of the Engineer the ability of the systems to meet the capacity and the performance requirements while maintaining design conditions, in accordance with the intent of these specifications.

C. Previous to any performance tests, the Contractor shall have set and adjusted valves, dampers, motors, controllers, thermostats, and other items as are necessary to properly balance phases of the mechanical systems and shall have the systems operating and maintaining design temperatures, humidity, and air circulation throughout all areas of the building.

D. See other sections of these specifications for other possible records and tests to be made.

E. During the first-year warranty, the Contractor may be required to make some or all of the readings above to assure system is functioning properly through the various seasons.

Contractor shall make additional adjustments as required.

2.15. PAINTING

A. Provide mechanical equipment with factory painted finish. Where factory finish is damaged during handling and installation, use touch-up paint of same type and color as original paint. Where extensive refinishing of factory applied finishes are required, equipment shall be repainted by the factory.

B. All uninsulated, ferrous equipment, tanks, pipes, fittings, pipe hangers, supports, miscellaneous steel, and ironwork without factory finish shall be primed and painted. Do not paint galvanized hanger rods or galvanized duct straps.

1. Where exposed to view, except in mechanical spaces, color shall be as selected by the Architect.

2. Where located in mechanical spaces or in areas not exposed to view, color shall be as directed by Owner's representative to match Owner's existing color schedule. In the absence of an Owner's color schedule, color shall be black.

C. All insulated mechanical equipment, tanks, and piping not provided with a factory finish shall be painted.

1. Where exposed to view, except in mechanical spaces, color shall be as selected by the Architect.

2. Where located in mechanical spaces or in areas not exposed to view, color shall be as directed by Owner's representative to match Owner's existing color schedule. In the absence of an Owner's color schedule, color shall be black.

D. For uninsulated material to be painted, prime with one coat of alkyd primer and paint with two coats of alkyd enamel gloss. Paint shall be suitable for the environmental and temperature conditions where material is installed.

E. Paint insulated material with two coats of alkyd enamel gloss. Paint shall be suitable for the environmental and temperature conditions where material is installed.

F. Prepare surfaces for painting in accordance with the paint manufacturer's requirements. Remove or protect portions of the work which are not to be painted.

G. Apply primer coat(s) of paint as recommended by the paint manufacturer.

H. Apply final coat(s) of paint as recommended by the paint manufacturer. Apply paint by brush or roller as dictated by the surface to be painted. Paint should have a smooth appearance without cloudiness, spotting, marks, runs, or other surface imperfections.

I. Clean-up the area of materials, waste, and rubbish. Clean splattered surfaces.

J. Protect the work from damage. Touch-up and restore defaced painted surfaces at the end of the project.

2.16. NOISE: Contractor shall isolate pipes, ductwork, equipment, and other items to insure no additional noise is generated or transmitted to the building when systems are in operation.

2.17. ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment and elevation to support and anchor mechanical materials and equipment. See Paragraph 3.11 for painting.

B. Field Welding: Comply with AWS D1.1.

2.18. OPERATION INSTRUCTIONS

A. Contractor shall provide bound manuals containing complete repair parts' lists, and operating service and maintenance instructions for equipment provided. The manual shall include:

1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of all replaceable parts.

2. Manufacturer's printed operating procedures to include start-up, break-in, routine and normal operating instructions; regulation, control, stopping, shut-down, and emergency instructions; and summer and winter operating instructions.

3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.

4. Servicing and instructions and lubrication charts and schedules.

B. Contractor shall carefully instruct the Owner's operations personnel during the adjustment and testing period of the equipment for such length of time as may be necessary to thoroughly familiarize them with the proper care, operation, and maintenance of the equipment.

C. Contractor shall turn special tools, maintenance items, keys, other devices and materials required to operate or maintain the systems over to the Owner.

2.19. CLEAN UP

A. Do not allow waste material or rubbish to accumulate in or about jobsite. Clean work areas daily.

B. At completion of work, remove rubbish, tools, scaffolding, and surplus materials from and about building, leaving work clean and ready for use without further cleaning required. Clean equipment, piping, valves, fixtures, and fittings of grease, metal cuttings, insulation cement, dust, dirt, paper labels, and other materials that are not part of the final finish.

C. Any discoloration or other damage to parts of building, its finish or furnishings due to failure to properly clean or keep mechanical systems clean shall be repaired without cost to Owner.

2.20. NAMEPLATE DATA:

A. Provide permanent operational data nameplate on each item of power operated mechanical equipment, indicating manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data.

B. Locate nameplates in an accessible location. Where manufacturer's name plate is not stamped or engraved, provide additional heavy gauge aluminum or brass, stamped or engraved nameplate.

C. Do not remove manufacturer's nameplates. When manufacturer's nameplates are to be covered by insulation or other material, provide a separate nameplate for mounting on the exterior of the covering.

2.21. RECORD DOCUMENTS

A. At completion of this project, the Contractor shall provide Engineer with one set of "red lined" design drawings and specification showing all Work installed by him.

B. These documents shall incorporate all changes made in the course of the project so as to enable the Owner to properly maintain, operate, and repair both exposed and concealed work. The redlines shall indicate changes:

1. Made by Contractor.

2. Addendum Items.

3. Change Orders.

4. Substitutions.

C. Drawings and specifications shall be updated during the progress of the work and kept at the job site.

D. Record Prints: Maintain one set of blue-line or black-line prints of the Contract Drawings, Submittals, and Shop Drawings.

1. Preparation: Mark Record Prints to show the actual installation where installation varies from that shown originally.

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 understandable drawing technique.

c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.

2.22. FINAL PROJECT OBSERVATION: The final project observation shall not be made until the following items have been assembled and approved as indicated in other sections of the specifications.

A. Certificate of acceptance from local inspecting authorities.

B. Letter of compliance from the Controls Systems Provider indicating that the system is complete, fully operational, and installed as specified by manufacturer's certified or licensed individuals.

C. Test and Balance report.

D. Owner's Operations and Maintenance manual.

E. Copies of bonds, insurance certificates, waivers, affidavits, warranties and guarantees, and other documents required in the specifications signed and ready for appropriate action.

F. Written notification from the Contractor that the work is complete and ready for final observation and the above documents are completed and available

G. Other documentation which may be required by the Engineer.

2.23. PROJECT CLOSEOUT

A. The final mechanical systems closeout shall not be completed until the Contractor has completed his work and submitted the documents required by Division 1 portions of the specifications. In addition, the following work items and specific mechanical documents described in other portions of this specification section shall also be submitted and approved:

1. Record drawings.

2. Record specifications.

3. Guarantee and Warranties.

4. Operating and Maintenance Manuals (O&M). O&M Manuals shall also be provided to the Owner in duplicate. Manuals shall contain approved shop drawings, operations and maintenance instructions, parts manuals for HVAC equipment, an accurate set of design plans showing all construction revisions to the design set, and a copy of the test and balance report.

5. Final clean up.

6. Final Test and Balance Reports with startup logs.

7. Pipe and Equipment Identification.

8. Pipe test certifications.

9. Water treatment analysis and application.

10. Bonds, Insurance Certificates, Waivers, Affidavits, and other documents required in the specifications signed and ready for appropriate action.

11. Other items which may be required by the Engineer.

B. Confirm in writing that specified training specified has been completed with the Owner.

C. Confirm in writing that specified demonstrations have been completed with the Owner.

D. Confirm that test and balance is complete.

END OF SECTION

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SECTION 23 0015 - FIRESTOPPING AND SMOKE STOPPING

PART 1 - GENERAL

1.01. SUMMARY

A. Section includes:

1. Through-penetration firestopping in fire rated construction.

B. Scope:

1. The scope of the work shall include the mechanical systems, HVAC piping and ductwork, plumbing piping, fire protection piping, and other systems installed by the contractor.

1.02. 1.02 REFERENCES

A. Underwriters Laboratories

1. U.L. Fire Resistant Directory

a. Through-penetration firestop devices (XHCR)

b. Fire resistance ratings (BXUV)

c. Through-penetration firestop systems (XHEZ)

d. Fill, void, or cavity material (XHHW)

B. American Society for Testing and Materials Standards:

1. ASTM E 814-88: Standard Test Method for Fire Tests of Through-Penetration Firestops.

1.03. 1.03 DEFINITIONS

A. Assembly: Particular arrangement of materials specific to given type of construction described or detailed in referenced documents.

B. Barriers: Time rated fire walls, time rated ceiling/floor assemblies, and structural floors.

C. Firestopping: Methods and materials applied in penetrations and unprotected openings to limit spread of heat, fire, gasses and smoke.

D. Penetration: Opening or foreign material passing through or into barrier or structural floor such that full thickness of rated materials is not obtained.

E. System: Specific products and applications, classified and numbered by Underwriters Laboratories, Inc. to close specific barrier penetrations.

F. Sleeve: Metal fabrication or pipe section extending through thickness off barrier and used to permanently guard penetration. Sleeves are described as part of penetrating system in other sections and may or may not be required.

1.04. SYSTEM DESCRIPTION

A. Design Requirements

1. Fire-rated construction: Maintain barrier and structural floor fire resistance ratings including resistance to cold smoke at all penetrations, connections with other surfaces or types of construction, at separations required to permit building movement and sound or vibration absorption, and at other construction gaps.

2. Smoke barrier construction: Maintain barrier and structural floor resistance to cold smoke at all penetrations, connections with other surfaces and types of construction and at all separations required to permit building movement and sound or vibration absorption, and at other construction gaps.

1.05. SUBMITTALS

A. Submit in accordance with general conditions unless otherwise indicated.

B. Product data: Manufacturer's specifications and technical data including the following:

1. Detailed specification of construction and fabrication

2. Manufacturer's installation instructions.

C. Shop drawings: Indicate dimensions, description of materials and finishes, general construction, specific modifications, component connections, anchorage methods, hardware, and installation procedures, plus the following specific requirements.

1. Details of each proposed assembly identifying intended products and applicable UL System number, or UL classified devices.

2. Manufacturer or manufacturers' representative shall provide qualified engineering judgements and drawings relating to non-standard applications as needed.

D. Quality control submittals:

1. Statement of qualifications.

E. Applicators' qualifications statement:

1. List past projects indicating required experience.

1.06. QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

B. Applicator: Company specializing in performing the work of this section with minimum three years documented experience and approved by manufacturer.

1.07. REGULATORY REQUIREMENTS

A. Conform to applicable code for fire resistance ratings and surface burning characteristics.

B. Provide certificate of compliance from authority having jurisdiction indicating approval of combustibility.

1.08. ENVIRONMENTAL REQUIREMENTS

A. Do not apply materials when temperature of substrate material and ambient air is below 60 degrees F.

B. Maintain this minimum temperature before, during, and for 3 days after installation of materials.

C. Provide ventilation in areas to receive solvent cured materials.

D. Furnish forced air ventilation during installation if required by manufacturer.

E. Keep flammable materials away from sparks or flame.

F. Provide masking and drop cloths to prevent contamination of adjacent surfaces by firestopping materials.

G. Comply with manufacturing recommendations for temperature and humidity conditions before, during and after installation of firestopping.

1.09. SEQUENCING

A. Sequence work to permit firestopping materials to be installed after adjacent and surrounding work is complete.

1.10. QUALITY ASSURANCE

A. Installer's qualifications: Firm experienced in installation or application of systems similar in complexity to those required for this project, plus the following:

1. Acceptable to or licensed by manufacturer, State or local authority where applicable.

2. At least 2 years' experience with systems.

3. Successfully completed at least 5 comparable scale projects using this system.

B. Local and State regulatory requirements: Submit forms or acceptance for proposed assemblies not conforming to specific UL Firestop System numbers, or UL classified devices.

C. Materials shall have been tested to provide fire rating at least equal to that of the construction.

1.11. DELIVERY, STORAGE, AND HANDLING

A. Packing and shipping:

1. Deliver products in original unopened packaging with legible manufacturer's identification.

2. Coordinate delivery with scheduled installation date, allow minimum storage at site.

B. Storage and protection: Store materials in a clean, dry, ventilated location. Protect from soiling, abuse, moisture and freezing when required. Follow manufacturer's instruction.

1.12. PROJECT CONDITIONS

A. Existing conditions:

1. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.

2. Proceed with installation only after penetrations of the substrate and supporting brackets have been installed.

1.13. GUARANTEE

A. Submit copies of written guarantee agreeing to repair or replace joint sealers which fail in joint adhesion, co-adhesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, or general durability or appear to deteriorate in any other manner not clearly specified by submitted manufacturer's data as an inherent quality of the material for the exposure indicated. The guarantee period shall be one year from date of substantial completion.

PART 2 PRODUCTS

2.01. THROUGH-PENETRATION FIRESTOPPING OF FIRE-RATED CONSTRUCTION

A. Systems or devices listed in the U.L. Fire Resistance Director under categories XHCR and XHEZ may be used, providing that it conforms to the construction type, penetrant type, annular space requirements and fire rating involved in each separate instance, and that the system be symmetrical for wall applications. Systems or devices must be asbestos-free.

1. Additional requirements: Withstand the passage of cold smoke either as an inherent property of the system, or by the use of a separate product included as a part of the U.L. system or device, and designed to perform this function.

2. Acceptable manufacturers and products: Those listed in the U.L. Fire Resistance directory for the U.L. System involved and as further defined in Part 3.06 of this section.

3. All firestopping products must be from a single manufacturer. All trades shall use products from the same manufacturer.

4. Products shall be 3M firestopping products and systems or equal.

2.02. SMOKE-STOPPING AT SMOKE PARTITIONS

A. Through-Penetration Smoke-Stopping: Any system complying with the requirements for through-penetration firestopping in fire-rated construction, as specified in this section, is acceptable, provided that the system includes the specified smoke seal or will provide a smoke seal. The length of time of the fire resistance may be disregarded.

B. Construction-Gap Smoke-Stopping: Any system complying with the requirements for construction-gap firestopping in fire-rated construction, as specified in this section, is acceptable, provided that the system includes the specified smoke seal or will provide a smoke seal. The length of time of the fire resistance may be disregarded.

2.03. MATERIALS

A. Firestopping Material: Single or multiple component silicone elastomeric rubber type

foam compound mixed with incombustible non-asbestos ceramic fibers.

B. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces.

2.04. 2.04 ACCESSORIES

A. Fill, void or cavity materials: As classified under category XHHW in the U.L. Fire Resistance Directory.

B. Forming materials: As classified under Category XHKU in the U.L. Fire Resistance Directory.

PART 3 EXECUTION

3.01. EXAMINATION

A. Verification of conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.

1. Verify barrier penetrations are properly sized and in suitable condition for application of materials.

2. Do not proceed until unsatisfactory conditions have been corrected.

3.02. SURFACE PREPARATION

A. Clean surfaces to be in contact with penetration seal materials, of dirt, grease, oil, loose materials, rust, or other substances that may affect proper fitting, adhesion, or the required fire resistance.

3.03. INSTALLATION

A. Apply primer and materials in accordance with manufacturer's instructions.

B. Install penetration seal materials in accordance with printed instruction of the U.L. Fire Resistance Directory and in accordance with manufacturer's instruction.

C. Seal holes or voids made by penetrations to ensure an effective smoke barrier.

D. Where floor openings without penetrating items are more than four inches in width and subject to traffic or loading, install firestopping materials capable of supporting same loading as floor.

E. Apply firestopping material in sufficient thickness to achieve rating and to a uniform density and texture.

F. Protect materials from damage on surfaces subject to traffic.

G. Install material at walls or partition openings which contain penetrating sleeves, piping, ductwork, conduit and other items requiring firestopping.

H. Place firestopping in annular space around fire dampers before installation of damper's

anchoring flanges - installed in accordance with fire damper manufacturer's recommendations.

I. Where large openings are created in walls or floors to permit installation of pipes, ducts, cable tray, bus duct or other items, close unused portions of opening with firestopping material tested for the application. See U.L. Fire Resistance Directory.

J. Install smoke stopping as specified for firestopping.

K. Where rated walls are constructed with horizontally continuous air space, double width masonry, or double stud frame construction, provide vertical 12-inch-wide fiber dams for full thickness and height of air cavity at maximum 15-foot intervals.

L. Dam material to remain.

3.04. FIELD QUALITY CONTROL

A. Examine penetration sealed areas to ensure proper installation before concealing or enclosing areas.

B. Keep areas of work accessible until inspection by applicable code authorities.

C. Perform under this section patching and repairing of firestopping caused by cutting or penetration by other trades.

3.05. ADJUSTING AND CLEANING

A. Clean adjacent surfaces of firestopping materials.

B. Clean up spills of liquid components.

C. Neatly cut and trim materials as required.

D. Remove equipment, materials and debris, leaving area in undamaged, clean condition.

3.06. PROTECTION OF FINISHED WORK

A. Protect adjacent surfaces from damage by material installation.

3.07. SYSTEMS AND APPLICATION

A. The installation shall be as required by manufacturer for type of construction, Type of U.L. systems, type of penetration, and type of fire stopping system.

END OF SECTION

SECTION 23 00 30 - ELECTRICAL REQUIREMENTS FOR MECHANICAL EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY:

A. This section specifies the basic requirements for electrical components which are to be provided for operation of mechanical equipment. These components include, but are not limited to, motors, starters, and disconnect switches when indicated, furnished as an integral part of packaged mechanical equipment, or furnished separately for mechanical equipment.

B. Furnish all motor controllers and contactors, not furnished as part of a motor control center, for proper operation of all motors.

C. Specific electrical requirements (i.e., horsepower and electrical characteristics) for mechanical equipment are specified within the individual equipment specification sections and scheduled on the drawings.

1.02 REFERENCES:

A. NEMA Standards MG 1: Motors and Generators.

B. NEMA Standard ICS 2: Industrial Control Devices, Controllers, and Assemblies.

C. NEMA Standard 250: Enclosures for Electrical Equipment.

D. NEMA Standard KS 1: Enclosed Switches.

E. National Electric Code (NFPA 70).

1.03 SUBMITTALS:

A. Separate submittal is not required. Submit product data for motors, starters, and other electrical components with submittal data required for the equipment for which it serves, as required by the individual equipment specification sections.

1.04 QUALITY ASSURANCE:

A. Electrical components and materials shall be UL labeled.

B. The electrical work shall comply with the National Electric Code.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Equipment shall be by same manufacturer, except those items furnished by an equipment manufacturer as an integral part of his equipment. Where possible the equipment shall be

by the same manufacturer specified in Division 16.

2.02 MOTORS: The following are basic requirements for simple or common motors. For special motors, more detailed and specific requirements are specified in the individual equipment specifications.

A. Torque characteristics shall be sufficient to satisfactorily accelerate the driven loads.

B. Motor sizes shall be large enough so that the driven load will not require the motor to operate in the service factor range.

C. 2-speed motors shall have 2 separate windings on poly-phase motors.

D. Temperature Rating: Rated for 40 degrees C. environment with maximum 90 degree C rise for continuous duty at full load (Class B insulation).

E. Starting Capability: Frequency of starts as indicated by automatic control system, and not less than 5 evenly spaced starts per hour for manually controlled motors.

F. Service Factor: 1.15 for poly-phase motors and 1.35 for single phase motors.

G. Motor Construction: NEMA Standard MG 1, general purpose, continuous duty, Design "B", except "C" where required for high starting torque.

1. Frames: NEMA Standard No. 48 or 56; use driven equipment manufacturer's standards to suit specific application.

2. Bearings:

a. Ball or roller bearings with inner and outer shaft seals.

b. Re-greasable, except permanently sealed where motor is normally inaccessible for regular maintenance.

c. Designed to resist thrust loading where belt drives or other drives produce lateral or axial thrust in motor.

d. For fractional horsepower, light duty motors, sleeve type bearings are permitted.

3. Enclosure Type:

a. Open drip-proof motors for indoor use where satisfactorily housed or remotely located during operation.

b. Guarded drip-proof motors where exposed to contact by employees or building occupants.

c. Weather protected Type I for outdoor use, Type II where not housed.

4. Overload Protection: Built-in thermal overload protection and, where indicated,

internal sensing device suitable for signaling and stopping motor at starter.

5. Noise Rating: "Quiet".

6. Efficiency:

   a. Motor shall comply with the efficiency requirements of the Energy Independence and Security Act of 2007.

   b. Motors smaller than 1 HP shall have minimum full load efficiencies levels per NEMA Standards.

   c. Motors 1 HP and larger shall be premium efficiency.

7. Nameplate: Indicate the full identification of manufacturer, ratings, characteristics, construction, special features and similar information.

2.03 STARTERS, ELECTRICAL DEVICES, AND WIRING:

A. Motor Starter Characteristics:

1. Enclosures: NEMA 1, general purpose enclosures with padlock ears, except in wet locations shall be NEMA 3R or NEMA 12 with conduit hubs installed by contractor, or units in hazardous locations which shall have NEC proper class and division.

2. Type and size of starter shall conform to adopted standards and recommended practices of the National Electric Code and Underwriters' Laboratories.

B. Manual Switches: Manual switches shall have:

1. Pilot lights and extra positions for multi-speed motors.

2. Overload protection: Melting alloy type thermal overload relays.

3. Manual starters / switches are to be used on fractional horsepower motors only.

C. Magnetic Starters:

1. Momentary contact push buttons and pilot lights, properly arranged for single speed or multi-speed operation as indicated.

2. Trip-free thermal overload relays, each phase.

3. Interlocks, witches and similar devices as required for coordination with control requirements of controls sections.

4. Built-in 120 volt control circuit transformer, with 2 primary and one secondary fuse, where service exceeds 240 volts. Fuses sized to carry holding coil circuit and other connected devices.

5. Externally operated manual reset.

6. Under-voltage release or protection (3-wire control).

7. Branch circuit protection shall meet type 2 coordination protection.

8. A hand-off-auto selector switch shall be provided in addition to start-stop buttons for all devices being controlled automatically.

9. Phase loss relay.

   a. Provide protective relays with DPDT 600V rated contacts, locking potentiometer undervoltage adjustment, and LED indicating light at each starter for motors greater than 5 HP. Equal to Square D Class 8430, Type MPD, mounted in suitable enclosure.

D. Motor Connections:

1. Flexible conduit, except where plug-in electrical cords are specifically indicated.

E. Heater Contactors:

1. Contactors for resistance heat shall be by same manufacturer as starters unless furnished with heaters. Contactors shall be of the magnetic type and mounted in NEMA Type 1 general purpose enclosure. Contactors shall carry a UL listing and shall be rated for 100,000 cycles.

F. Disconnect Switches:

1. Fusible Switches: Fused, each phase; heavy duty; horsepower rated; non-teasible, quick-make, quick-break mechanism; dead front line side shield; solderless lugs suitable for copper or aluminum conductors; spring reinforced fuse clips; electro silver plated current carrying parts; hinged doors; operating lever arranged for locking in the "open" position; arc quenchers; capacity and characteristics as indicated.

2. Non-fusible Switches: For equipment less than 1 horsepower, switches shall be horsepower rated; toggle switch type; quantity of poles and voltage rating as indicated. For equipment 1 horsepower and larger, switches shall be the same as fusible type.

2.04 CAPACITORS:

A. Features:

1. Individual unit cells, all welded steel housing, each capacitor internally fused, non-flammable synthetic liquid impregnant, craft tissue insulation, and aluminum foil electrodes.

2. KVAR size shall be as required to correct motor power factor to 90 percent or better and shall be installed on all motors 1 horsepower and larger that have an

uncorrected power factor of less than 85 percent at rated load.

PART 3 - EXECUTION

3.01 GENERAL

A. Install motors on motor mounting systems in accordance with motor manufacturer's instructions, securely anchored to resist torque, drive thrusts, and other external forces inherent in mechanical work. Secure sheaves and other drive units to motor shafts with keys and Allen set screws, except motors of 1/3 hp and less may be secured with Allen set screws on flat surface of shaft. Unless otherwise indicated, set motor shafts parallel with machine shafts.

B. Deliver starters and wiring devices which have not been factory-installed on equipment unit to electrical installer for installation.

C. Install starters and wiring devices at locations indicated, securely supported and anchored, and in accordance with manufacturer's installation instructions. Locate for proper operation access, including visibility, and for safety. Do not cover equipment data or informational tags when device is to be mounted on equipment.

D. Install control connections for motors to comply with NEC and applicable provisions of Electrical. Install equipment grounding except where non-grounded isolation of motor is indicated.

E. Connect protective relays to line side lugs of the motor starter and wire control contacts into motor starter circuit.

F. Label starters with engraved plastic nameplate describing the equipment served, e.g., "A.C. Unit No. 1". Nameplates shall be U.V. stabilized for use indoor / outdoor. Attach nameplates with clear silicone sealant.

END OF SECTION

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SECTION 23 0060 - BASIC PIPING

PART 1 - GENERAL

1.01. THERMAL EXPANSION:

A. Swing joints, turns, expansion loops, and long offsets shall be provided where necessary to allow for expansion and contraction. Pipe, fittings, or equipment damaged during the warranty period due to thermal expansion shall be replaced at no additional cost to the Owner.

1.02. NOISE CONTROL:

A. Piping shall be free of any objectionable self-generated noise. Isolate piping from building where required to prevent transmission of noise.

1.03. CROSS CONNECTIONS:

A. No piping shall be installed that will provide a cross-connection between potable water system and a polluted supply.

1.04. SUBMITTALS

A. Product Data: Submit catalog cut sheets and specifications for each type of pipe, tube, and fitting. Submit pipe schedule showing manufacturer, pipe or tube weight, fitting type, and joint type for each piping system.

1.05. DELIVERY, STORAGE, AND HANDLING

A. Except for hub and spigot, clay, and similar piping, provide factory applied end caps on all pipe and tubing to prevent damage, and dirt and moisture entry. Maintain end caps through shipping, storage, and handling.

B. Where possible, store pipe, tube, flanges, and fittings inside and protected from the weather. Where necessary to store outside, elevate above grade and enclose with durable, waterproof wrapping.

1.06. QUALITY ASSURANCE

A. Qualify and certify welding and brazing procedures, equipment, and operators in accordance with ASME codes and standards for shop and job site work.

B. Welder's Qualifications: All welders shall be qualified in accordance with ASME Boiler and Pressure Vessel Code, Section IX, Welding and Brazing Qualifications.

C. Welding procedures and testing shall comply with ANSI Standard B31.1.

D. Soldering and brazing procedures and testing shall comply with ANSI Standard B31.9. Comply with ANSI Standard B31.5 for refrigerant piping.

PART 2 - PRODUCTS

2.01. MATERIALS:

A. Refer to specific piping specification sections for materials to be used on the various piping systems.

B. Materials shall be manufactured by firms whose products of types and sizes required for this project have been in satisfactory use in similar service for 5 years.

C. All materials shall be new and undamaged.

D. For corrosive environments all bare copper piping shall be provided with special Heresite coating even if located within outdoor equipment.

2.02. CONDENSATE, CONDENSING FURNACE, EXHAUST, AND INTAKE PIPE: Sch 40 PVC

A. Condensate exhaust pipe should be sloped back to furnace.

2.03. REFRIGERANT PIPE, INCLUDING LIQUID AND HOT GAS LINES: hard drawn copper, Type "L" (degreased).

A. Soft copper will be permitted when sleeving below grade or installing in wall to eliminate fittings. Soft copper may also be installed on units less than 1 1/2 tons.

B. Do not run refrigerant lines thru return air plenum unless approved by engineer.

C. Do not run refrigerant piping underground.

2.04. JOINING MATERIALS:

A. Refer to specific piping specification sections for special joining materials not list below.

B. Pipe Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8 inch maximum thickness, unless other thickness or specific material is indicated.

2. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.

3. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

4. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Solder Filler Metals: ASTM B 32.

1. Alloy Sn95 or Alloy Sn94: approximately 95 percent tin and 5 percent silver, with 0.1 percent lead content.

2. 2. Alloy E: Approximately 95 percent tin and 5 percent copper, with 0.1 percent maximum lead content.

3. Alloy HA: Tin-antimony-silver-copper zinc, with 0.1 percent maximum lead content.

4. Alloy HB: Tin-antimony-silver-copper nickel, with 0.1 percent maximum lead content.

5. Alloy Sb5: 95 percent tin and 5 percent antimony, with 0.2 percent maximum lead content.

E. Brazing Filler Metals:

1. BcuP Series: Copper-phosphorus alloys.

2. Bag1: Silver Alloy.

F. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

G. Solvent Cements: Manufacturer's standard solvent cements for the following:

1. 1. ABS Piping: ASTM D 2235.

2. 2. CPVC Piping: ASTM F 493.

3. 3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

4. 4. PVC to ABS Piping Transition: ASTM D 3138.

H. Plastic Pipe Seals: ASTM F 477, elastomeric gasket.

I. Flanged, Ductile-Iron Pipe Gasket, Bolts, and Nuts: AWWA C110, rubber gasket, carbon-steel bolts and nuts.

J. Couplings: Iron-body sleeve assembly, fabricated to match OD of plain-end, pressure pipes.

1. Sleeve: ASTM A 126, Class B, gray iron.

2. Followers: ASTM A 47 (ASTM A 47M) malleable iron or ASTM A 536 ductile iron.

3. Gaskets: Rubber.

4. Bolts and Nuts: AWWA C111.

5. Finish: Enamel Paint.

K. Dielectric Fittings

1. 1. Provide dielectric connection at all connections between pipe materials of differing types whether indicated on plans or not.

2. 2. Insulating Material: Suitable for system fluid, pressure, and temperature.

3. 3. Dielectric Unions: Factory fabricated, union assembly, for 250-psig minimum working pressure at 180 °F.

4. 4. Dielectric flanges: Factory fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

5. 5. Dielectric-Flange Insulation Kits: Field assembled, companion-flange assembly, full-face or ring type. Components include neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers. Provide separate companion flanges and steel bolts and nuts for 150- or 300-psig minimum working pressure as required to suit system pressures.

6. 6. Dielectric couplings: Galvanized steel coupling with inert and non-corrosive, thermoplastic lining; threaded ends, and 300-psig minimum working pressure at 225°F,

7. 7. Dielectric Nipples: Electroplated steel nipple with inert and non-corrosive, thermoplastic lining; threaded ends, and 300-psig minimum working pressure at 225°F.

2.05. PIPE ESCUTCHEONS:

A. Inside diameter shall closely fit pipe outside diameter, or outside of pipe insulation where pipe is insulated. Select outside diameter of escutcheon to completely cover pipe penetration hole in floor, walls, or ceilings; and pipe sleeve extension, if any. Furnish solid pipe escutcheons with nickel or chrome finish for occupied areas. Prime paint finish for unoccupied areas. Split hinge type is not acceptable in occupied areas, except on existing piping.

B. For waterproof floors and areas where water and condensation can be expected to accumulate, provide cast brass or sheet brass escutcheons.

2.06. PIPE SLEEVES:

A. Sheet-Metal: Fabricate from galvanized sheet metal; round tube closed with snaplock joint, welded spiral seams, or welded longitudinal joint. Fabricate from the following gauges: 3” diameter and smaller, 20 gauge; 4” to 6” diameter, 16 gauge; over 6” diameter, 14 gauge.

B. Steel-Pipe: Fabricate from ASTM A 53, Grade A, Schedule 40 galvanized steel pipe.

C. Iron-Pipe: Fabricate from cast-iron or ductile iron pipe; cast-iron sleeve to be same wall thickness as equivalent ductile iron pipe.

2.07. SLEEVE SEALS:

A. Mechanical Sleeve Seals: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between pipe and sleeve, connected with bolts and pressure plates which cause rubber sealing elements to expand when tightened, providing water tight seal and electrical insulation. Thunderline, “Link Seal” or equal.

B. Fire Protection Mechanical Sleeve Seals: Three (3) hour rated modular mechanical type, consisting of interlocking fire resistant silicone rubber links shaped to continuously fill annular space between pipe and sleeve, connected with bolts and pressure plates which cause rubber sealing elements to expand when tightened, providing water tight seal and fire resistant seal. Thunderline, “Link Seal” or equal.

C. Fire Protection Sealant

1. Firestop System installation must meet requirements of ASTM E 814, UL 1479 or UL 2079 tested assemblies and provide a fire rating equal to that of construction being penetrated.

2. All firestop materials and methods shall conform to applicable governing codes having local jurisdiction, whether approved by submittal or not.

3. For those firestop applications that exist for which no UL tested system is available through any manufacturer, a manufacturer’s engineering judgment derived from similar independently tested system designs will be submitted to local authorities having jurisdiction for their review and approval prior to installation.

D. Elastomeric Joint Sealant: Type S, Grade NS, Class 25, Use O, neutral-curing, silicone sealant unless otherwise indicated.

E. Grout: Nonshrink, nonmetallic, hydraulic cement grout, ASTM C 1107, Grade B. Post hardening, volume adjusting, dry, nonstaining, noncorrosive, and nongaseous recommended for interior and exterior applications. 5000 psig, 28 day strength.

PART 3 - EXECUTION

3.01. GENERAL:

A. Install piping as described below, unless indicated otherwise in the individual piping sections. See the individual piping sections for unique piping installation requirements.

B. Exposed lines are to be run parallel with, or perpendicular to, building lines and wherever possible shall be grouped together for easy service and identification. Lines requiring a definite grade for drainage shall have precedence in routing over all other lines. Wherever possible, horizontal and vertical lines shall be held as close as possible to walls, ceilings, struts, and structural members to occupy minimum space consistent with the proper requirements for insulation, expansion, removal of pipe, and access to valves. Except in mechanical spaces, piping shall not be run exposed in finished area of buildings unless otherwise noted.

C. General Locations and Arrangements: Drawings including plans, schematics, and diagrams indicate the general location and arrangement of the piping systems. Location and arrangement of piping layout take into consideration pipe sizing and friction loss, expansion, pump sizing, and other design considerations. So far as practical, install piping as indicated. Refer to individual system specifications for requirements for coordination drawing submittals.

D. Locate groups of pipes parallel to each other, spaced to permit valve servicing.

E. Install fittings for changes in direction and branch connections.

F. Conceal all pipe installations in walls, pipe chases, utility spaces, above ceilings, and below grade or floors, unless indicated otherwise.

G. Install piping at indicated slopes and as prescribed by Code.

H. Install components with pressure rating equal to or greater than system operating pressure.

I. Install piping free of sags and bends.

J. Install piping with sufficient space above removable ceiling panels to allow for panel removal.

K. Install drains at low points in mains, risers, and branch lines consisting of a branch fitting, 3/4" ball valve, and short 3/4" threaded nipple and cap.

L. Piping shall be worked into place without springing and/or forcing. Arrange piping so that it does not interfere with removal of other equipment or devices, nor to block access to doors, windows, manholes, or other access openings.

M. All piping shall be installed so as to avoid liquid or air pockets throughout the work. Piping shall be erected and pitched to insure proper draining. Provide air vents and drain traps where indicated and as required.

N. All exposed plumbing fixture supplies and stops shall be chrome-plated.

O. Do not run piping through electrical or electronic equipment spaces and enclosures unless unavoidable. If piping must be run through electrical spaces, comply with NFPA 70 for access clearance requirements for electrical equipment. Install drip pan under piping which must be run through electrical spaces. Pan drain shall be run at exterior or sanitary, as permitted by Code.

P. Exterior Wall Penetrations: Seal pipe penetrations through exterior walls using sleeves and mechanical sleeve seals. Pipe sleeves smaller than 6" shall be steel; pipe sleeves 6" and larger shall be sheet metal.

Q. Fire Barrier Penetrations: Where pipes pass through fire rated walls, partitions, ceilings, or floors, the fire rated integrity shall be maintained.

3.02. ASSEMBLY:

A. All pipes shall be cut square and shall have burr and cutting slag removed by reaming or other cleaning methods.

B. Remove scale, slag, dirt, and debris from both inside and outside of piping and fittings before assembly.

C. Unions or flanges shall be used at all equipment connections to facilitate dismantling.

D. All joints and changes of direction shall be made with standard fittings. Reducers shall be used at pipe size changes.

E. Where required to prevent electrolysis and corrosion, dielectric fittings and couplings, or brass or bronze fittings or valves, shall be used between copper and steel piping. Provide insulating coupling on all underground metallic utility lines where they connect to building.

F. Nipples shall be of same material and composition as pipe on which they are installed, and shall be extra heavy when unthreaded shoulder is less than 1-1/2". No running thread nipples will be permitted. Minimum exposed shoulder of any nipple shall not be less than 3/4".

G. Joints between steel or copper pipe and cast iron shall be made with caulking ferrules.

H. Cast iron soil pipe and fittings shall be assembled with approved molded push-on type gaskets. Approved no-hub pipe may be used where applicable.

I. Galvanized steel pipe shall be assembled with galvanized screwed fittings.

J. Black steel pipe shall be assembled with screwed or welded fittings.

K. Copper pipe shall be assembled with wrought copper fittings. Use Alloy Sn95 (95/5) solder as a minimum. See specific piping sections for other requirements.

L. For steel piping, use new forged tees for branch connections to main in new piping systems. Forged tees or forged weld-o-lets shall be used for branch connections to existing mains.

M. Soldered Joints: Construct joints according to AWS's "Soldering Manual"; or CDA's "Copper Tube Handbook".

N. Brazed Joints: Construct joints according to AWS's "Brazing Handbook".

O. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Use appropriate tape or thread compound as required unless dry threading is specified.

P. Welded Joints: Construct joints according to AWS D10.12 using qualified processes and welding operators.

Q. Flanged Joints: Align flange surfaces parallel. Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned.

Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly using torque wrench.

R. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe handling practice of cleaners, primers, and solvent cements.

2. ABS Piping: ASTM D 2235 and ASTM D 2661.

3. CPVC Piping: ASTM D 2846 and ASTM F 493.

4. PVC Pressure Piping: ASTM D 2672.

5. PVC Nonpressure Piping: ASTM D 2855.

6. PVC to ABS Nonpressure Transition Fittings: Procedure and solvent cement according to ASTM D 3138.

3.03. FITTINGS AND ACCESSORIES:

A. Install strainers on the supply side of each control valve, pressure reducing or regulating valve, solenoid valve, and elsewhere as indicated.

B. Install unions adjacent to each valve at the final connection to each piece of equipment and plumbing fixture having 2" and smaller connections, and elsewhere as indicated.

C. Install flanges in piping 2-1/2" and larger, where indicated, adjacent to each valve, and at the final connection to each piece of equipment.

D. Pipe Escutcheons: Install pipe escutcheons on each pipe penetration through walls, partitions, and ceilings where penetration is exposed to view; and on the exterior of the building.

3.04. SUPPORTS:

A. Provide an adequate pipe suspension system in accordance with recognized engineering practices, using, where possible, standard, commercially accepted pipe hangers and accessories. No piping shall be supported by, or from, hangers supporting electrical conduit.

3.05. SLEEVES

A. Install pipe sleeves of types indicated where piping passes through walls, floors, slabs, ceilings, and roofs. Do not install sleeves through structural members of work, except as detailed on drawings, or as directed by the Structural Engineer.

B. Install sleeves accurately centered on pipe runs. Size sleeves so that piping and insulation (if any) will have free movement in sleeve, including allowance for thermal

expansion; but not less than two (2) pipe sizes larger than piping run. Where insulation includes vapor barrier jacket, provide sleeve with sufficient clearance for insulation.

C. Install length of sleeve equal to the thickness of construction penetrated, and finished flush to surface; except extend floor sleeves 1 inch above level floor finish.

D. Sleeves are not required for core-drilled holes.

E. Permanent sleeves are not required for holes formed by removable plastic sleeves.

F. Provide temporary support of sleeves during placement of concrete and other work around sleeves. Provide temporary closure to prevent concrete and other materials from entering sleeves.

G. Install sheet-metal sleeves at interior partitions and ceilings other than suspended ceilings for pipe diameter including insulation (if any) of 6 inches and larger.

H. Install iron-pipe sleeves at exterior penetrations, both above and below grade and for slab on grade penetrations.

I. Install steel-pipe sleeves at interior partitions for pipe diameter including insulation (if any) of less than 6 inches.

J. Seal voids between outside of sleeve and construction with nonshrink, nonmetallic grout.

K. Sleeves Seals:

1. Provide sleeve seals for core drilled holes and holes made using removable plastic sleeves.

2. Provide mechanical sleeve seals for exterior wall, floor, and slab on grade applications. Install in accordance with manufacturer's recommendations for a water tight seal. Except for slab on grade and below grade wall penetrations, elastomeric joint sealants may be used in lieu of mechanical sleeve seals.

3. Provide fire mechanical sleeves seals for penetrations of rated walls, slabs, floors, and ceilings. Fire protection sealants complying with all authorities having jurisdiction may be used in lieu of mechanical type seals.

4. Sleeve seals are not required in non-rated interior partitions and ceilings.

3.06. CLEANING, FLUSHING, INSPECTION:

A. Clean exterior surfaces of installed piping systems and prepare for application of coating and painting (if any). Flush out piping systems with clean water before proceeding with required tests. Inspect each length for completion, supports, and accessories.

3.07. TESTING:

A. Test all piping systems as hereinafter specified and furnish to the Engineer copies of the test reports signed by the Contractor.

B. Piping located underground shall be tested and inspected by the governing agency before backfilling.

C. Equipment and personnel required for tests shall be furnished without additional cost. Testing equipment shall be as required for particular test, with all equipment and gauges accurate and in good working order.

D. Equipment subject to damage at given test pressure shall be removed from line before pressure is applied. Use proper plugs or caps.

E. Repair piping system sections which fail the required test, by disassembly and re-installation, using new materials. Do not use chemicals, stop-leak, mastics, or other temporary repair methods. Retest the system.

F. Drain test water after testing and repair work has been completed.

G. See specific piping system sections for test pressure, duration and medium.

H. Comply with ANSI Standard B31.1.

END OF SECTION 23 0060

SECTION 230075 - MECHANICAL IDENTIFICATION

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following mechanical identification applications:

1. Equipment identification.

2. Pipe identification.

3. Valve tags.

4. Valve schedule.

5. Duct identification.

1.02 SUBMITTALS

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

B. Product Schedule: Provide schedule indicating each type of identification material to be used for equipment, piping, and ductwork. Indicate colors to be used.

C. Valve and Steam Trap Schedule: Submit a valve and steam trap schedule for each piping system, typewritten and reproduced on 8-1/2" x 11" bond paper. Provide three (3) copies. Mark valves which are intended for emergency shut-off, normally open, normally closed, and similar special uses by special flag in the margin of the schedule. Include the following for each valve:

1. Valve identification number.

2. System.

3. Purpose.

4. Location.

5. Type.

6. Size.

7. Manufacturer.

1.03 QUALITY ASSURANCE

A. ASME Compliance: Comply with ASME A13.1, "Scheme for the Identification of Piping Systems", for letter size, length of color field, for colors not included in the schedule herein, and for viewing angles of identification devices for piping.

1.04 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with location of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.01 EQUIPMENT IDENTIFICATION

A. Engraved Plastic Laminate Identification Signs

1. General: Provide engraving stock melamine plastic laminate in the sizes and thicknesses indicated, with engraver's standard letter style, black with white core (letter color) except as otherwise indicated, punched for mechanical fastening except where using adhesive mounting.

2. Thickness: 1/16" for units up to 20 inches square or 8" length; 1/8" for larger units.

3. Fasteners: Self tapping stainless steel screws except use contact-type, permanent adhesive where screws cannot or should not penetrate the substrate. Where sign cannot be attached directly to device or equipment, attach with brass chain.

4. Letter sizes: Minimum ¼ inch for names of units if viewing distance is less than 24 inches, ½ inch for viewing distances up to 72 inches, and proportionally larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of the principal lettering.

2.02 PIPE IDENTIFICATION

A. All above grade piping shall be identified with pipe markers with colors as indicated. Identification shall have proper legend and meet OSHA specifications. Comply with ASME A13.1, unless otherwise noted.

B. For piping where diameter including insulation is less than 8", pipe markers shall be plastic, pre-tensioned, semi-rigid type that encircles entire pipe without the use of adhesives. Tape and sticker types are unacceptable.

C. For piping where diameter including insulation is 8" or greater, pipe markers shall be plastic, full-band, semi-rigid type strapped to pipe using manufacturer's standard stainless steel bands.

D. Underground line markers: Manufacturer's standard permanent, bright colored, continuous printed, plastic tape intended for direct burial service, not less than 6" wide and 4 mils thick. Provide tape with printing which most accurately indicates the type of buried pipe.

E. Manufacturer: Pipe markers as manufactured by Seton, Brady, Brimar, or EMED are acceptable.

F. Identification Schedule:

Piping System	Legend	Band/Text Color

1. Chilled Water System

Chilled Water Supply	Chilled Water Supply	Green/White
Chilled Water Return	Chilled Water Return	Green/White
Condensate Drain	Drain	Green/White
System Make-up Water	Make-Up Water	Green/White

2. Hot Water System

Hot Water Supply	Hot Water Supply	Green/White
Hot Water Return	Hot Water Return	Green/White
System Make-up Water	Make-Up Water	Green/White

3. Cooling Tower System

Condenser Water Supply	Condenser Water Supply	Green/White
Condenser Water Return	Condenser Water Return	Green/White
Cooling Tower Feedwater	Make-Up Water	Green/White
Cooling Tower Drain	Drain	Green/White

4. Steam Piping System

Low Pressure Steam	Low Pressure Steam	Green/White
High Pressure Steam	High Pressure Steam	Green/White
Condensate Return	Condensate Return	Green /White
Pumped Condensate	Cond. Pump Discharge	Green /White

5. Arrows and lettering shall be black. Arrows shall point in the direction of flow. Locate downstream of pipe legend.

6. Arrows shall be of same color as bands and shall point in direction of flow. Locate downstream of pipe legend.

7. Valve Identification: Provide brass tags for all valves and steam traps with legend describing function of each valve and trap. Tag shall also indicate normally open or normally closed, where position is noted on the drawings.

G. Valve Tags: Brass tags shall be a minimum of 2" diameter or 3-1/2" oval, to accommodate 1" high numbers. Tag shall be equipped with a 3/16" X 6" long brass chain.

2.03 DUCT IDENTIFICATION

A. Engraved Plastic Laminate Identification Signs

1. General: Provide engraving stock melamine plastic laminate in the sizes and thicknesses indicated, with engraver's standard letter style, colored black background with white letters except as otherwise indicated.

2. Thickness: 1/16" for units up to 20 inches square or 8" length; 1/8" for larger units.

3. Fasteners: Contact-type, permanent adhesive.

4. Letter sizes: Minimum ¼ inch for names of units if viewing distance is less than 24 inches, ½ inch for viewing distances up to 72 inches, and proportionally larger lettering for greater viewing distances. Include secondary lettering two-thirds to

three-fourths the size of the principal lettering.

B. Stencils: As specified and indicated herein.

2.04 STENCILS:

A. Prepared with letter sizes according to ASME A13.1 for piping; minimum letter height of 1-1/4" for ducts; and minimum letter height of ¾" for equipment and access door signs.

B. Use alkyd paint.

C. Use stencils only as directed herein.

PART 3 - EXECUTION

3.01 EQUIPMENT IDENTIFICATION

A. Provide permanent, factory, operational data, nameplate on each item of power operated mechanical equipment, indicating manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data. Locate nameplates in an accessible location. Where manufacturer's nameplate is not stamped or engraved, provide additional heavy gauge, aluminum or brass, stamped or engraved nameplate. Do not remove manufacturer's nameplates. When manufacturer's nameplates are to be covered by insulation or other material, provide a separate nameplate for mounting on the exterior of the covering.

B. In addition to factory nameplate, provide an engraved plastic laminate (stenciled) identification sign for each major item of mechanical equipment and each operational device. Provide identification signs for the following general categories of equipment.

1. Main control and operating valves, including safety devices and hazardous units such as gas outlets or steam relief valves.

2. Chillers, cooling towers, condensing units, compressors, pumps, and similar motor-driven units.

3. Heat exchangers, coils, and similar equipment.

4. Fans and blowers.

5. Packaged and central-station type air units.

6. Tanks and pressure vessels.

7. Strainers, filters, humidifiers, water treatment systems, and similar equipment.

8. 8. Control panels.

9. Fuel burning units, such as boilers, furnaces, and heaters.

10. Fire department hose valves and hose stations.

C. Provide engraved sign at each access door, indicating equipment or device to be accessed.

D. Coordinate names, abbreviations, and other designations used in equipment identification with corresponding designations shown, specified, scheduled, or as designated by the Owner's representative. Provide numbers, lettering, and wording as indicated or as directed by the Owner's representative. Owner shall set priority for lettering and graphics. Where multiple systems of the same generic name are shown and specified, provide identification which indicates individual system number as well as service (as examples; Boiler No. 3, AHU-1H, Standpipe G14).

3.02 PIPE IDENTIFICATION

A. Provide 1" thick molded fiberglass insulation with jacket under each plastic pipe marker to be installed on uninsulated pipes where fluid temperatures will be 125°F or greater. Insulation shall extend 4" beyond edges of marker.

B. Valve tags and steam traps shall be numbered as indicated on the valve listing provided to the Owner.

C. As a minimum, identification shall be applied to piping at the following locations:

1. Adjacent to each valve.

2. At each branch and riser take-off.

3. At each pipe passage through wall, floor, and ceiling construction.

4. At each pipe passage to underground.

5. At not more than forty feet spacing on straight pipe runs.

D. Place identification so it can be easily read. Arrows shall be applied to indicate direction of flow.

E. Underground Piping: During back-filling of each exterior underground piping system, install plastic line marker, located directly over buried line no deeper than 8" below finished grade. Where multiple small lines are buried in common trench and do not exceed overall width of 16", install a single line marker.

3.03 DUCTWORK IDENTIFICATION

A. Identify ductwork with plastic identification signs. Letter color shall be white. Sign background color shall be according to the following color codes. Indicate direction flow and duct service (such as supply, return, and exhaust).

1. Green: Supply air ductwork.

2. Yellow: Return air ductwork.

3. Blue: Exhaust, outside air, mixed air, and relief air.

B. Apply ductwork identification at the following locations:

1. Adjacent to each damper.

2. At each passage through walls, floors, or ceiling construction.

3. At no more than forty feet intervals.

4. At air handling units, fans, and air terminal boxes

END OF SECTION

SECTION 23 0086 - PIPING INSULATION

PART 1 - GENERAL

1.01. SUMMARY

A. Perform all Work required to provide and install piping insulation, jackets, and accessories indicated by the Contract Documents with supplementary items necessary for proper installation.

B. Insulation of Underground Piping is specified elsewhere and not work of this Section.

1.02. REFERENCE STANDARDS

C. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.

D. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.

E. All materials, installation and Workmanship shall comply with the applicable requirements and standards addressed within the following references:

1. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.

2. ASTM C168 - Terminology Relating to Thermal Insulation Materials.

3. ASTM C177 - Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded- Hot-Plate Apparatus.

4. ASTM C195 - Mineral Fiber Thermal Insulating Cement.

5. ASTM C335 - Steady-State Heat Transfer Properties of Horizontal Pipe Insulation.

6. ASTM C449 - Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.

7. ASTM C518 - Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

8. ASTM C534 - Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.

9. ASTM C547 - Mineral Fiber Pipe Insulation.

10. ASTM C552 - Cellular Glass Thermal Insulation.

11. ASTM C578 - Rigid, Cellular Polystyrene Thermal Insulation.

12. ASTM C585 - Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System).

13. ASTM C591 - Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.

14. ASTM C450 - Thermal Insulating Fitting Covers for NPS Piping, and Vessel Lagging.

15. ASTM C610 - Molded Expanded Perlite Block and Pipe Thermal Insulation.

16. ASTM C921 - Jackets for Thermal Insulation.

17. ASTM C1126 - Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation.

18. ASTM D1056 - Flexible Cellular Materials - Sponge or Expanded Rubber.

19. ASTM D1667 - Flexible Cellular Materials – Poly (Vinyl Chloride) Foam (Closed-Cell).

20. ASTM D2842 - Water Absorption of Rigid Cellular Plastics.

21. ASTM C795 - Insulation For Use Over Austenitic Steel.

22. ASTM E84 - Surface Burning Characteristics of Building Materials.

23. ASTM E96 - Water Vapor Transmission of Materials.

24. NFPA 255 - Surface Burning Characteristics of Building Materials.

25. UL 723 - Surface Burning Characteristics of Building Materials.

26. ASTM D5590 - Standard Test Method for Determining the Resistance of Paint Films and Related Coatings to Fungal Defacement by Accelerated Four-Week Agar Plate Assay

1.03. DEFINITIONS

F. Concealed: Areas that cannot be seen by the building occupants.

G. Interior Exposed: Areas that are exposed to view by the building occupants, including underneath countertops, inside cabinets and closets, and all equipment rooms.

H. Interior: Areas inside the building exterior envelope that are not exposed to the outdoors.

I. Exterior: Areas outside the building exterior envelope that are exposed to the outdoors, including building crawl spaces and loading dock areas.

J. Unconditioned Space: Interior space that is not temperature-controlled by cooling and/or heating system. Includes attics, chases, unconditioned living spaces and non-conditioned equipment rooms.

1.04. QUALITY ASSURANCE

K. All piping requiring insulation shall be insulated as specified herein and as required for a complete system. In each case, the insulation shall be equivalent to that specified and materials applied and finished as described in these Specifications.

L. All insulation, jacket, adhesives, mastics, sealers, and accessories utilized in the fabrication of these systems shall meet NFPA for fire resistant ratings (maximum of 25 flame spread and 50 smoke developed ratings) and shall be approved by the insulation manufacturer for guaranteed performances when incorporated into their insulation system, unless a specific product is specified for a specific application and is stated as an exception to this requirement.

1. Certificates to this effect shall be submitted along with submittal data.

2. No material shall be used that, when tested by the ASTM E84-89 test method, is found to melt, drip or delaminate to such a degree that the continuity of the flame front is destroyed, thereby resulting in an artificially low flame spread rating.

M. Application Company Qualifications: Company performing the Work of this Section shall have minimum three (3) years experience specializing in the trade.

N. All insulation shall be applied by mechanics skilled in this particular Work and regularly engaged in such occupation.

O. All insulation shall be applied in strict accordance with these Specifications and with factory printed recommendations on items not herein mentioned. Unsightly, inadequate, damaged or water-soaked Work will not be acceptable.

P. Stainless Steel: Insulation applied on stainless steel shall meet requirements of ASTM C795 and NRC 1.36. These requirements are for prevention of external stress Corrosion Cracking (ESCC) for austenitic stainless steel.

1.05. SUBMITTALS

Q. Prepare a schedule of piping insulation showing systems insulated. For each system, show insulation type, thickness, temperature rating, and special conditions where applicable.

R. Submit product data for each piping system. Product data shall include but not be limited to the following:

1. Manufacturer's name

2. Insulation material and thickness

3. Jacket

4. Adhesives

5. Fastening methods

6. Fitting materials

7. Manufacturer's data sheets indicating density, thermal characteristics, temperature ratings

8. Insulation installation details (manufacturer's installation instructions/details, Contractor's installation details, MICA plates where applicable)

9. Other appropriate data

S. Samples: When requested, submit three (3) samples of any representative size illustrating each insulation type.

T. Operation and Maintenance Data: Indicate procedures that ensure acceptable standards will be achieved. Submit certificates to this effect.

1.06. DELIVERY, STORAGE AND HANDLING

U. Deliver materials to the Project Site in original factory packaging, labeled with manufacturer's identification including product thermal ratings and thickness.

V. Store insulation in original wrapping and protect from weather and construction traffic. Protect insulation against dirt, water, chemical, and mechanical damage.

W. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics and insulation cements.

PART 2 - PRODUCTS

2.01. GENERAL

A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

2.02. MANUFACTURERS

B. Insulation:

1. Owens-Corning

2. Certainteed Corporation

3. Johns Manville Corporation

4. Knauf Corporation

5. Armstrong/Armacell (Armaflex)

6. RBX Industries/Rubatex

7. FOAMGLAS (Cellular Glass) by Pittsburgh Corning

C. Jackets:

1. Childers Products Company

2. PABCO

3. RPR Products, Inc.

4. John Mansfield Speedline

5. Foamglas

D. Coatings, Sealants, and Adhesives:

1. Foster

2. Childers

2.03. INSULATION MATERIALS

E. Products shall not contain asbestos, lead, mercury, or mercury compounds.

F. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

G. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

H. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

I. Piping Insulation Type P1: Glass-Fiber, Preformed Pipe Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A with factory applied ASJ-SSL vapor barrier jacket with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I. Provide one of the following:

1. Owens Corning; Evolution Fiberglas Pipe Insulation.

2. Johns Manville; Micro-Lok Pipe Insulation.

3. Knauf; Earthwool 1000 degree Pipe Insulation.

J. Piping Insulation Type P2: Flexible Elastomeric Pipe Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials. Provide one of the following:

1. Armacell LLC; AP Armaflex

2. Aeroflex USA Inc; Aerocel

3. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.

K. Piping Insulation Type P3: Handicap Lavatory and Sink Piping Insulation Kit:

1. Handicap lavatory and sink drain piping, P-trap, cold and hot water assemblies and valves shall be insulated with fully molded insulation kit specifically designed for handicap lavatories and sinks. ADA conforming.

2. Material shall be 3/16" thick molded closed cell vinyl with nylon fasteners, white finish and be self-extinguishing per ASTM D635, with K value of 1.17 BTU/in./hr./sq. ft./deg. F.

L. Piping Insulation Type P4: Preformed Cellular Glass: Comply with ASTM C 585, ASTM C 450. Provide one of the following:

1. Pittsburgh Corning; Foamglas

2.04. FIELD-APPLIED FABRIC-REINFORCING MESH

M. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in., in a Leno weave, for pipe. Provide one of the following:

1. Foster Brand, Specialty Construction Brands, Inc; Mast-A-Fab.

2. Vimasco Corporation; Elastafab 894.

2.05. FIELD-APPLIED JACKETS

N. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

O. Piping Jacket Type J1: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; 40 mil thickness, roll stock ready for shop or field cutting and forming. Provide factory-fabricated fitting covers to match jacket. Provide one of the following

1. Johns Manville; Zeston.

2. Proto Corporation; LoSmoke

P. Piping Jacket Type J2: Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14. Provide factory-fabricated fitting covers or field fabricate covers only if factory-fabricated fitting covers are not available. Provide one of the following:

1. Provide Childers Brand Metal Jacketing Systems.

2. Provide shop fabricated smooth aluminum jacket 0.016".

2.06. TAPES

Q. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Width: 3 inches.

2. Thickness: 11.5 mils.

3. Adhesion: 90 ounces force/inch in width.

4. Elongation: 2 percent.

5. Tensile Strength: 40 lbf/inch in width.

6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

R. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

1. Width: 2 inches.

2. Thickness: 6 mils.

3. Adhesion: 64 ounces force/inch in width.

4. Elongation: 500 percent.

5. Tensile Strength: 18 lbf/inch in width.

2.07. INSULATION INSERTS

S. Provide insert between support shield and piping on piping 1 1/2" diameter or larger. Inserts shall be factory fabricated of heavy density insulating material suitable for temperature. Insulation inserts shall not be less than the following lengths:

1. 1 1/2" to 2 1/2" pipe size 10" long

2. 3" to 6" pipe size 12" long

3. 8" to 10" pipe size 16" long

4. 12" and over 22" long

2.08. PIPE INSULATION ACCESSORIES

T. Vapor Retarder Lap Adhesive: Compatible with insulation.

U. Covering Adhesive Mastic: Compatible with insulation.

V. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12-inch centers.

W. Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement: ASTM C449/C449M.

X. Insulating Cement: ASTM C195; hydraulic setting on mineral wool.

Y. Adhesives: Compatible with insulation.

Z. Banding:

1. Aluminum bands, 3/4" x 0.02 inches

2. Stainless Steel, 304, 3/4" by 0.02 inches

PART 3 - EXECUTION

3.01. PREPARATION

A. Thoroughly clean all surfaces to be insulated as required to remove all oil, grease, loose scale, rust, and foreign matter. Piping shall be completely dry at the time of application. Insulating piping where condensate is occurring is unacceptable. Wet insulation is unacceptable and shall be removed and replaced before acceptance by the Owner.

B. Coordinate insulation installation with trade installing heat trace. Comply with requirements for heat tracing that apply to insulation.

C. Verify that piping has been tested for leakage before applying insulation.

3.02. GENERAL INSTALLATION REQUIREMENTS

D. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards, and shall conform to codes and ordinances of authorities having jurisdiction.

E. Installation of insulation and jacket materials shall be in accordance with manufacturer's published instructions.

F. Handle and install materials in accordance with manufacturer's instructions in the absence of specific instructions herein.

G. On exposed piping, locate insulation cover seams with the ridge of the lap joint is directed down.

H. Provide dams in insulation at intervals not to exceed 20 feet on cold piping systems to prevent migration of condensation or fluid leaks. Indicate visually where the dams are located for maintenance personnel to identify and also provide dams at butt joints of insulation at fittings, flanges, valves, and hangers.

I. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

J. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

K. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

L. Install insulation with longitudinal seams at top and bottom of horizontal runs.

M. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

N. Keep insulation materials dry during application and finishing.

O. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

P. Install insulation with least number of joints practical.

Q. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.

2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.

3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

R. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

S. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.

2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive.

3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.

5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

T. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

U. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

V. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere and seal patches similar to butt joints.

W. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.

2. Testing agency labels and stamps.

3. Nameplates and data plates.

4. Manholes.

5. Handholes.

6. Cleanouts.

3.03. PENETRATIONS

X. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.

2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.

4. Seal jacket to roof flashing with flashing sealant.

Y. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

Z. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.

2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.

4. Seal jacket to wall flashing with flashing sealant.

AA. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

BB. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions. Comply with requirements in Section 15050 for firestopping and fire-resistive joint sealers.

CC. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.

2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 15050."

3.04. GENERAL PIPE INSULATION INSTALLATION

DD. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

EE. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.

2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.

3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.

4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.

5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.

6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.

7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.

8. For services not specified to receive a field-applied jacket, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.

9. Stencil or label the outside insulation jacket where concealed unions, check valve or piping specialties are insulated. Provide descriptive label at device under the insulation. For example, at each union stencil with the word "union." Match size and color of pipe labels.

FF. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

GG. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.

2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.

3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.

4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.

5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.05. INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

HH. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

II. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.

2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.

3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.

4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

JJ. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.

2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

KK. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.

2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.

3. Install insulation to flanges as specified for flange insulation application.

4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.06. INSTALLATION OF GLASS-FIBER PREFORMED PIPE INSULATION

LL. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.

2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.

3. For insulation with factory-applied jackets on below-ambient surfaces, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

MM. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.

2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.

3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.

4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

NN. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.

2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with bands.

OO. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.

2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.

3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.

4. Install insulation to flanges as specified for flange insulation application.

3.07. FIELD-APPLIED JACKET INSTALLATION

PP. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications. Seal with manufacturer's recommended adhesive. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

QQ. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.08. FINISHES

RR. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

SS. Do not field paint aluminum jackets.

3.09. PIPING SYSTEMS INSULATION SCHEDULE

PIPING SYSTEMS INSULATION SCHEDULE					
Service	Insulation Type	Location	Jacket Type	Pipe Size	Insulation Thickness by Pipe Size
COLD PIPING					
Chilled Water	P1	Interior Concealed	--	3.0" and smaller	1.0"
				4.0" and larger	1.5"
Cooling Tower Condenser Water	P1	Interior Exposed	J1	3.0" and smaller	1.0"
		Exposed		4.0" and larger	1.5"
		Unconditioned Space	--	3.0" and smaller	1.0"
				4.0" and larger	1.5"
		Unconditioned Space	--	3.0" and smaller	1.5"
				4.0" and larger	2.0"
		Exterior	J2	3.0" and smaller	1.5"
				4.0" and larger	2.0"
		Equipment Rooms	J1	3.0" and smaller	1.5"
		below 7.0ft above floor		4.0" and larger	2.0"
Make-Up Water		Interior	J1	0.5" and smaller	0.5"
		Exposed		1.0" through 2.0"	1.0"

				2.5" and larger	1.5"
		Unconditioned Space	--	0.5" and smaller	0.5"
				1.0" through 2.0"	1.0"
				2.5" and larger	1.5"
		Unconditioned Space	--	0.5" and smaller	0.5"
				1.0" through 2.0"	1.0"
				2.5" and larger	1.5"
		Exterior	J2	0.5" and smaller	1.0"
				1.0" through 2.0"	1.5"
				2.5" and larger	2.0"
		Equipment Rooms below 7.0ft above floor	J1	0.5" and smaller	0.5"
				1.0" through 2.0"	1.0"
				2.5" and larger	1.5"
Refrigerant Suction	P2	Interior Concealed	--	3.0" and smaller	0.75"
				4.0" and larger	1.0"
		Interior Exposed	J1	3.0" and smaller	0.75"
				4.0" and larger	1.0"
		Unconditioned Space	--	3.0" and smaller	0.75"

				4.0" and larger	1.0"
		Exterior	J2	3.0" and smaller	0.75"
				4.0" and larger	1.0"
		Equipment Rooms: below 7.0ft above floor	J1	3.0" and smaller	0.75"
				4.0" and larger	1.0"
Cooling Coil Condensate Drain Branch Lines	P2	Interior Concealed	--	3.0" and smaller	0.5"
				4.0" and larger	0.75"
Cooling Coil Condensate Drain Main Lines		Interior Exposed	J1	3.0" and smaller	0.5"
				4.0" and larger	0.75"
Sewer/Storm Drain Lines Carrying Cooling Coil Condensate		Unconditioned Space	--	3.0" and smaller	0.5"
				4.0" and larger	0.75"
		Exterior	J2	3.0" and smaller	0.5"
HOT PIPING					
Heating Water	P1	Interior Concealed	--	3.0" and smaller	1.0"
				4.0" and larger	1.5"
		Interior Exposed	J1	3.0" and smaller	1.5"
				4.0" and larger	2.0"
		Unconditioned Space	--	3.0" and smaller	1.5"

				4.0" and larger	2.0"
		Exterior	J2	3.0" and smaller	1.5"
				4.0" and larger	2.0"
		Equipment Rooms below 7.0ft above floor	J1	3.0" and smaller	1.5"
				4.0" and larger	2.0"
Refrigerant Hot Gas	P2	Interior Concealed	--	3.0" and smaller	0.75"
				4.0" and larger	1.0"
		Interior Exposed		3.0" and smaller	0.75"
				4.0" and larger	1.0"
		Unconditioned Space	--	3.0" and smaller	0.75"
				4.0" and larger	1.0"
		Exterior	J2	3.0" and smaller	0.75"
				4.0" and larger	1.0"
		Equipment Rooms below 7.0ft above floor		3.0" and smaller	0.75"
				4.0" and larger	1.0"

END OF SECTION 23 0086

SECTION 23 0090 - SUPPORTS, HANGERS AND ANCHORS

PART 1 GENERAL

1.01. WORK INCLUDED

A. Inserts, Anchors, and Upper Attachments

B. Pipe Hangers, Rods, Supports, and Accessories

C. Fabricated Steel Support

1.02. QUALITY ASSURANCE

A. Design of pipe supporting elements shall be in accordance with ANSI B31.1

B. Fabrication and installation of pipe hangers and supports shall be in accordance with the following Manufacturers Standardization Society (MSS) Standards:

1. SP-58 Pipe Hangers and Supports: Materials, Design and Manufacture.

2. SP-69 Pipe Hangers and Supports: Selection and Application.

3. SP-89 Pipe Hangers and Supports: Fabrication and Installation Practices.

C. Steel angles, channels and plate shall be in accordance with ASTM A36, red primed or hot dipped galvanized for interior applications and hot galvanized for exterior applications.

D. Bolts, including nuts and washers, used for fabricating steel members shall be in accordance with ASTM A325 and shall be stainless steel or plated for corrosion protection. Plain steel components are unacceptable.

E. Welding of steel members shall be in accordance with AWS D1.1.

F. Steel supports for ducts, pipe anchors, pipe guides, and piping supported from below shall be fabricated in accordance with AISC Specification for the Design, Fabrication and Erection of Structural Steel for buildings. If required, the Contractor shall include the cost of the services of a structural engineer to design or review the system.

1.03. APPLICABLE PUBLICATIONS

A. Applicable sections of the publications listed below form a part of this Section. The publications are referenced by the basic designation only.

1. American Institute of Steel Construction (AISC)

2. American National Standards Institute (ANSI)

3. American Society for Testing and Materials (ASTM)

4. American Welding Society (AWS)

5. The Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS)

6. National Fire Protection Agency (NFPA)

7. Sheet Metal and Air Conditioning Contractor's National Association, Inc. (SMACNA)

1.04. SUBMITTALS

A. Submit schedule indicating type of hanger to be used by system and pipe size. Include rod size for each hanger size.

B. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.

C. Provide shop drawings for fabricated steel supports.

PART 2 PRODUCTS

2.01. ACCEPTABLE MANUFACTURERS

A. Inserts, Anchors, and Upper Attachments:

1. Anvil International, Inc.
2. Carpenter Paterson, Inc.
3. Cooper B-Line, Inc.
4. Elecen Metal Products
5. Hilti
6. Unistrut
7. ITW Red Head

B. Pipe Hangers, Rods, Supports and Accessories:

1. Anvil International, Inc.
2. Carpenter Paterson, Inc.
3. Cooper B-Line, Inc.
4. Elcen Metal Products
5. Hilti
6. Unistrut

C. Fabricated Steel Support: As indicated on Drawings.

2.02. DESIGN REQUIREMENTS

A. Supports capable of supporting the pipe for all service and testing conditions. Provide 4-to-1 safety factor.

B. Allow free expansion and contraction of the piping to prevent excessive stress resulting from service and testing conditions or from weight transferred from the piping or attached equipment.

C. Design supports and hangers to allow for proper pitch of pipes.

D. For chemical and waste piping, design, materials of construction, and installation of pipe hangers, supports, guides, restraints, and anchors:

1. ASME B31.3.
2. MSS SP-58 and MSS SP-69.

3. Except where modified by this Specification.

E. For steam and hot and cold water piping, design, materials of construction and installation pipe hangers, supports, guides, restraints and anchors:

1. ASME B31.1

2. MSS SP-58 and MSS SP-69.

F. Check all physical clearances between piping, support system, and structure. Provide for vertical adjustment after erection.

G. Support vertical pipe runs in pipe chases at base of riser. Support pipes for lateral movement with clamps or brackets.

H. Place hangers on outside of pipe insulation. Use a pipe covering protection saddle for insulated pipe at support point.

I. Fabricated Steel Supports: As detailed on the drawings.

2.03. INSERTS AND ANCHORS

A. Inserts: MSS Type 18; malleable iron body and nut, galvanized finish, opening in top of insert for reinforcing rod, lateral adjustable.

B. Anchors: Steel shell and expander plug, snap off end fastener

2.04. HORIZONTAL PIPING HANGERS AND SUPPORTS

A. Select size of hangers and supports to exactly fit pipe size for bare piping, and around piping insulation with saddle or shield for insulated piping.

B. For suspension of non-insulated or insulated stationary pipe lines: Adjustable steel clevices, MSS Type I.

C. For suspension of non-insulated stationary pipe lines: Adjustable band hangers, MSS Type 7 or 9; or split pipe rings, MSS Type II.

D. For support of piping where horizontal movement due to expansion and contraction may occur, and where a low coefficient of friction is desired: Pipe slides and slide plates, MSS Type 35, including guided plate mounted on a concrete pedestal or structural steel support.

E. For support from floor stanchion, using floor flange to secure stanchion to floor: Adjustable pipe stanchion saddles, MSS Type 37 or 38, including steel pipe base support and cast-iron floor flange.

F. For suspension of pipe from two (2) rods where longitudinal movement due to expansion and contraction may occur: Adjustable roller hangers, MSS Type 43.

G. For suspension of pipe from a single rod where horizontal movement due to expansion and contraction may occur: Adjustable roller hangers, MSS Type 43.

H. For support of pipe from a single rod where vertical adjustment is not necessary: Pipe roll stands, MSS Type 45.

I. For support of pipe where small horizontal movement due to expansion and contraction may occur, but vertical adjustment is not necessary: Pipe rolls and plates, MSS Type 45.

J. For support of pipe lines where vertical and lateral adjustment during installation may be required in addition to provision for expansion and contraction: Adjustment pipe rolls stands, MSS Type 46.

2.05. VERTICAL PIPING CLAMPS

A. Select size of vertical piping clamps to exactly fit size of bare pipe.

B. For support and steadying of pipe risers: Two-bolt riser clamps, MSS Type 8 or 42.

2.06. HANGER ROD ATTACHMENTS

A. Select size of hanger rod attachments to suit hanger rods.

B. For adjustment up to six (6) inches for heavy loads: Steel turnbuckles, MSS Type 13.

C. For use on high temperature piping installations: Steel clevices, MSS Type 14.

D. For use with split pipe rings, MSS Type II: Swivel turnbuckles, MSS Type15.

E. For attaching hanger rod to various types of building attachments: Malleable iron sockets, MSS Type 16 or 17.

F. Rods:

1. Size 3/8" and up: All thread steel rod electro galvanized. Sizing for pipe or equipment support as follows:

Copper Tube, Plastic	Steel, Cast Iron		
Pipe Size (Copper, Plastic)	Pipe Size (Steel, Cast Iron)	Rod Size	Max. Equip. Load
1/4" to 2"	1/4" to 2"	3/8"	730 lbs.
2-1/2" to 4"	2-1/2" to 3"	1/2"	1,350 lbs.
6"	4"	5/8"	2,160 lbs.
8" to 12"	6"	3/4"	3,230 lbs.
14"	8" to 12"	7/8"	4,480 lbs.
16"	14" to 16"	1"	5,900 lbs.
18" to 20"	18" to 20"	1-1/4"	9,500 lbs.
22" to 42"	22" to 42"	1-1/2"	13,800 lbs.

2. Rods may be reduced one size for double rod hangers with 3/8" minimum diameter, or when other paragraphs require a minimum of 2 hangers per section, provided the minimum diameter of 3/8" is maintained.

G. For upper attachment for suspending pipe hangers from concrete: Concrete inserts MSS Type 18.

H. For attachment to top flange of structural shape: Top beam C-clamps, MSS Type 19.

I. For attachment to bottom flange of structural shape: Side beam or channel clamps, MSS Type 20 or 27.

J. For attachment to center of bottom flange of beams: Center beam clamps, MSS Type 21.

K. For attachment to bottom of beams where heavy loads are encountered and hanger rod sizes are large: Welded attachments, MSS Type 22.

L. For attachment to structural shapes: C-clamps, MSS Type 23.

M. For attachment to top of beams when hanger rod is required tangent to edge of flange: Top I-beams clamps, MSS Type 25.

N. For attachment to bottom of steel I-beams for heavy loads: Steel I-beam/WF-beam clamps with eye nut, MSS Type 28 or 29.

O. Steel brackets, for indicated loading:

1. Light duty, 750 pounds, MSS Type 31.

2. Medium duty, 1,500 pounds, MSS Type 32.

3. Heavy duty, 3,000 pounds, MSS Type 33.

P. For use on sides of steel beams: Side beam brackets, MSS Type 34.

2.07. SPRING HANGERS AND SUPPORTS

A. Select spring hangers and supports to suit pipe size and loading.

B. For control of piping movement: Restraint control devices, MSS Type 47.

C. For light loads where vertical movement does not exceed 1-1/4 inch: Springs cushion hangers, MSS Type 48.

D. For equipping Type 41 roll hanger with springs: Spring cushion roll hangers, MSS Type 49.

E. For retardation of sway or thermal expansion in piping systems: Spring way braces, MSS Type 50.

F. For absorbing expansion and contraction of piping system from hanger: Variable spring hangers, MSS Type 51; preset to indicated load and limit variability factor to 25%.

G. For absorbing expansion and contraction of piping system from base support: Variable spring base supports, MSS Type 52; preset to indicated load and limit variability factor to 25%; include flange.

H. For absorbing expansion and contraction of piping system from trapeze support: Variable spring trapeze hangers, MSS Type 53; preset to indicated load and limit variability factor to 25%.

I. Constant supports: Provide one of the following types, selected to suit piping system. Include auxiliary stops for erection and hydrostatic test, and field load-adjustment capability.

1. Horizontal Type: MSS Type 54.

2. Vertical Type: MSS Type 55.

3. Trapeze Type: MSS Type 56.

2.08. SUPPLEMENTARY SUPPORTS

A. Where support spacing is more frequent than distance between structural members, provide

steel angles, channels or beams sized to provide a deflection of less than 1/240 of span when fully loaded, to transfer pipe support loads to structural members.

B. Where deflection of center of trapeze support exceeds 1/240 of distance between hanger rods, provide additional hanger rods.

C. Where multiple risers are supported within shafts, provide steel angles, channels or beams, sized to provide a deflection of less than 1/240 of span when fully loaded, to transfer loads to the concrete floor slab. Anchor supplemental supports to the slab, and provide resilient element where required by other Sections of this Division.

2.09. ACCESSORIES

A. Protective Shields, MSS Type 40: Carbon steel, galvanized minimum of 12" length sized for required insulation.

B. Protective Saddles, MSS Type 39: Carbon steel plate, minimum of 12" length, sized for required insulation.

C. Steel Turnbuckle, MSS Type 13: Forges steel, galvanized finish with locknuts. Rated at a minimum of 730 lbs. at 3/8" size.

D. Steel Clevis, MSS Type 14: Forged steel, galvanized finish with steel pin and cotter pin. Rated for a minimum of 730 lbs. at 3/8" size.

E. Weldless Eye Nut, MSS Type 17: Forges steel, galvanized finish. Rated for a minimum of 730 lbs. at 3/8" size.

2.10. PIPE INSULATION HANGER SHIELDS

A. Where hangers are placed outside the jackets of pipe insulation, provide shields equal to "Thermal Hanger Shields" as manufactured by Pipe Shields, Inc. or equivalent by Elcen Metal Products Company.

B. Shields shall consist of a 360-degree insert of high-density, 100 psi, waterproof calcium silicate, encased in a 360-degree galvanized sheet steel shield. Insert shall be same thickness as adjoining pipe insulation, and shall extend 1 inch beyond sheet metal shield in each direction on cold lines. Shield lengths and minimum sheet metal gauges shall be as directed below:

PIPE SIZE	SHIELD LENGTH	MINIMUM GAUGE
1/2" to 1-1/2"	4"	26
2" to 6"	6"	20
8" to 10"	9"	16
12" to 18"	12"	16
20" & Larger	18"	16

C. Shields shall be Model CS-CW, except for pipe roller applications: then provide Model CSX-CW.

D. At the Contractor's option, shop-fabricated galvanized metal shields may be provided based on approved shop drawings. Length and gauge of sheet metal shall be as specified above.

E. For all insulated piping 4” and larger, provide insulation insert at a minimum of 12” long. Insert

shall extend a minimum of one inch beyond shield. Insulation inserts shall be minimum 12” long section of foam glass insulation.

2.11. METAL FRAMING: Provide products compliant with NEMA ML-1.

2.12. STEEL PLATES, SHAPES AND BARS: Provide products compliant with ANSI/ASTM A-36.

2.13. PIPE GUIDES: Provide factory-fabricated guides, of cast semi-steel or heavy fabricated steel, consisting of a bolted two-section outer cylinder and base, with a two-section guiding spider bolted tight to pipe or as shown on Drawings. Size guides and spiders to clear pipe, cylinder and insulation, if any. Provide guides of length recommended by manufacturer to allow indicated travel.

PART 3 EXECUTION

3.01. GENERAL REQUIREMENTS

A. Where applicable, install in accordance with the manufacturer's written installation instructions.

B. Where supports are in contact with copper pipe, provide copper plated support.

C. Where supports are in contact with glass, aluminum or brass pipe, provide plastic coating on supports.

D. Interior hangers, supports, including attachments, that are plain steel shall be primed and painted.

E. Hangers and supports, including attachments, exposed to weather or located in utility tunnels or accessible utility trenches or subject to spillage shall be hot dip galvanized after fabrication.

F. Fabricated steel supports exposed to weather or located in utility tunnels and accessible utility trenches or subject to spillage shall be primed and painted. Cut, welded, drilled or otherwise damaged surfaces of coating shall be repaired.

3.02. PREPARATION

A. Proceed with installation of hangers, supports and anchors only after required building structural work has been completed in areas where the work is to be installed. Correct inadequacies including but not limited to proper placement of inserts, anchors and other building structural attachments.

3.03. INSTALLATION OF HANGERS AND SUPPORTS

A. Install hangers, supports, clamps and attachments to support piping properly from building structure in compliance with MSS SP-69. Arrange for grouping of parallel runs of horizontal piping to be supported together in trapeze-type hangers where possible. Install supports with maximum spacing as specified in this Section. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for small diameter pipe. Do no use wire or perforated metal to support piping, and do not support piping from other piping.

B. Install hangers and supports complete with necessary bolts, rods, nuts, washers, and other accessories. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of same type and style as installed for adjacent similar piping.

C. Support fire protection water piping independently of other piping

D. The location of hangers and supports shall be coordinated with the structural work to ensure that the structural members will support the intended load.

E. Provide hex head nut on rod at top and bottom of clevis hanger yoke, and at each rod connection to intermediate und upper attachment. Rod nuts shall be securely locked in place.

F. Hanger rods shall be subject to tensile loading only. Where lateral or axial movement is anticipated, use suitable linkage in hanger rod to permit swing.

G. Hangers shall be fabricated to permit adequate adjustment after erection while still supporting the load. Turnbuckles shall be provided where required for vertical adjustment of the piping.

H. Supports for vertical piping shall be located at each floor or at intervals of not more than 15 feet and at intervals of not more than 8 feet from end of risers. Where supports are provided on intermediate floors spaced 15 feet or less between floors, no additional supports are required other than those specified for end of risers.

I. A hanger or support shall be provided adjacent to each piece of equipment to ensure that none of the pipe weight is supported from the equipment.

J. Provide protective shields on all piping required to be insulated.

K. Provide protective saddles sized to match insulation thickness on all hot piping required to be insulated. Fill void between saddle and pipe with insulation as specified.

L. Provide turnbuckles on all hangers that require leveling or aligning.

M. Provide steel clevis where detailed and/or required.

N. Provide weldless eye nuts on hanger terminations where disassembly or swing may be required. Use in combination with steel clevis.

O. Supports

1. Provide additional supports at:

    a. Changes in direction.

    b. Branch piping and runouts over 5 feet.

    c. Concentrated loads due to valves, strainers and similar items.

    d. At valves 4 inches and larger in horizontal piping.

    e. Support piping on each side of valve.

    f. Brace hubless piping to prevent horizontal and vertical movement.

    g. Where number of grooved couplings exceeds 3 between supports or provide continuous steel between supports.

2. Sanitary waste and vent, roof drains per UPC Section 316: Vertical supports are not required within 2.5 feet of wall penetrations for pipes 8 inches in diameter and smaller, and not more than 3 feet for 10 inches and larger.

3. Other piping support spacing shall be as scheduled on Drawing or as required by referenced standard.

3.04. HANGER SPACING

A. The maximum spacing between pipe supports for straight runs shall be in accordance with the following chart. If any deviation from the table exists within the manufacturer's written installation instruction, whichever spacing reflecting the smaller centerline to centerline dimension shall be used.

MAXIMUM HORIZONTAL PIPE HANGER AND SUPPORT SPACING TABLE

1. Steel Pipe (Schedule 40 & 80):
   Up to 1" ..... 7 ft. on center
   1-1/4" and greater ..... 10 ft. on center

2. Copper Pipe (Types L, K and M):
   Up to 1" size: ..... 5 ft. on center
   1-1/4" to 2-1/2" ..... 7 ft. on center
   3" and larger..... 10 ft. on center

3. Ductile Iron and Cast Iron: Two hangers per section length.

4. Polyvinyl Chloride (PVC):
   Up to 1-1/2" ..... 3 ft. on center
   2" to 4" ..... 4 ft. on center
   5" to 8" ..... 5 ft. on center
   10" and larger..... 6 ft. on center

5. Sprinkler and Standpipe: Pipe hangers to be as per NFPA-13 and NFPA-14 standards.

B. Hanger centerline spacing shall be reduced by 50% in areas of concentrated valves and/or fittings, also no more than a maximum distance of 12 inches from valves, fittings and/or couplings, or 24 inches from a change in direction.

3.05. ATTACHMENT TO STRUCTURE

A. For plain steel devices, prime and paint.

B. Adjust attachment location for proper alignment and no more than 4 degrees offset from a perpendicular alignment.

C. If proper alignment cannot be achieved from the existing building structure, provide a trapeze type support sized to handle the design load with a minimum safety factor of 5.

3.06. INSERTS

A. Contractor shall have inserts at site and dimensional location drawings ready at the beginning of the involved concrete work.

B. Install inserts by securing to concrete forms and inserting reinforcing rod through the opening provided in the insert in accordance with shop drawings.

C. Provide necessary supervision while concrete is being poured to correct any misalignment caused by the concrete.

3.07. INSTALLATION OF ANCHORS

A. Install anchors at proper locations to prevent stresses from exceeding those permitted by ANSI B-31, and to prevent transfer of loading and stresses to connected equipment.

B. Fabricate and install anchor by welding steel shapes, plates and bards to piping and to structure. Comply with ANSI B-31, with AWS standards, and with the Details shown on the drawings.

C. Where expansion compensators are indicated, install anchors in accordance with expansion unit manufacturer's written instructions to limit movement of piping and forces to maximums recommended by manufacturer for each unit.

D. Anchor Spacing: Where not otherwise indicated, install anchors at ends of principal pipe runs and at intermediate points in pipe runs between expansion loops and bends. Make provisions for preset of anchors as required, accommodating both expansion and contraction of piping.

E. Size anchor shell length to assure a minimum of 1" solid concrete remaining from shell and to concrete face.

3.08. INSTALLATION OF TRAPEZES OR PIPE RACKS

A. Light/Medium Duty: Assemble from standard manufactured metal framing systems, in accordance with manufacturer's recommendations.

B. Heavy Duty: Fabricate from structural steel shapes selected for loads required. Weld steel in accordance with AWS standards.

3.09. AUXILIARY STEEL

A. Furnish all miscellaneous structural members necessary to hang or support ductwork, piping, and mechanical equipment.

B. Notify Engineer of any adjustment necessary in main structural system for proper support of major equipment.

C. Fabricated Steel Supports: Steel for supports shall be saw cut, with sharp edges ground smooth. After fabrication, remove all foreign material, including welding slag and spatter, and leave ready for painting.

END OF SECTION

SECTION 23100 - VIBRATION ISOLATION AND SEISMIC RESTRAINT FOR MECHANICAL COMPONENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

The work under this section is subject to the requirements of the Contract Documents, including General and Supplementary Conditions and Division 01 General Requirements.

Specifications throughout all Divisions are directly applicable to this Section, and this Section is directly applicable to them. In the event that this section conflicts with the requirements of other Sections, the more stringent criteria shall apply.

1.2 DESCRIPTION

This section includes requirements for vibration isolation and seismic restraint of nonstructural components in Risk Category I, II, III, & IV structures, including, but not limited to:

1. Mechanical Components: heating, ventilating, and air-conditioning systems; hot/chilled water systems; boiler equipment and components; tanks and vessels, etc.

Work in this section includes the restraint design and/or equipment/product certifications to be submitted for review by the registered design professional.

1.3 DEFINITIONS

Active Equipment: Equipment with dynamic moving or rotating parts or parts that are energized.

Attachments / Anchorage: Means by which nonstructural components or supports for nonstructural components are secured or connected to the seismic-force resisting system of the structure. Such attachments may include anchor bolts, welded connections, mechanical fasteners or other approved attachment devices. Friction attachments do not constitute positive attachments.

Bracing: Struts, braces, cables, anchors or other structural elements providing restraint for nonstructural components to prevent excessive movement.

Certificate of Compliance: A certificate, supplied by the component manufacturer, stating that materials and products meet specified standards and project specific requirements.

Component Importance Factor (I_p): Factor applied to a component that defines the criticality of that component. This factor can be 1.0 or 1.5 in accordance with ASCE 7, Section 13.1.3.

Consequential Damage: Failure of an essential component caused by the failure of a separate essential or non-essential component due to the functional and physical interrelationship of the components, their supports, and their effect on each other.

Designated Seismic System: Those nonstructural components that require design in accordance with Chapter 13 of ASCE 7, for which the Component Importance Factor (Ip) is 1.5 in accordance with Section 13.1.3 of ASCE 7.

Special Seismic Certification: A certificate of compliance, supplied by the manufacturer of Active Designated Seismic Systems, which certifies that the equipment will remain operable during the design seismic event. Components with hazardous contents shall be certified as maintaining containment following the design seismic event.

Structure: The load-bearing building elements designed by the Structural Engineer of Record. Non-load bearing partition walls, unreinforced slabs or other building elements that do not provide direct load transfer to the load-bearing building elements shall not be defined as part of the Structure and cannot be used for attachment of seismic restraints.

Supports: Those members, assemblies of members, or manufactured elements, including braces, frames, legs, snubbers, curbs, rails, hangers, saddles or struts, and associated fasteners that transmit loads between non-structural components and their attachments to the structure.

1.4 REGULATORY REQUIREMENTS

Comply with the 2021 International Building Code (IBC) and applicable local adopted amendments, and the 2016 Edition on ASCE 7 (ASCE 7-16).

1.5 DESIGN PERFORMANCE CRITERIA

Provide seismic restraint of components to withstand seismic forces and displacements without displacing or overturning. Design of seismic restraint shall be performed in accordance with the 2021 International Building Code and ASCE 7, as follows.

1. Seismic forces shall be determined in accordance with Chapter 13 of ASCE 7. The seismic design parameters shall be as noted in the project Structural drawing. The assigned Component Importance Factors (Ip) for each component, shall be as noted on the project drawings and/or specifications.

2. For components installed on the exterior of the building, wind forces shall be determined in accordance with Chapter 29 of ASCE 7-16, except that the uplift forces per Equation 29.5-3 shall be considered regardless of the building height. Reference the Structural drawings for wind design criteria.

3. In addition to seismic and wind loads, consideration shall be given to other loads, including but not limited to dead, live, snow, etc., as applicable. All restraint design shall be based on the "worst case" combination of the applicable loads as prescribed by the referenced code and standards.

4. Consideration shall also be given to thermal stresses and expansion. Where thermal expansion applies, seismic restraint design shall be in accordance with the requirements of ASME B31.1 in addition to ASCE 7.

1.6 SUBMITTALS

Submit under the provisions of Division 1. Submittals shall include Product Data, Shop Drawings and the required Certificates of Compliance as described below.

Shop drawings shall be prepared and sealed by a professional engineer licensed in the state of the project, with a minimum of 5 years of experience in the design of vibration isolation and seismic restraint.

Vibration Isolation: submit the following, at a minimum, as applicable.

1. Detailed schedules of equipment requiring isolation, including clearly identified equipment identification or tag and equipment weight, and corresponding isolator type, manufacturer and model number.

2. Detailed drawings showing equipment, isolator bases and isolator spacing.

3. Descriptive data or cut sheets for each type of isolation mounting, including:

    a. Dimensional data

    b. Materials and finish

    c. Rated loads

    d. Rated deflection

    e. Isolator free and operating heights

    f. Detailed installations instructions

Seismic Restraint: submit the following, at a minimum, as applicable.

4. Catalog cut or data sheets on specific restraints detailing compliance with the project drawings and specifications.

5. Detailed schedules of components, showing seismic restraints by referencing numbered descriptive drawings.

6. Description, layout and location of items to be restrained with anchorage or brace points noted and dimensioned.

7. Details of anchorage or bracing at large scale with all members, parts brackets shown, together with all connections, fasteners, bolts, welds etc. clearly identified and specified.

8. Numerical value of design seismic restraint loads, or controlling loads if different than load combinations with seismic, with all supporting calculations.

9. Detailed installation instructions for seismic restraints.

10. Acceptable attachment methods of seismic restraints to structural members.

11. Fabrication details for equipment bases including dimensions, structural member sizes and support point locations.

12. Details for housekeeping pads for base-mounted equipment, including reinforcing and doweling requirements to the building structure.

13. Documentation verifying seismic prequalification for anchors in concrete per ACI 318 Appendix D.

14. Additional information as required to substantiate adequate design and installation of seismic restraints.

15. Manufacturer's Seismic Certificate of Compliance: Each manufacturer of a Designated Seismic System (with a Component Importance Factor, Ip = 1.5) shall submit a ***Certificate of Compliance*** for review and acceptance by the design professional in responsible charge and the authority having jurisdiction, prior to installation.

PART 2 - PRODUCTS

2.1 GENERAL

All materials and devices shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

Refer to the "Selection Guide" table in Section 4 to correlate the specification references listed below with the appropriate components.

2.2 MANUFACTURERS

Isolators and seismic restraints shall be from the following manufacturers, or approved equals. Unless otherwise noted, the isolators and seismic restraint systems listed in the following sections are as manufactured by Gripple and California Dynamics.

1. Gripple
2. California Dynamics
3. The VMC Group
4. Mason Industries
5. Kinetics Noise Control
6. Cooper B-Line
7. CADDY
8. Hilti
9. Twin City Hose

10. Imperial Metals

2.3 EQUIPMENT BASES

Specification B-1 (Integral Structural Steel Base): Vibration isolation manufacturer shall furnish integral structural steel bases. Rectangular bases are preferred for all equipment. Pump bases for split case pumps shall be large enough to support suction and discharge elbows. All perimeter members shall be steel beams with a minimum depth equal to 1/10 of the longest dimension of the base. Height saving brackets shall be employed in all mounting locations to provide a base clearance of 1". Bases shall be type XW as manufactured by California Dynamics Corporation or approved equal.

Specification B-2 (Wide Flange Structural Steel Base): Vibration isolation manufacturer shall furnish integral structural steel bases. Rectangular bases are preferred for all equipment. Pump bases for split case pumps shall be large enough to support suction and discharge elbows. All perimeter members shall be steel beams with a minimum depth equal to 1/10 of the longest dimension of the base. Height saving brackets shall be employed in all mounting locations to provide a base clearance of 1". Bases shall be type XW as manufactured by California Dynamics Corporation or approved equal.

Specification B-3 (Concrete Inertia Base): Rectangular steel concrete pouring forms for floating concrete frames. Bases shall be a minimum of 1/12 of the longest dimension of the base but not less than 6". The base depth need not exceed 12" unless specifically recommended by the base manufacturer for mass or rigidity. Forms shall include minimum concrete reinforcing consisting of 1/2" bars welded in place on 12" centers running both ways in a layer 1 1/2" above the bottom. Height saving brackets shall be employed in all mounting locations to maintain a 1" clearance below the base. Base shall be type CW as manufactured by California Dynamics Corporation or approved equal

Specification B-4 (Non-Isolated Curbs): Non isolated seismically rated rooftop curb system that is flashed into roofing membrane. Air and watertight curb shall have a neoprene sponge seal at the top and be rigid enough to provide continuous perimeter support for rooftop unit. Curb must provide means to positively anchored to concrete deck, or bolted or welded directly to structural steel to withstand seismic loading. Curb shall provide a means by which contractor supplied insulation may be installed for thermal insulation and acoustic attenuation. Curbs shall accommodate roof pitch shown on drawings. **Curb shall use minimum 18 gage galvanized steel and shall be designed with crossbracing required to withstand the greater of calculated seismic forces and /or wind loading per local building code**. Design must be certified by registered professional engineer.

Specification B-5 (Isolated Curbs): Seismically rated rooftop isolation curb system that is flashed into roofing membrane. Standard unit curb will not be used. Air and watertight upper curb shall have a neoprene sponge seal at the top and be rigid enough to provide continuous perimeter support for rooftop unit. The upper curb shall be supported by Spec SV-1 isolators welded or bolted to concrete deck to the structure to withstand seismic loading. An EPDM nylon reinforced air tight weatherproof seal shall consolidate the upper and lower curbs. The lower curb shall be weatherproof and provide a base that the roofing system may be flashed to. Weatherproof access panel shall be provided at each isolator to allow isolator adjustment. Isolation curb shall provide a means by which contractor supplied insulation may be installed for thermal insulation and acoustic attenuation. Curbs shall accommodate roof pitch shown on drawings**. Isolation curb shall be designed to withstand the greater of calculated seismic forces and / or wind loading per local building code**. Design must be certified by registered professional engineer.

Specification B-6 (Non-Isolated Rails): Non isolated seismically rated rooftop rail system that provides equipment support in one roof flashed assembly with all features as described for Non-Isolated Curbs.

Specification B-7 (Isolated Rails): Vibration isolation manufacturer shall provide steel members welded to height saving brackets to cradle equipment having legs or bases that do not require a complete supplementary base. Members shall have sufficient rigidity to prevent misalignment of equipment. Structural steel rails shall be type, WW as manufactured by California Dynamics Corporation or approved equal.

2.4 VIBRATION ISOLATION

Specification V-1 (Pad Type Elastomer Isolator): A pad type mounting consisting of two layers of ribbed elastomeric pads with a 1" sandwich pad in between. Where the equipment foot is less than 80 percent of the surface of the pad a load distribution plate must be added to the top of the pad. Pads shall be VT as manufactured by California Dynamics Corporation or approved equal.

Specification V-2 (Neoprene Mounting): Elastomeric mounts single or double-deflection type, oil-resistant rubber or Neoprene isolator element with factory-drilled, bonded in place top plate for bolting to equipment and factory drilled base plate for bolting to structure. Color-coded or otherwise identify to indicate capacity range. Mount shall be type RM/RMD as manufactured by California Dynamics Corporation or approved equal.

Specification V-3 (Spring Isolator, Free Standing): Spring isolators shall be free standing and laterally stable without any housing and complete with a Neoprene acoustical pad between the base plate and the spring support. All mountings shall have load transfer bolts that must be rigidly bolted to the equipment. Installed and operating heights shall be equal. The ratio of the spring diameter divided by the compressed spring height shall be no less than 0.8. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. Mountings shall be type SSL/K, as manufactured by California Dynamics Corporation or approved equal.

Specification V-4 (Elastomer Hanger Isolator): Hanger shall consist of a rigid steel frame and up to ½"deflection of a molded Neoprene element projecting thru the steel box so that no metal-to-metal contact occurs. Hanger shall be type RH/RHD as manufactured by California Dynamics Corporation or approved equal.

Specification V-5 (Spring Hanger Isolator): Hanger shall consist of a rigid steel frame containing a steel spring with a Neoprene sleeve to prevent steel to steel contact. Hanger shall be type CH as manufactured by California Dynamics Corporation or approved equal

Specification V-6 (Combination Spring/Elastomer Hanger Isolator): Hangers shall consist of rigid steel frames containing double deflection Neoprene element at the top and a steel spring and a Neoprene sleeve on bottom to position spring and prevent steel to steel contact. Spring diameters and hanger box lower hole sizes shall be large enough to permit the hanger rod to swing through a 30º arc from side to side. Hangers shall be type HH30 as manufactured by California Dynamics Corporation or approved equal.

2.5 VIBRATION ISOLATION WITH SEISMIC RESTRAINT

Specification SV-1 (Seismically Restrained Spring Isolator): Restrained spring isolators shall be free standing, laterally stable, springs with seismic restraints. A steel housing with cushioned lateral and vertical limit stops to restrict spring extension due to wind loads, or when weight is removed. The housing shall be Zinc plated. A clearance of ¼" maximum shall be maintained around restraining bolts and between the housing and the spring so as not to interfere with the spring action. Limit stops shall be out of contact during normal operation. Outside spring diameter not less than 80 percent of the compressed height of the spring at rated load. Minimum additional travel 50 percent of the required deflection at rated load. Isolator/Restraint shall be CQA as manufactured by California Dynamics Corporation or approved equal. This product is an OSHPD/ DSA approved product. Product tested for IBS.

Specification SV-2 (Seismically Restrained Spring Isolator): Restrained spring isolators shall be free standing, laterally stable, springs with seismic restraints. A welded housing with cushioned lateral and vertical limit stops to restrict spring extension due to wind loads, or when weight is removed. A clearance of ¼" maximum shall be maintained around restraining bolts and between the housing and the spring so as not to interfere with the spring action. Limit stops shall be out of contact during normal operation. Outside spring diameter not less than 80 percent of the compressed height of the spring at rated load. Minimum additional travel 50 percent of the required deflection at rated load. Isolator/Restraint shall be DLK as manufactured by California Dynamics Corporation or approved equal.

Specification SV-3 (Neoprene Mounting with Seismic Snubber) JQTQN Restrained Neoprene isolators shall be free standing, with a rated static defection of .5". A steel housing with cushioned lateral and vertical limit stops to restrict extension due to wind loads, or when weight is removed. The housing shall be hot-dipped galvanized or zinc plated. Hot-Dipped zinc coating shall be not less than 2 ounces per square foot complying with ASTM A123. A clearance of ¼ "maximum shall be maintained around restraining bolts and between the housing and the Neoprene so as not to interfere with the isolator action. Limit stops shall be out of contact during normal operation. Isolator/Restraint shall be JQTQN as manufactured by California Dynamics Corporation.

2.6 SEISMIC RESTRAINTS

Specification S-1 (Seismic Snubbers): All directional seismic restraints shall consist of interlocking steel members. Neoprene shall have a minimum thickness of ¼". Incorporate a minimum air gap of 1/8", and a maximum air gap of ¼" in the design, before contact is made between the rigid and resilient surfaces. Provide removable end plate to allow inspection of internal clearances. Restraints shall be type RL-A/ RL-C as manufactured by California Dynamics Corporation.

Specification S-2 (Seismic Cable Restraints): A restraint assembly for suspended equipment, piping or ductwork consisting of high strength galvanized steel aircraft cable. Cable Restraints shall be listed with any one of following evaluation agencies with certified break strength and shall be color-coded or include a tag for easy field verification.

1. IAPMO-UES

2. ICC-ES

3. OSHPD

4. Underwriters Laboratories (UL)

Secure cable to structure and braced component through bracket or stake eye specifically designed to meet or exceed cable restraint rated capacity. Cable must be manufactured to meet or exceed minimum materials and standard requirements per ASTM A1023 or EN-12385 or other approved equivalent. Cables shall be installed to prevent excessive seismic motion and so arranged that they do not engage during normal operation. Restraint shall be Gripple Inc. GS series.

Specification S-3 (Rigid Brace Restraints): A restraint assembly for suspended equipment, piping or ductwork consisting of steel angles or channels. Rigid braces and connecting elements shall be sized for the applied seismic loads. Connecting elements shall be steel assemblies that swivel to the final installation angle and utilize two anchor bolts to provide proper attachment. Restraint shall be CADDY Strut Seismic Hinge.

2.7 FLEXIBLE PIPE CONNECTIONS

Specification F-1 (Water Service Flexible Connection):

1. For flanged connections – A double sphere arch rubber expansion joint constructed of molded reinforced neoprene with integral steel floating flanges, and designed to be suitable for pressures up to 225 PSI (4 to 1 safety factor) and temperatures up to 225 degrees F. Connectors shall have minimum movement capabilities of 1.77" compression, 1.18" lateral and 1.18" extension. Connectors shall provide a minimum 35 degree angular movement up to 6", minimum 30 degree up to 12" and minimum 20 degree up to 24". Spring loaded control units shall be furnished to limit movement to within allowables. Flex connector shall be Twin City Hose Type MS2.

2. For threaded type – A double spherical rubber hose connector, minimum 8" long, constructed of molded neoprene, nylon cord reinforced, with female pipe unions each end. Connectors shall have a minimum movement capability of 7/8" compression, 7/8" lateral, ¼" extension and 20 degree angular through 1-1/4", 13 degree through 2", and 9 degree through 3". Connectors shall be suitable for a maximum working pressure (4 to 1 safety factor) of 150 psi and 225 degree F. Connectors shall have cable control units to limit extension to ¼". Flex connector shall be Twin City Hose Type MSFU.

Specification F-2 (Steam and Condensate Service):

3. For flanged connection – A metal hose connector constructed of stainless-steel hose and braid with carbon steel plate flanges. Live lengths shall conform to hose minimum length to absorb thermal and dynamic movement. Hose axis must be perpendicular to pipe movement. Flex connector shall be Twin City Hose Type TCHS-FLG.

4. For threaded connections – A metal hose connector constructed of stainless-steel hose and braid with carbon steel NPT threaded end fittings. Flex connector shall be Twin City Hose Type TCHS-MMT.

PART 3 - EXECUTION

3.1 EXAMINATION

All areas that will receive components requiring vibration isolation and seismic restraint shall be thoroughly examined for deficiencies that will affect the installation or performance of the installed devices. Such deficiencies shall be corrected prior to the installation.

3.2 INSTALLATION, GENERAL

Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.

All installation shall be in accordance with the requirements set forth in the project drawings and specifications, as well as the manufacturer's published instructions and all approved submittal data.

Do not anchor components to gypsum wallboard, plaster or other wall or ceiling finish that has not been engineered to resist imposed loads.

3.3 SEISMIC RELATIVE DISPLACEMENTS

Provide joints with sufficient flexibility capable of accommodating seismic relative displacements as follows.

1. Vertical ductwork, piping, etc. that pass between floors of the building,

2. Components that pass through a building seismic or expansion joint,

3. Rigidly supported components that connect to other components.

3.4 POST-INSTALLED ANCHORS:

Install all anchors in accordance with the manufacturer's written instructions for seismic applications.

Post-installed anchors in concrete shall be seismically prequalified for use in cracked concrete based on seismic testing in accordance with ACI 355.2 for mechanical anchors or ACI 355.4 for adhesive anchors.

3.5 HOUSEKEEPING PADS

Housekeeping pads shall be designed by the seismic restraint vendor with adequate reinforcing and doweling to the building structure, so as to withstand calculated seismic or wind forces. Frictional resistance due to the effects of gravity shall be neglected.

The size & thickness of the housekeeping pad shall be determined to ensure adequate edge distances & embedment depths in order to obtain the desired equipment anchor capacities.

1. If cast-in-place anchors are used, the housekeeping pads shall be sized to accommodate the ACI requirements for bolt coverage and embedment.

2. If post-installed anchors are used, the minimum edge distances, embedment depths and concrete/masonry member thicknesses specified by the anchor manufacturer shall be maintained.

3.6 MECHANICAL COMPONENTS

Floor and base-mounted components, vibration isolated equipment and associated system vibration and seismic controls for connections.

1. Design equipment anchorage to resist seismic design force in any direction.

2. Design vibration and seismic controls for equipment to include base and isolator requirements.

3. Provide flexible connections between equipment and interconnected piping to account for seismic relative displacements.

4. Where equipment is mounted on vibration isolators, use isolators designed for amplified code forces per ASCE 7 and with demonstrated ability to resist required forces including gravity, operational and seismic forces.

5. Provide supplemental steel or concrete base as required for mounting equipment on isolators. Where equipment is not designed to be point loaded, provide base capable of transferring gravity and seismic demands from equipment to isolator base plate anchorage.

6. Where concrete floor thickness is less than required for expansion anchor installation per ICC-ESR, install through bolt in lieu of expansion anchor. Where timber/wood floor or other substrate is inadequate for installation of lag bolts, screws or other mechanical fasteners, furnish and install supplemental framing or blocking to transfer loads to structural elements.

7. Housekeeping pads shall be coordinated with the seismic restraint vendor based on the equipment anchorage specified in the seismic design.

Suspended mechanical equipment

8. Design support and bracing to resist seismic design force in any direction.

9. Provide flexible connections between equipment and interconnected piping to account for seismic relative displacements.

10. Brace equipment hung from spring mounts using cable or other bracing that will not transmit vibration to the structure.

Wall-mounted mechanical equipment

11. Design attachments to resist seismic design force in any direction.

12. Install backing plates or blocking as required to deliver load to primary wall framing members. Do not anchor to gypsum wallboard, plaster or other wall finish that has not been engineered to resist imposed loads.

Piping

13. Provide supports, braces and anchors to resist gravity and seismic design forces.

14. Design piping and piping risers to accommodate interstory drift. Provide flexible connections wherever relative differential movements could damage pipe in an earthquake.

15. Brace every run (5’ or more in length) with two transverse and one longitudinal bracing locations. For pipes and connections constructed of ductile materials (copper, ductile iron, steel or aluminum and brazed, welded or screwed connections) provide transverse bracing at not more than 40 feet on center and longitudinal bracing at spacing not more than 80 feet on center. For pipes and their connections constructed of nonductile materials (cast iron, no-hub pipe and plastic or non-UL listed grooved coupling pipe), provide transverse bracing at not more than 20 feet on center and longitudinal bracing at spacing not more than 40 feet on center.

16. Provide lateral restraint for risers at not more than 30 feet on center or as required for horizontal runs, whichever is less.

17. Where piping is explicitly exempt from seismic bracing requirements,

    a. Install piping such that swinging of the pipes will not cause damaging impact with adjacent components. This will be considered satisfied if there is horizontal clear distance of at least 2/3 the hanger length between subject components.

    b. Provide flexible connections between piping and connected equipment, including in-line devices such as VAV boxes and reheat coils.

Ductwork

18. Provide supports, braces and anchors to resist gravity and seismic design forces.

19. Design ducts and duct risers to accommodate interstory drift. Provide flexible connections wherever relative differential movement could damage duct in an earthquake

20. Provide independent support and bracing for all in-line devices weighing more than 75 pounds.

3.7 QUALITY CONTROL

Do not install vibration isolators or seismic restraints until submittals have been reviewed and approved by the registered design professional in responsible charge.

Verify that multiple systems installed in the same vicinity can be installed without conflict.

Verify tolerances between installed items to confirm that unbraced components will not come into contact with restrained equipment or structural members during an earthquake. When contact is possible, provide seismic restraint or provide justification to the satisfaction of the registered design professional in responsible charge of the project that contact will not cause unacceptable damage to the components in contact, their supports, finishes or other elements that are contacted.

Coordinate with the Structural Engineer of Record for confirming that the structure is capable of supporting the loads imposed by nonstructural components.

No work shall be concealed by the Contractor prior to the required inspections being performed and all discrepancies resolved. The Contractor shall be responsible for all repairs required to uncover uninspected or unapproved work.

Where Special Inspections are required per Sections 1704 and 1705 of the 2015 International Building Code, the owner shall engage a qualified agency to perform the required inspections for components listed in the project-specific Statement of Special Inspections.

PART 4 - EQUIPMENT ISOLATION AND SEISMIC RESTRAINT SCHEDULE

MECHANICAL EQUIPMENT

EQUIPMENT TAG	**Ip (Note 7)**	**ISOLATION SPEC.**	**ISOLATION DEFL.**	**SEISMIC REST. SPEC. (NOTE 1)**
PACKAGED RTU > 5 TONS	1.0	SPEC B-5	2”	SPEC B-5
PACKAGED RTU ≤ 5 TONS	1.0	N/A	N/A	SPEC B-4
GAS PACKAGED RTU > 5 TONS	1.5	SPEC B-5	2”	SPEC B-5
GAS PACKAGED RTU ≤ 5 TONS	1.5	N/A	N/A	SPEC B-4
SUSPENDED GAS FURNACE	1.5	V-6	1.5”	SPEC S-2
AIR HANDLING UNITS	1.0	INTERNAL	2”	NOTE 2

EQUIPMENT TAG	Ip (Note 7)	ISOLATION SPEC.	ISOLATION DEFL.	SEISMIC REST. SPEC. (NOTE 1)
(FLOOR)		BY MANUF.		
AIR HANDLING UNITS (SUSP)	1.0	SPEC V-6 SPEC F-1	1.5”	SPEC S-2
VAV (NON-FAN) TERM. < 20 LB.	1.0	NONE	N/A	NONE
VAV (NON-FAN) TERM. ≥ 20 LB.	1.0	NONE	N/A	SPEC S-2
FAN VAV TERMINAL	1.0	SPEC V-4	.5”	SPEC S-2
INLINE FANS	1.0	SPEC V-6	1.5”	SPEC S-2
CEILING FANS ≥ 20 LB.	1.0	SPEC V-4	.5”	SPEC S-2
CEILING FANS < 20 LB.	1.0	NONE	N/A	NONE
CEILING DIFFUSERS ≥ 20 LB.	1.0	NONE	N/A	(2) 12 GA WIRES TO STRUCTURE, NOTE 3
WALL MOUNT FANS	1.0	NONE	N/A	NOTE 2
UTILITY SETS (FLOOR)	1.0	SPEC SV-2	1”	SPEC SV-2
UTILITY SETS (SUSP.)	1.0	SPEC V-6	1.5”	SPEC S-2
ROOF EXHAUST FANS	1.0	NONE	N/A	SPEC B-3
CHILLERS (ON GRADE)	1.0	SPEC V-1 SPEC F-1	.15”	NOTE 2
CHILLERS (ROOF OR UPPER FLOORS)	1.0	SPEC SV-1 SPEC F-1	2.0”	SPEC SV-1
BOILERS (ON GRADE)	1.5	SPEC V-1	.15”	NOTE 2
BOILERS (UPPER FLOORS)	1.5	SPEC SV-1	1”	SPEC SV-1
PUMPS (ON GRADE) < 7.5 HP	1.0	NONE SPEC F-1	.15”	NOTE 2
PUMPS (ON GRADE) ≥ 7.5 HP	1.0	SPEC B-3 & SV-2 SPEC F-1	1”	SPEC SV-2
PUMPS (UPPER FLOORS)	1.0	SPEC B-3 & SV-2 SPEC F-1	2”	SPEC SV-2

EQUIPMENT TAG	Ip (Note 7)	ISOLATION SPEC.	ISOLATION DEFL.	SEISMIC REST. SPEC. (NOTE 1)
INLINE PUMPS < 5 HP	1.0	NONE	N/A	SPEC S-2
INLINE PUMPS ≥ 5 HP	1.0	SPEC V-6	1.5”	SPEC S-2
AIR SEPARATORS & EXP. TANKS	1.0	NONE	N/A	NOTE 2
COOLING TOWERS (ON GRADE)	1.0	SPEC B-2 & V-1	.15”	NOTE 2
COOLING TOWERS (ROOF)	1.0	SPEC B-2 & SV-1	2.0”	SPEC SV-1
GAS PIPING	1.5	NOTE 6	N/A	SPEC S-2
GAS UNIT HEATERS (SUSP)	1.5	NONE	N/A	SPEC S-2
UNIT HEATERS (SUSP)	1.0	NONE	N/A	SPEC S-2
CABINET HEATERS (SUSP)	1.0	SPEC V-4	.5”	SPEC S-2
FAN COILS	1.0	SPEC V-6	1.5”	SPEC S-2
KITCHEN HOODS	1.5	NONE	N/A	SPEC S-2
WATER SOURCE HEAT PUMP (SUSP.)	1.0	SPEC V-6	1.5”	SPEC S-2
WATER SOURCE HEAT PUMP (FLOOR)	1.0	SPEC SV-2	1”	SPEC SV-2
STEAM TO WATER HEAT EXCHANGER	1.5	NONE	N/A	NOTE 2
WATER TO WATER HEAT EXCHANGER	1.0	NONE	N/A	NOTE 2
EXPANSION TANK	1.0	NONE	N/A	NOTE 2
AIR SEPARATOR	1.0	NONE	N/A	NOTE 2
FLASH TANK	1.5	NONE	N/A	NOTE 2
CHILLED WATER PIPING	1.0	NOTE 6	N/A	SPEC S-2
HOT WATER PIPING	1.0	NOTE 6	N/A	SPEC S-2
STEAM PIPING	1.5	NOTE 6	N/A	NOTE 4
STEAM CONDENSATE PIPING	1.5	NOTE 6	N/A	NOTE 4
DUCT	1.0	NOTE 6	N/A	SPEC S-2
DUCT USED FOR SMOKE	1.5	NOTE 6	N/A	SPEC S-2

EQUIPMENT TAG	Ip (Note 7)	ISOLATION SPEC.	ISOLATION DEFL.	SEISMIC REST. SPEC. (NOTE 1)
CONTROL				

NOTES

1. Provide seismic restraint per table or as directed by seismic engineer stamped drawings.
2. Anchor bolts for non-isolated and internally isolated equipment shall be sized by the seismic engineer. If required, Spec. S-1 snubbers or Spec. S-2 cable kits shall be provided.
3. Diffusers weighing less than 20 lbs. must be mechanically attached to ceiling grid, but require no additional restraint.
4. Anchors and guides to be designed to accommodate thermal expansion and seismic loads.
5. Roof curbs provided by others must be certified by a professional engineer for the required seismic loads.
6. Provide Type V-6 isolator for the first three hangers from all equipment specified with spring isolation.
7. All components in a Risk Category IV building are assigned a Component Importance Factor I_p equal to 1.5.

END OF SECTION

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SECTION 23 0160 - MECHANICAL SYSTEMS INSULATION

PART 1 GENERAL

1.01 Provide required insulation for HVAC ductwork and plumbing piping.

1.02 All ductwork and piping is insulated unless otherwise noted.

1.03 SUBMITTTALS

A. Submit product data for each system. Product data shall include but not be limited to the following:

1. Manufacturer's name

2. Insulation material and thickness

3. Jacket

4. Adhesives

5. Fastening methods

6. Fitting materials

7. Manufacturer's data sheets indicating density, thermal characteristics, temperature ratings

8. Insulation installation details (manufacturer's installation instructions/details, Contractor's installation details, MICA plates where applicable)

9. Other appropriate data

1.04 QUALITY ASSURANCE

A. All ductwork and piping requiring insulation shall be insulated as specified herein and as required for a complete system. In each case, the insulation shall be equivalent to that specified and materials applied and finished as described in these Specifications.

B. All insulation, jacket, adhesives, mastics, sealers, etc., utilized in the fabrication of these systems shall meet NFPA for fire resistant ratings (maximum of 25 flame spread and 50 smoke developed ratings) and shall be approved by the insulation manufacturer for guaranteed performances when incorporated into their insulation system, unless a specific product is specified for a specific application and is stated as an exception to this requirement. Certificates to this effect shall be submitted along with Contractor's submittal data for this Section of the Specifications. No material may be used that, when tested by the ASTM E84-89 test method, is found to melt, drip or delaminate to such a degree that the continuity of the flame front is destroyed, thereby resulting in an artificially low flame spread rating.

C. Application Company Qualifications: Company performing the Work of this Section must have a minimum of three (3) years' experience specializing in the trade.

D. All insulation shall be applied by mechanics skilled in this particular Work and regularly engaged in such occupation.

E. All insulation shall be applied in strict accordance with these Specifications and with adequate factory-printed recommendations on items not herein mentioned. Unsightly, inadequate, damaged or water-soaked Work will not be acceptable.

PART 2 PRODUCTS

2.01 GENERAL

A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

2.02 HVAC PIPING:

A. Condensate Drain (Above Ground): Armstrong's "Armaflex AP" pipe insulation, 1/2" thick.

B. Refrigerant

1. Insulate with “Armaflex AP" pipe insulation, 1/2" thick for the following:

a. All Suction Lines.

b. Mixed Phase lines for ductless split systems.

c. Suction and Liquid lines for dedicated 100% outside air split systems.

2.03 MANUFACTURERS

A. CertainTeed Corporation.

B. Johns Manville Corporation.

C. Knauf Corporation.

D. Owens-Corning.

E. Unifrax 1 LLC (FyreWrap).

F. Armacell

2.04 INSULATION MATERIALS

A. Type D1: Flexible glass fiber; ASTM C553 and ASTM C1290; commercial grade; 'k' value of 0.25 at 75 degrees F; 1.5 lb/cu ft minimum density; 0.002 inch foil scrim kraft facing for air ducts.

B. Type D2: Rigid glass fiber; ASTM C612, Class 1; 'k' value of 0.23 at 75 degrees F; 3.0 lb/cu ft minimum density; 0.002 inch foil scrim kraft facing for air ducts.

C. Type D3: Ductliner (to be used in return air sound boots only), flexible glass fiber; ASTM C1071; Type II, 'k' value of 0.23 at 75 degrees F; 3.0 lb/cu ft minimum density; coating air side for maximum 4,000 feet per minute air velocity. The airstream surface must be protected with a durable acrylic surface coating specifically formulated to:

1. Be no more corrosive than sterile cotton when tested in accordance with the test method for corrosiveness in ASTM C665.

2. Absorb no more than 3 percent by weight when tested in accordance with the test method for moisture vapor sorption in ASTM C1104.

3. Not support the growth of fungus or bacteria, when tested in accordance with the test method for fungi resistance in ASTM C1071, ASTM C1338, ASTM G21, and ASTM G22.

4. Show no signs of warpage, cracking, delaminating, flaming, smoking, glowing, or any other visibly negative changes when tested in accordance with the test method for temperature resistance in ASTM C411.

5. Have a flame spread rating of 25 or less and a smoke developed rating of 50 or less when tested in accordance with the test method for surface burning in ASTM E 84.

6. Meet the sound absorption requirements when tested in accordance with the test method for sound absorption in ASTM C423.

7. Show no evidence of continued erosion, cracking, flaking, peeling, or delamination when tested in accordance with the test method for erosion resistance in UL181.

D. Type D4: Fire Rated Grease Duct Insulation (High Temperature Flexible Blanket); 1-1/2-inch thick refractory grade fibrous fire barrier material with minimum service temperature design of 2,000 degrees F; aluminum foil laminated on both sides; with a minimum 'k' value of 0.25 and a minimum density of 6 lbs/cu ft; containing no asbestos. Listed by a nationally recognized testing laboratory (NRTL) UL to meet ASTM E 2336, ASTM E119, and with flame spread/smoke minimum rating of 25 / 50 when tested as per ASTM E84/UL 723.

E. Type D5: Outdoor Duct Insulation (Closed Cell Flexible Elastomeric Insulation); 1 inch thick material that has a service temperature range from –60 degrees F to 180 degrees F. This outdoor duct insulation meets ASTM C 177 or C 518 and shall have minimum 'k' value of 0.27 Btu-in. / hr-ft2- degrees F at minimum density measurement of 3 lb/cu ft. The insulation and outside surface must be protected with a white Thermo Plastic Rubber Membrane formulated to:

1. Be resistant to UV, and ozone, acid rain, and physical elements produced from outdoor weather per ASTM E 96 Procedure A.

2. Have aflame spread rating of 25 or less and a smoke developed rating of 50 or less when tested in accordance with the test method for surface burning in ASTM E 84.

3. Show no evidence of continued erosion, delaminating, cracking, flaking, or peeling when tested in accordance with the test method for erosion resistance in UL181. Be resistant to

mold growth resistance, ASTM G 21/C 1338 resistant to fungi, and resistant to bacteria growth per ASTM G 22.

F. Type D6: Ductliner (to be used in return air sound boots only), flexible glass fiber; ASTM C1071; Type II, 'k' value of 0.23 at 75 degrees F; 3.0 lb/cu ft minimum density; coating air side for maximum 4,000 feet per minute air velocity. The airstream surface must be protected with a durable polyacrylate copolymer emulsion specifically formulated to:

1. Not support the growth of fungus or bacteria, when tested in accordance with the test method for fungi resistance in ASTM D 5590 with "0" growth rating.

2. Act as a fungicidal protective coating: water based, VOC < 50 g/l. Fungicidal coating must be EPA registered for use in HVAC duct systems. Manufacturer: H.B. Fuller Construction Products Inc., Foster 40-20 (white) or 40-30 (black) Fungicidal Protective Coating or approved equal. Coatings may also be used to repair damage to duct liner insulation.

G. High Density Duct Insulation Insert, see Type D2.

2.05 INSULATION ACCESSORIES

A. Adhesives: Waterproof vapor barrier type, meeting requirements of ASTM C916; Childers CP-82 or Foster 85-20/85-60.

B. Weather Barrier: Breather Mastic: Childers CP-10/CP-11 or Foster 46-50 White.

C. Vapor Barrier Coating: Permeance - ASTM E 96, Procedure B, 0.08 perm or less at 45-mil dry film thickness, tested at 100F and 50%RH; Foster 30-65 or Childers CP-34

1. When higher humidity levels may be of concern, only specify the following fungus/mold resistant coating: Foster 30-80 AF (anti-fungal). Coating must meet ASTM D 5590 with 0 growth rating**

D. Reinforcing Mesh: 10x10 or 9x8 glass mesh; Foster Mast a Fab or Childers #10

E. Jacket: Pre-sized glass cloth, minimum 7.8 oz/sq yd.

F. Type D4 Insulation Adhesive: Fire resistive to ASTM E84, Childers CP-82 or Foster 85-20.

G. Impale Anchors: Galvanized steel, 12 gage self-adhesive pad.

H. Joint Tape: Glass fiber cloth, open mesh.

I. Tie Wire and Wire Mesh: Annealed steel, 16 gage.

J. Stainless Steel Banding: 3/4-inch wide, minimum 22 gage, 304 stainless.

K. Armaflex 520, 520 BLV, or Foster 85-75 contact adhesive.

L. Armatuff 25 white seal seam tape.

PART 3 EXECUTION

3.01 GENERAL

A. The application of all insulation shall be performed by experienced mechanics, regularly employed in the trade, in a neat and workmanlike manner. Unless otherwise specified to a greater quality, the application of all insulation shall be in accordance with the manufacturer's recommendations.

B. Omit insulation from the following items:

1. Exposed plated plumbing pipe.

2. Vents to atmosphere, discharge from safety and relief valves, overflow pipes, and hot only drain pipes.

3. Valves, unions, flanges, traps, strainers, and devices in HOT ONLY piping.

C. Foil-Faced (FF) Duct Insulation shall comply with NFPA Standards 90A and 90B.

D. All exposed ends of pipe insulation shall be pointed up neatly with appropriate insulating cement, or use pre-molded PVC end caps on cold only piping and preformed aluminum end caps on dual-temp, hot or steam piping.

E. Provide high density insert at duct hangers. Maintain vapor barrier between insulation and duct hanger. Do not insulate duct hangers or supports.

3.02 DUCT AND PIPE PREPARATION

A. Verify that piping and ductwork has been tested before applying insulation materials.

B. Verify that surfaces are clean, foreign material removed, and dry.

C. Maintain required ambient temperature during and after installation for a minimum period of 24 hours.

3.03 ARMAFLEX PIPE INSULATION

A. Apply in strict accordance with latest edition of Armstrong's "Installation Instructions to the Contractor". Joints and seams shall be sealed moisture tight without gaps and openings in the insulation

3.04 INSTALLATION

A. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.

B. All installation shall be in accordance with manufacturer’s published recommendations.

C. Extend duct insulation without interruption through walls, floors, and similar penetrations, except where otherwise indicated.

D. Provide external insulation on all round ductwork connectors to ceiling diffusers and on top of diffusers as indicated in the Ductwork Insulation Application and Thickness Schedule and the Drawings. Secure insulation to the top of ceiling diffusers with UL181B-FX listed polypropylene duct tape Do not insulate top of ceiling diffuser if it is used in ceiling return air plenum or in an open space with no ceiling.

E. Flexible and Rigid fiberglass insulation (Types D1 and D2) application for exterior of duct:

1. Secure flexible insulation jacket joints with vapor barrier adhesive, tape. Tape shall be UL181B-FX listed polypropylene duct tape.

2. Install without sag on underside of ductwork. Use 4-inch wide strips of adhesive on 8-inch centers and mechanical fasteners where necessary to prevent sagging. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.

3. Insulate standing seams and stiffeners that protrude through the insulation with 1-1/2 inch thick, unfaced, flexible blanket insulation. Cover with reinforcing mesh and coat with vapor barrier finish coating.

4. On circumferential joints, the 2-inch flange on the facing shall be secured with 9/16 inch outward clinch steel staples on 2-inch centers, and taped with minimum 3-inch wide strip of glass fabric and finish coating.

5. Vapor seal all seams, joints, pin penetrations and other breaks with vapor barrier coating reinforced with reinforcing mesh.

F. Duct Liner (Type D3 or D6) application for interior of return air sound boots or return air plenums:

1. Secure insulation with 100 percent coverage of duct liner adhesive, pins and clips not more than 18 inches on center.

2. Secure bottom of duct insulation using alternate single and double clips. The first pin will secure the insulation and the second clip will be used to secure the cladding. Isolate the exterior clip from the cladding by using two 1/8 inch closed cell neoprene (Armaflex) washers on either side of the cladding. Predrill holes in cladding and avoid contact with pin during installation.

3. For round duct, secure insulation with 100 percent coverage of duct liner adhesive. Secure cladding with 3/4 inch, 0.020 inch stainless steel bands on 12-inch centers.

4. For joints and overlaps, fold cladding to form a double thickness hem 2 inches minimum. Seal with a non-shrink, non-hardening sealing compound.

5. Type D6: Provide fungicidal coating in air handlers ten feet on either side, first ten feet downstream of cooling coils, ten feet downstream of mix boxes, in mechanical rooms or as otherwise specified in potentially high humidity areas in the duct system shall be coated with an fungicidal coating; EPA registered for use in HVAC duct systems at a coverage rate of 80 ft2/gallon.

G. Insulation (Type D4) application for exterior of grease ducts:

1. External duct wrap system requires two (2) 1.5-inch layers of lightweight, flexible wrap overlapped to provide an effective fire barrier. The barrier is installed in 24-inch or 48-inch wide sections. Insulation pins are welded in certain locations to maintain the fire barrier material up against the duct.

2. Grease duct doors to be installed so the door can be removed and re installed and meet code requirements.

3. Install duct wrap as tested per manufacturer's instructions to assure the duct wrap is mechanically attached per the manufacturer's spacing of bands or weld pins.

4. Vertical and horizontal members of the support hanger system shall be wrapped with one layer of the insulation. Vertical and horizontal portions shall be wrapped independent of one another. The horizontal hanger shall be removed from the vertical support rods and wrapped and then immediately replaced so that an adjacent horizontal support can be removed, wrapped, and reinstalled. The end of the threaded vertical rod shall extend 6-inch past the horizontal member at the beginning of the installation.

5. Penetrations: Where ducts penetrate fire rated walls, floors and roofs, the duct wrap shall be used in conjunction with a firestop system that is listed by a nationally recognized laboratory and rated for penetration of a rated wall or floor by the fire rated grease duct system used.

H. Insulation (Type D5) application for outdoor ducts:

1. Horizontal ductwork located outdoors shall be sloped at a minimum 2-degree angle to prevent the accumulation of water on top of the finished insulated duct. Support members that connect directly to the ductwork are to be insulated with this same material. Keep compression or sharp creases of outdoor insulation to a minimum by distributing the weight of the duct resting on horizontal duct support members.

2. Follow the insulation manufacturer's installation instructions and procedures to assure the ductwork is properly insulated and that the insulation will meet the manufacturer's warranty requirements.

I. All ductwork, accessories, and all plenums including metal and masonry construction, etc., shall be insulated as indicated on the Drawings, as specified herein and as required for a complete system. In each case, the insulation shall be equal to that specified and materials applied and finished as described in these Specifications.

J. Flexible ductwork connections to equipment shall not be insulated.

K. Where vapor barriers are required, the vapor barrier shall be on the outside. Extreme care shall be taken that the vapor barrier is unbroken. Joints, etc., shall all be sealed. Where insulation with a vapor barrier terminates, it shall be sealed off with the vapor barrier being continuous to the surface being insulated. Ends shall not be left raw.

L. Extreme care shall be taken in insulating high and medium pressure ductwork including all ductwork between the fan discharge and all mixing boxes to ensure the duct is not pierced with

sheet metal screws or other fasteners. All high and medium pressure ducts in these Specifications are classified as high velocity ductwork.

M. Where canvas finish is specified use lagging adhesive/coating to prevent mildew in securing canvas. Do not use wheat paste. Use only anti-fungal lagging adhesive that adheres to ASTM D 5590 with 0 growth rating. (Foster 30-36AF, Childers CP-137AF). In addition, cover all exterior canvas-covered insulation with a fire retardant weather barrier mastic.

N. All supply ductwork in the Project shall be insulated; all exhaust and fume hood exhaust ductwork shall not be insulated, unless used for energy recovery purposes or noted on drawings.

O. Flexible round ducts shall be factory insulated.

3.05 INSPECTION

A. Visually inspect the completed insulation installation per manufacturers recommended materials, procedures and repair or replace any improperly sealed joints.

B. Where there is evidence of vapor barrier failure or “wet” insulation after installation, the damaged insulation shall be removed, duct surface shall be cleaned and dried and new insulation shall be installed.

3.06 DUCTWORK INSULATION APPLICATION AND THICKNESS SCHEDULE

Ductwork System	Application	Insulation Type	Insulation Thickness
Supply Air (Hot, Cold, Combination)	At air handler, exposed, and/or otherwise noted internally-lined ducts	D3	1"
	Concealed branches	D1	2"
Return Air, Relief Air, and Exhaust Air	All	D1	1"
Outside Air	Treated and Untreated	D1	2"
Kitchen Grease Hood Exhaust Air	All	D4	3"
Duct mounted coils	Inside of Mechanical Rooms	D2	2”
Terminal Unit Heating Coils	All	D1	2”
Supply Air Diffusers	Top of Diffuser	D1	2"
Supply Air Duct	Outdoor Environment	D5	2”
Return, Exhaust Air Duct	Outdoor Environment	D5	1-1/2"
Return Air Sound Boots/Elbows/Return Air Plenums	All	D6	1"

END OF SECTION 23 0160

SECTION 15184 - REFRIGERANT PIPING

PART 1 - GENERAL

1.01 Do not vent refrigerants to the atmosphere. Install new systems using recovering methods. Evacuate and recover existing systems to be modified or removed.

1.02 Submit piping materials, fittings, and refrigeration accessories.

PART 2 - PRODUCTS

2.01 REFRIGERANT PIPING:

A. Pipe: Type "K" copper, soft-drawn. Soft-drawn may be used where bending is required on 1-3/8" O.D. and smaller. All other shall be Type "L" Copper, hard-drawn, marked "ACR".

B. Fittings: Wrought copper or forged brass for refrigerant use.

PART 3 - EXECUTION

3.01 REFRIGERANT PIPING:

A. To be installed by machine mechanics skilled in this type work, and in accordance with recognized industry standards.

B. Make joints with "Sil-Fos" backed with nitrogen.

C. Piping and specialties to be sized and installed as recommended by the manufacturer of refrigerant piping.

D. Pre-charged lines may be used with approval of Engineer. These lines shall be installed as recommended by the unit manufacturer. Check and adjust charge after installation.

E. Isolate piping from building structure to prevent transmitting equipment vibration.

F. Installation:

1. Minimum Requirements: Protect refrigerant system during construction against entrance of foreign matter, dirt and moisture; have open ends of piping and connections to compressors, condensers, evaporators and other equipment tightly capped until assembly. Pass nitrogen gas through the pipe or tubing to prevent oxidation as each joint is brazed. Cap the system with a reusable plug after each brazing operation to retain the nitrogen and prevent entrance of air and moisture.

2. Testing:

a. General: Every refrigerant containing part of every system that is erected on the premises, except compressors, condensers, evaporators, safety devices, pressure gages, control mechanisms and systems that are factory tested, shall be tested and proved tight after complete installation, and before operation. The high and low side of each system shall be tested and proved tight at not less than the lower of the design pressure or the setting of the

pressure-relief device protecting the high or low side of the system, respectively.

b. Test Medium: Oxygen, or any combustible gas, or combustible mixture of gases shall not be used within the system for testing. The means used to build up the test pressure shall have either a pressure-limiting device or a pressure-relief device, and a gage on the outlet side. Set the pressure-relief device above the test pressure but low enough to prevent permanent deformation of the system components.

c. System Test and Charging: Recommended by the equipment manufacturer or as follows:

1) Connect source or refrigerant to charging connection and introduce enough refrigerant into system to raise the pressure to 10 psig. Close valves and disconnect refrigerant drum. Test system for leaks with halide test torch or other approved method suitable for the test gas used. Repair all leaking joints and retest.

2) Connect a source of dry nitrogen to charging valve and bring test pressure to design pressure for low side and for high side. Refer to Table For Test Pressures. Test entire system again for leaks.

3) Evacuate the entire refrigerant system by the triplicate evacuation method with a vacuum pump equipped with an electronic gage reading in microns. Pull the system down to 100 microns and hold for four hours then break the vacuum with dry nitrogen (or refrigerant). Repeat the evacuation two more times breaking the third vacuum with the refrigeration to be charged and charge with the proper volume of refrigerant.

END OF SECTION

SECTION 23 0710 - HVAC SHEET METAL

PART 1 - GENERAL

1.01 SCOPE:

A. All low pressure duct work including supply, exhaust, and outside air to complete the systems as shown on the Drawings or specified herein.

1.02 SUBMITTALS:

A. Submit the following:

1. Air distribution devices.
2. Life safety dampers and doors.
3. Flexible duct.
4. Flexible connections.
5. Access doors and duct access doors.
6. Turning vanes.
7. Duct take-off, fittings.
8. Roof outside air intake.
9. Duct sealants.
10. Duct leak tests.

1.03 GOVERNING PUBLICATIONS AND AUTHORITIES:

A. ASHRAE "Guide".

B. SMACNA "Low Velocity Duct Construction Standards".

C. Underwriters' Laboratories, Inc.

D. NFPA Pamphlets No. 90A, 90B, 91 and 96.

PART 2 - PRODUCTS

2.01 DUCT MATERIALS:

A. Galvanized steel sheets shall be lock-forming quality (LFQ), shall have a galvanized 690 zinc coating of 1-1/4 oz. total for both sides of one square foot, and the gauge of galvanized steel sheets shall be as prescribed by the latest edition of SMACNA for pressure classification of ductwork.

B. Aluminum sheets shall be made from an aluminum base alloy having not more than 0.5% copper (for corrosion resistance), a minimum tensile strength of 16,000 psi and the ability to satisfactorily make a Pittsburgh lock seam without splitting.

2.02 FLEXIBLE CONNECTIONS:

A. Flexible connections shall be made on duct connections of air moving equipment greater than 2000 CFM or as required for equipment installation.

B. Connections shall be made of 30 ounce woven glass fabric; fire-, water-, and weather-resistant fabric equal to “Ventfab”, double coated with neoprene "Ventglas", or equal. Canvas connections to give no less than 3" clear break between metals jointed. Insulate with 1" minimum fiberglass duct wrap with a vapor barrier facing of foil reinforced kraft. Seal with reinforced aluminum tape.

C. Flexible connections on exterior shall be protected from weather with sheetmetal cover which shall be coated for protection same as ductwork.

D. Connections in high pressure systems, fume hoods, and for those exposed to the weather shall be made from "Ventglas", neoprene coated glass fabric.

2.03 ACCESS DOORS:

A. Access doors to 16" by 24" size shall be "Ventlock" stamped insulated access doors.

B. Larger access doors shall be double panel construction with one inch thick 1.5 pcf density rigid insulation between panels. Doors with largest dimension over 24", but less than 48", shall use "Ventlock" series 200 latches, hinges and gasketing, and construction shall be 22 gage galvanized steel. Doors with largest dimension over 48" shall use "Ventlock" series 300 latches, hinges and gasketing, and construction shall be 20 gage galvanized steel.

C. Provide vision panels on access doors for fire dampers and control dampers.

2.04 FLEXIBLE DUCT:

A. Low Pressure: furnish and install, where indicated on the drawings, flexible metal insulated round ductwork, factory fabricated, listed under U.L. #181, Class 1 and NFPA 90A, capable of a minimum centerline bend radius equal to duct inside diameter. Insulation shall be 1-1/2" thick, 3/4 lb. density fiberglass blanket, maximum "K" value of 0.25 btu-in/hr-ft5-EF., and vapor barrier shall be neoprene coated fiberglass fabric laminated to aluminized polyester film. Flexible duct shall be rated for 10" positive and 2" negative static pressure.

B. Vinyl or non- aluminized vapor barriers will not be allowed. Maximum runouts shall not exceed length indicated on drawings in notes or details.

2.05 AIR DISTRIBUTION DEVICES:

A. General:

1. All outlet grilles shall have gaskets.

2. Furnish opposed blade volume controls on all supply outlets and return grilles.

B. Devices: Devices shall be as scheduled on the drawings.

2.06 LIFE SAFETY DAMPERS:

A. Dampers shall be equal to those manufactured by the Ruskin Corporation or Greenheck.

B. Dampers shall be U.L. listed.

C. Fire, smoke or combination fire/smoke dampers shall be provided in rated assemblies

requiring them.

D. All dampers, methods and location of installation shall comply with the requirements of the International Building Code, National Fire Protection Association and all authorities having jurisdiction. In the case of discrepancies, most stringent requirements shall dictate installation.

E. Fire and smoke dampers shall be provided with an approved means of access, large enough to permit inspection and maintenance of the damper and its operating parts. Access shall be provided on either side of damper assemblies.

F. Access shall not affect the integrity of fire-resistance-rated assemblies. The access openings shall not reduce the fire-resistance rating of the assembly.

G. Provide access door minimum 12" x 12".

H. Access points shall be permanently identified on the exterior by a label having letters not less than 0.5 inch (12.7 mm) in height reading: fire/smoke damper, smoke damper or fire damper.

I. Access doors in ducts shall be tight fitting and suitable for the required duct construction. Contractor shall install dampers in accordance with the following:

J. Fire dampers shall be constructed and tested in accordance with UL Safety Standard 555. Dampers shall have an hourly rating as indicated on the drawings, a 212°F fusible link, and shall include a UL label.

K. All outlet grilles shall have gaskets.

L. Contractor shall furnish opposed blade volume controls on all supply outlets and return grilles.

M. Dampers shall be equipped for vertical or horizontal installation as required by the location.

N. Manufacturer’s integral sleeves and frames may be used at the contractor's option.

O. Dampers shall be provided which are tested and rated for design duct velocity and pressure.

P. Dampers rating shall meet or exceed the rating of the wall in which it is housed.

Q. Contractor shall install fire or smoke or combination dampers in all rated walls as necessary to maintain the integrity of all rated walls whether indicated on the plans or not.

2.07 ACCESSORIES:

A. Manufactured Turning Vanes: Furnish and install single thickness, multiple radius, airfoil steel turning vanes. Static pressure loss for square ducts shall be no more than 20% of velocity head. Turning vanes shall be furnished with a mounting plate to facilitate installation in ductwork.

B. Manual Balancing Damper:

1. Square or Rectangular: Minimum 16 ga. body and 18 ga. blades, equal to Ruskin or Greenheck with vinyl blade seal and locking hand operator quadrant.

2. Round: Minimum 20 ga. body and 22 ga. blades, equal to Ruskin or Greenheck with locking hand operator

C. Control Dampers:

1. Control dampers shall be furnished by AHU Manufacturer or Control System.

D. All dampers shall be capable of 100% seal off.

PART 3 - EXECUTION

3.01 GENERAL:

A. All ductwork not specifically indicated on drawings or specified elsewhere to be high-pressure duct shall be fabricated, braced and erected in accordance with SMACNA "Low Velocity Duct Construction Standard" or the latest edition of ASHRAE "Guide".

B. Ductwork shall be galvanized steel unless otherwise noted.

C. Stainless steel and aluminum ductwork shall welded seam.

D. Adhere to drawings as closely as possible. However, where required to meet structural or other interferences vary the run and shape of ducts and make offsets during progress of work. Duct routes shall be established and field measurements shall be taken before duct work is fabricated. Where pipes or other items are "taken-in" to the duct, streamline collars shall be formed and placed around the item. If collar obstructs more than 20% of the cross sectional area, the duct shall be enlarged to accommodate obstruction.

E. All changes of direction and elbows shall be fitted with turning vanes. Standard radius elbows may be used if space permits.

F. Ductwork shall be free of any objectionable self-generating noise or rattles.

G. Furnish and install shop fabricated ductwork. Pre-assemble work in shop to the greatest extent possible, so as to minimize field assembly of systems. Fabricate ductwork with accessories installed during fabrication to the greatest extent possible.

H. Fabricate duct fittings to match adjoining ducts, and to comply with duct requirements as applicable to fittings. Except as otherwise indicated, fabricate elbows with center-line radius equal to associated duct width. Limit angular tapers to 30 degrees for contracting tapers and 20 degrees for expanding tapers.

I. Duct Sealing: All ductwork, regardless of system pressure classification, shall be sealed in accordance with Seal Class A, as referenced in SMACNA Standards. All transverse joints, longitudinal seams, and duct wall penetrations shall be sealed.

1. All seams and joints in shop and field fabricated ductwork shall be sealed by applying duct sealant complying with manufacturer’s recommendations. Tapes recommended by the sealant manufacturer may used in addition to sealant to achieve leakage limit requirements.

2. Sealant shall be water based latex UL 181A-M sealant with flame spread of 0 and smoke developed of 0. Sealants shall be Hard Cast Iron Grip 601, Ductmate Pro Seal, Foster 32-19, Childers CP-146 or Design Polymerics DP 1010.

3. Sealing tapes shall be from the same manufacturer as duct sealants.

4. Sealer shall be rated by the manufacturer and shall be suitable for use at the system pressure classification of applicable ductwork.

5. Except as noted, oil or solvent-based sealants are specifically prohibited.

6. For exterior applications, “Uni-Weather” (United McGill Corporation), solvent-based sealant, or Foster 32-19 shall be used.

J. Support materials shall be hot dipped galvanized steel fasteners, anchors, rods, straps, trim and angles. (Support duct with all thread rods and unistrut as equal trapeze hangers).

K. Install air flow measuring stations, furnished by Control Contractor, where indicated on the drawings.

3.02 MANUAL BALANCING DAMPERS:

A. All low pressure branch ducts on either supply, return or exhaust shall be provided by some means of balancing in addition to dampers at registers.

B. Splitter dampers shall be made of at least the same thickness material as duct (minimum thickness 22 gage). They shall be securely hinged at air leaving edge and made of 2 thicknesses so that entering edge presents a rounded surface to air flow.

C. Butterfly dampers shall be made of 16 gage galvanized steel. Butterfly dampers may be used in widths up to 10" wide. Dampers that require blades over 10" wide shall be multi-blade louver dampers.

D. Multi-blade louver dampers used for balancing shall be of the opposed blade type. Damper blades shall be constructed of 16 gage steel. Individual blade width shall not exceed 10" and blade length shall not exceed 48".

E. All dampers shall be so constructed and installed that there shall be no vibration due to air flow over damper.

F. Extend all handles and levers to outside of insulation.

3.03 ACCESS DOOR:

A. Access doors shall be provided at all dampers, equipment in duct and as indicated on drawings.

B. Access doors shall be minimum of 12" X 12" unless a larger size is required for maintenance of equipment or a smaller size must be used because of small duct size.

C. Provide access doors at all fire dampers, smoke dampers, humidifiers, and as indicated on the drawings.

3.04 FLEXIBLE CONNECTIONS:

A. Furnish and install sound isolating flexible connections on the inlet and outlet of each fan and unit to which duct connectors are made.

B. At least one inch slack shall be allowed in these connections to insure that no vibration is transmitted from fan to ductwork.

C. The fabric shall either be folded in with the metal or attached with metal collar frames at each end to prevent air leakage.

3.05 FLEXIBLE DUCT

A. Maximum runout shall not exceed lengths indicated on drawings.

B. Ducts shall be supported at intervals indicated in SMACNA and not laid on top of ceiling.

C. Minimum bend radius shall be as recommended by manufacturer.

D. Ducts shall be run straight and true with minimum offsets, and with excess duct lengths removed.

E. Connections to ducts and air devices shall be with minimum of one duct diameter straight into connection (kinked or pinched installations restricting flows are not acceptable).

F. Connections to duct and air devices shall be air tight.

3.06 TESTS:

A. Test duct systems in accordance with SMACNA latest edition of HVAC Air Duct Leakage Test Manual to achieve air tight systems not exceeding the limits outlined in the manual. Submit test results.

END OF SECTION

SECTION 23 0990 - TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.01 SUMMARY:

A. This section specifies the requirements and procedures for total mechanical systems testing, adjusting, and balancing. Requirements include measurement and establishment of the fluid quantities and temperatures of the mechanical systems as required to meet design specifications, and recording and reporting the results.

1. Test, adjust, and balance the following mechanical systems:

a. Supply air systems, all pressure ranges.

b. Return air systems.

c. Exhaust air systems.

d. Outside air systems.

e. Verify control system operation.

f. Hydronics systems.

2. Contractor shall:

a. Put heating, ventilating, and air conditioning systems and equipment into full operation and continue the operation of same during each working day of testing and balancing.

b. Allow the air balance agency to schedule this work in cooperation with other trades involved and comply with the completion date.

c. Make available to the balance agency a complete copy of submittal data on mechanical equipment including pump performance curves, fan curves, manufacturer's balancing factors and other manufacturers ratings for installed equipment.

d. Make any changes in pulleys, belts, and dampers or the addition of dampers as required for correct balance as recommended by TAB Contractor, at no additional cost to the Owner.

e. Have strainers and filters clean prior to starting of testing and balancing activity.

B. This section does not include:

1. Specifications for materials for patching mechanical systems.

2. Specifications for materials and installation of adjusting and balancing devices. If devices must be added to achieve proper adjusting and balancing, refer to the respective system sections for materials and installation requirements.

3. Requirements and procedures for piping and ductwork systems leakage tests.

1.02 DEFINITIONS:

A. Systems testing, adjusting, and balancing is the process of checking and adjusting building environmental systems to produce design objectives. It includes:

1. Balance of air distribution;

2. Adjustment of total system to provide design qualities;

3. Electrical measurement;

4. Verification of performance of equipment and automatic controls;

B. Test: To determine quantitative performance of equipment.

C. Adjust: To regulate the specified fluid flow rate and air patterns at the terminal equipment (e.g., reduce fan speed, throttle valves and dampers) to proportional flows within the distribution system (mains, branches, and terminals) according to specified design quantities.

D. Report Forms: Test data sheets arranged for collecting test data in logical order for submission and review. These data should also form the permanent record to be used as the basis for required future testing, adjusting and balancing.

E. Terminal: The point where controlled fluid enters or leaves the distribution system. These are supply inlets on water terminals, supply outlets on air terminals, return outlets on water terminals, and exhaust or return inlets on air terminals such as registers, grilles, diffusers, louvers, and hoods.

1.03 SUBMITTALS:

A. Agency Data: Submit proof that the proposed testing, adjusting, and balancing agency meets the qualifications specified below.

B. Technicians Data: Submit proof that the Test and Balance Staff assigned to supervise the procedures, and the technicians proposed to perform the procedures meet the qualifications specified below.

C. Procedures and Agenda: Submit a synopsis of the testing, adjusting, and balancing procedures and agenda proposed to be used for this project.

D. Maintenance Data: Submit maintenance and operating data that include how to test, adjust, and balance the building systems.

E. Sample Forms: Submit sample forms.

F. Certified Reports: Submit testing, adjusting, and balancing reports bearing the seal and signature of the Test and Balance Technician. The reports shall be certified proof that the systems have been tested, adjusted, and balanced in accordance with the referenced standards; are an accurate representation of how the systems have been installed; are a true representation of how the systems are operating at the completion of the testing, adjusting, and balancing procedures; and are an accurate record of all final quantities

measured, to establish normal operating values of the systems. Follow the procedures and format specified below.

G. Draft Reports: Upon completion of testing, adjusting, and balancing procedures, prepare draft reports on the approved forms. Draft reports may be hand written, but must be complete, factual, accurate, and legible. Organize and format draft reports in the same manner specified for the final reports. Submit 2 complete sets of draft reports. Only 1 complete set of draft reports will be returned.

H. Final Report: Upon verification and approval of draft reports, prepare final reports, type written, and organized and formatted as specified below. Submit 2 complete sets of final reports.

I. Report Format: Report forms shall be those standard forms prepared by the referenced standard for each respective item and system to be tested, adjusted, and balanced. Bind report forms complete with schematic systems diagrams and other data in reinforced, vinyl, three-ring binders. Provide binding edge labels with the project identification and a title descriptive of the contents. Divide contents of binder into the below listed divisions, separated by divider tabs:

1. General Information and Summary

2. Air Systems

3. Hydronic Systems

4. Temperature Control Systems

J. Report Contents: Provide the following minimum information, forms and data:

1. General Information and Summary: Inside cover sheet to identify testing, adjusting, and balancing agency, Contractor and Project. Include addresses, and contact names and telephone numbers. Also include a sheet containing the seal and name address, telephone number, and signature of the Certified Test and Balance Technician. Include in this division a listing of the instrumentations used for the procedures along with the proof of calibration.

2. The remainder of the report shall contain the appropriate forms for each respective item and system. Prepare a schematic diagram for each item of equipment and system to accompany each respective report form.

3. Air systems report shall include the following:

a. blower RPM;

b. motor full load amperes and voltages; system static pressures, suction and discharge;

c. cfm outside air (for demand controlled ventilation with CO2 sensors, provide airflow readings at 2 different CO2 levels;

d. entering air temperatures; DB/WB

e. leaving air temperatures; DB/WB

f. main supply, return, and exhaust air ducts cfm, (pitot transverse);

g. each diffuser, grille and register cfm. (Balance to within +/-10% of design requirements and pressure relationships shown on drawings.)

h. each grille, diffuser, and register shall be identified as to location and area;

i. copies of start-up logs;

j. space temperatures and humidity readings; DB/WB

k. pressure drops across coils, filters, dampers, and other equipment in ducts.

l. pressure profiles of each system.

m. sheave size, brand name, and number.

n. belt quantity, stock name, and number.

K. Calibration Reports: Submit proof that required instrumentation has been calibrated to tolerances specified in the referenced standards, within a period of 6 months prior to starting the project.

1.04 QUALITY ASSURANCE:

A. Agency Qualifications:

1. Employ the services of an independent testing, adjusting, and balancing agency meeting the qualifications specified below, to be the single source of responsibility to test, adjust, and balance the building mechanical systems identified above, to produce the design objectives. Services shall include checking installations for conformity to design, measurement and establishment of the fluid quantities of the mechanical systems as required to meet design specifications, and recording and reporting the results.

2. The independent testing, adjusting, and balancing agency shall be certified by National Environmental Balancing Bureaus (NEBB) or Associated Air Balance Council (AABC) in those testing and balancing disciplines required for this project, and having at least one Technician, certified by NEBB or AABC.

B. B. Codes and Standards:

1. NEBB: "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems".

2. AABC: "National Standards for Total System Balance".

3. ASHRAE: ASHRAE Handbook, Current Systems Volume, Chapter 37, Testing, Adjusting, and Balancing.

C. Pre-Balancing Conference: Prior to beginning testing, adjusting, and balancing procedures, schedule and conduct a conference with the Contracting Officer and

representatives of installers of the mechanical systems. The objective of the conference is final coordination and verification of system operation and readiness for testing, adjusting, and balancing.

1.05 PROJECT CONDITIONS:

A. Systems Operation: Systems shall be fully operational prior to beginning procedures.

1.06 ACCEPTANCE:
The Contracting Officer will not accept the building until the systems have been properly started, balanced, and the TAB Report is approved.

PART 2 - PRODUCTS: NOT USED
PART 3 - EXECUTION

3.01 PRELIMINARY PROCEDURES FOR AIR SYSTEM BALANCING:

Before operating the system, perform these steps:

A. Obtain design drawings and specifications and become thoroughly acquainted with design intent.

B. Obtain copies of approved shop drawings of air handling equipment, outlets (supply and return) and temperature control diagrams.

C. Compare design to installed equipment and field installations.

D. Walk the system from the system air handling equipment to terminal units to determine variations of installation from design.

E. Check filters for cleanliness.

F. Check dampers (both volume and fire) for correct and locked position, and temperature control for completeness of installation before starting fans.

G. Prepare report test sheets for both fans and outlets. Obtain manufacturer's outlet factors and recommended procedures for testing. Prepare a summation of required outlet volumes to permit a crosscheck with required fan volumes.

H. Determine best locations in main and branch ductwork for most accurate duct traverses.

I. Place outlet dampers in full open position.

J. Prepare schematic diagrams of system "as-built" ductwork and piping layouts to facilitate reporting.

K. Verify that motors and bearings have been lubricated.

L. Check fan belt tension.

M. Check fan rotation.

3.02 MEASUREMENTS:

A. A. Provide required instrumentation to obtain proper measurements, calibrated to

the tolerances specified in referenced standards. Instruments shall be properly maintained and protected against damage.

B. Provide instruments meeting the specifications of the referenced standards.

C. Use only those instruments which have the maximum field measuring accuracy and are best suited to the function being measured.

D. Apply instrument as recommended by the manufacturer.

E. Use instruments with minimum scale and maximum subdivisions and with scale ranges proper for the value being measured.

3.03 PERFORMING TESTING, ADJUSTING, AND BALANCING:

A. Perform testing and balancing procedures on each system identified, in accordance with the detailed procedures outlined in the referenced standards.

B. extent necessary to allow adequate performance of procedures.

C. Patch insulation, ductwork, and housings, using materials identical to those removed.

D. Seal ducts and piping, and test for and repair leaks.

E. Seal insulation to re-establish integrity of the vapor barrier.

F. Mark equipment settings, including damper control positions, valve indicators, fan speed control levers, and similar control and devices, to show final settings. Mark with paint or other suitable, permanent identification materials.

G. Retest, adjust, and balance systems subsequent to significant system modifications, and resubmit test results.

3.04 CONTROL SYSTEM VERIFICATION:

A. In conjunction with Control System Vendor, during the process of TAB work, manipulate control system devices as required to facilitate necessary system TAB. Provide listing of control system components and/or sequences that are not operating properly in TAB report and to Control System Vendor.

3.05 RECORD AND REPORT DATA:

A. Record data obtained during testing, adjusting, and balancing in accordance with, and on the forms recommended by referenced standards, and as approved on sample report forms.

B. Prepare report of recommendations for correcting unsatisfactory mechanical performances when system cannot be successfully balanced.

3.06 DEMONSTRATION:

A. Training:

1. Train maintenance personnel on troubleshooting procedures and testing, adjusting, and balancing procedures. Review with personnel the information

contained in Operating and Maintenance Data.

2. Schedule training through the Owner with at least 7 days' prior notice.

END OF SECTION

BLANK

SECTION 239000 - AUTOMATIC CONTROL SYSTEM

PART 1 GENERAL

1.01. WORK INCLUDED

A. Furnish a totally native BACnet-based system. Control system shall be an addition to and an extension of the existing Building Automation system that serves the existing campus.

B. System

1. Provide all necessary BACnet-compliant hardware and software to meet the system's functional specifications.

2. Prepare individual hardware layouts, interconnection drawings, and software configuration from project design data.

3. 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.

4. Design, provide, and install all equipment cabinets, panels, data communication network cables needed, and all associated hardware.

5. Provide and install all interconnecting cables between supplied cabinets, application controllers, and input/output devices.

6. Provide and install all interconnecting cables between all equipment controllers.

7. Provide complete manufacturer's specifications for all items that are supplied. Include vendor name of every item supplied.

8. Provide supervisory specialists and technicians at the job site to assist in all phases of system installation, startup, and commissioning.

9. Provide a comprehensive operator and technician training program as described herein.

10. 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.

11. All measurable points on each piece of hardware, duct, or equipment monitored by the building control system shall be made available to view, control, and trend from the user interface.

1.02. SYSTEM DESCRIPTION

A. 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, using native BACnet-compliant components. Non-BACnet-compliant or proprietary equipment or systems (including gateways) shall not be acceptable and are specifically prohibited.

B. Room sensors shall be provided with digital readout that allow the user to view room temperature, view outside air temperature, adjust the room setpoint within preset limits and set desired override time. User shall also be able to start and stop unit from the digital sensor. Include all necessary wiring and firmware such that room sensor includes field service mode

1.03. APPROVED MANUFACTURERS

A. Johnson Controls

1.04. QUALITY ASSURANCE

A. Responsibility: The supplier of the EMCS shall be responsible for inspection and Quality Assurance (QA) for all materials and workmanship furnished.

B. Component Testing: 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: The EMCS supplier shall provide all tools, testing, and calibration equipment necessary to ensure reliability and accuracy of the system.

D. The systems control contractor shall have been in business a minimum of five years and be the authorized installing contractor for the manufacturer of the BACnet components.

E. Control system shall be engineered, programmed and supported completely by representative's local office that must be within 75 miles of project site.

1.05. SUBMITTALS

A. Drawings

1. The system supplier shall submit engineered drawings, control sequence, and bill of materials for approval.

2. Drawings shall be submitted in the following standard sizes: 11" x 17" (ANSI B).

3. Eight complete sets (copies) of submittal drawings shall be provided.

4. Drawings shall be available on CD-ROM.

1.06. WARRANTY

A. Warranty shall cover all costs for parts, labor, associated travel, and expenses for a period of one year from completion of system acceptance.

B. Hardware and software personnel supporting this warranty agreement shall provide on-site or off-site service in a timely manner after failure notification to the vendor. The maximum acceptable response time to provide this service at the site shall be 24 hours Monday through Friday, 48 hours on Saturday and Sunday.

C. This warranty shall apply equally to both hardware and software.

PART 2 PRODUCTS

2.01. BACnet APPLICATION EQUIPMENT CONTROLLERS

A. Provide one or more native BACnet application controllers for each controlled piece of equipment. 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 units. Controllers shall be fully programmable using graphical programming blocks. Programming tool shall be resident at the operator workstation.

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 native BACnet devices. 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. Please 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.

2. 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.

C. Application controllers shall include universal inputs with 10-bit resolution that accept 3K and 10K thermistors, 0–10VDC, 0–5 VDC, 4–20 mA and dry contact signals. Any input on a controller may be either analog or digital with a minimum of 3 inputs that accept pulses. Controller shall also include support and modifiable programming for interface to intelligent room sensor with digital display. Controller shall include binary and analog outputs on board. Analog outputs shall be switch selectable as either 0–10VDC or 0–20mA. Software shall include scaling features for analog outputs. Application controller shall include 24VDC voltage supply for use as power supply to external sensors.

D. All program sequences shall be stored on board application 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 capable of multiple PID loops for control of multiple devices. All calculations shall be completed using floating-point math and system shall support display of all information in floating-point nomenclature at operator's terminal. Programming of application controller shall be completely modifiable in the field over the installed BACnet LANs from the Touch Screen Interface.

E. Application controller shall include support for intelligent room sensor (see section 2.9.B.)

Display on intelligent room sensor shall be programmable at application 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.

2.02. OPERATOR'S WORKSTATION

A. Contractor shall furnish and install (1) new operator workstation and associated software for graphical user interface (GUI).

2.03. SENSORS 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 top of thermostat at approximately 44 inches above finished floor, align with light switch of associated room. Duct sensors to be installed such that the sensing element is in the main air stream.

B. 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. 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.

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.

2.04. ENCLOSURES

A. All controllers, power supplies and relays shall be mounted in enclosures.

B. 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.

C. Enclosures shall have hinged, locking doors.

D. 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.

PART 3 EXECUTION

3.01. 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.

3.02. INSTALLATION (GENERAL)

A. Install in accordance with manufacturer's instructions.

B. 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.

3.03. INTERLOCKING AND CONTROL WIRING

A. Provide all interlock and control wiring. All wiring shall be installed neatly and professionally, in accordance with Specification Division 16 and all national, state and local electrical codes.

B. 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.

C. 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.

D. Provide auxiliary pilot duty relays on motor starters as required for control function.

E. Provide power for all control components from nearest electrical control panel or as indicated on the electrical drawings—coordinate with electrical contractor.

F. All control wiring in the mechanical, electrical, telephone and boiler rooms to be installed in raceways. 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).

3.04. TRAINING

A. Provide application engineer to instruct owner in operation of systems and equipment.

B. Provide on-site training above as required, up to 8 hours as part of this contract.

END OF SECTION

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SECTION 260000 - ELECTRICAL - GENERAL PROVISIONS

PART 1 GENERAL

1.1 SCOPE OF WORK

A. Furnish all labor, materials and equipment required and install complete and make operational, electrical system as shown on the Drawings and as specified herein.

B. The work shall include the following:

1. Coordinate the electrical service requirements with the power company and provide the electrical service(s) from the Power Company at the locations indicated.

2. Provide conduit, wire and field connections for all equipment, HVAC systems, panelboards, transformers, and electrical equipment furnished under Divisions 1, 11, 21, 22, 23, and 26.

C. Each bidder or their authorized representatives shall, before preparing their proposal, visit all areas of the existing buildings and structures in which work under this sub-bid is to be performed and inspect carefully the present installation. The submission of the proposal by this bidder shall be considered evidence that their representative has visited the buildings and structures and noted the locations and conditions under which the work will be performed and that he/she takes full responsibility for a complete knowledge of all factors governing his/her work.

2.1 SUBMITTALS

A. As a minimum all equipment specified in each Section of Division 26 shall be submitted at one time. As an example all lighting fixtures shall be submitted together, all motor control centers shall be submitted together, etc. Submittals that do not comply will be returned disapproved.

B. Mark submittals to clearly identify proposed equipment including accessories, options, and features and to exclude parts not applicable to the project. When manufacturer’s cut sheets apply to a product series rather than a specific product, the data specifically applicable to the project shall be highlighted or clearly indicated by other means. Each submittal piece of literature and each submittal drawing shall clearly reference the Project Specification and/or Contract Drawing that the submittal is to cover. General catalogs will not be accepted as cut sheets to fulfill submittal requirements.

C. Check shop drawings for accuracy prior to submittal. Shop drawings shall be stamped with the date checked and a statement indicating that the shop drawings conform to this Section and the Drawings. This statement shall also list all exceptions to this Section and the Drawings. Mark submittals to identify proposed equipment including accessories, options and features being proposed for approval and exclude parts not to be used. Shop drawings not so checked and noted shall be returned marked NOT APPROVED.

D. The Engineer's check shall be for conformance with the design concept of the project and compliance with this Section and the Drawings. Errors and omissions on approved shop

drawings shall not relieve the Contractor from the responsibility of providing materials and workmanship required by this Section and the Drawings.

E. All dimensions shall be field verified at the job site and coordinated with the work of all other trades.

F. Material shall not be ordered or shipped until the shop drawings have been approved. No material shall be ordered or shop work started if shop drawings are marked “APPROVED AS NOTED - CONFIRM," "APPROVED AS NOTED - RESUBMIT" or "NOT APPROVED."

G. Operation and Maintenance Data

1. Submit operations and maintenance data for equipment furnished under this Division, in accordance with Section 017823. The manuals shall be prepared specifically for this installation and shall include catalog data sheets, drawings, equipment lists, descriptions, parts lists including replacement part numbers, to instruct operating and maintenance personnel unfamiliar with such equipment.

2. Manuals shall include the following as a minimum:

a. A complete "As-Built" set of approved shop drawings.

b. A complete list of the equipment supplied, including serial numbers, ranges and pertinent data.

c. Detailed service, maintenance and operation instructions for each item supplied.

H. Exceptions for Submittals

1. Exceptions to the Specifications or Drawings shall be clearly defined by the Electrical Subcontractor in a separate section of each submittal package. The submittal shall contain the reason for the exception, the exact nature of the exception and the proposed substitution so that a proper evaluation may be made by the Engineer. The acceptability of any device or methodology submitted as an “or equal” or “exception” to the Specifications shall be at the sole discretion of the Engineer.

I. Submittals will be returned to the Contractor under one of the following codes.

Code 1 -"APPROVED" is assigned when there are no notations or comments on the submittal. When returned under this code the Contractor may release the equipment and/or material for manufacture.

Code 2 -"APPROVED AS NOTED" - This code is assigned when a confirmation of the notations and comments IS NOT required by the Contractor. The Contractor may release the equipment or material for manufacture; however, all notations and comments must be incorporated into the final product.

Code 3 -"APPROVED AS NOTED/CONFIRM" - This combination of codes is assigned when a confirmation of the notations and comments IS required by the Contractor. The Contractor may, at his own risk, release the equipment or material for manufacture; however, all notations and comments must be incorporated into the final product. This confirmation shall specifically

address each omission and nonconforming item that was noted. Confirmation is to be received by the Engineer within 10 calendar days of the date of the Engineer's transmittal requiring the confirmation.

Code 4 -"APPROVED AS NOTED/RESUBMIT" - This combination of codes is assigned when notations and comments are extensive enough to require a resubmittal of the package. This resubmittal is to address all comments, omissions and non-conforming items that were noted. Resubmittal is to be received by the Engineer within 15 calendar days of the date of the Engineer's transmittal requiring the resubmittal.

Code 5 -"NOT APPROVED" is assigned when the submittal does not meet the intent of the Contract Documents. The Contractor must resubmit the entire package revised to bring the submittal into conformance. It may be necessary to resubmit using a different manufacturer/vendor to meet the Contract Documents.

Code 6 -"COMMENTS ATTACHED" is assigned where there are comments attached to the returned submittal which provide additional data to aid the Contractor.

Code 7 -"RECEIPT ACKNOWLEDGED" - This code is assigned to acknowledge receipt of a submittal that is not subject to the Engineer’s review and approval; and, is being filed for informational purposes only. This code is generally used in acknowledging receipt of *means and methods of construction* work plan, field conformance test reports, and Health and Safety plans.

Codes 1 through 5 designate the status of the reviewed submittal with Code 6 showing there has been an attachment of additional data.

3.1 REFERENCE STANDARDS

A. Electric equipment, materials and installation shall comply with the National Electrical Code (NEC).

B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

4.1 PRIORITY OF THE CONTRACT DOCUMENTS

A. If, during the performance of the work, the Contractor finds a conflict, error or discrepancy between or among one or more of the Sections or between or among one or more Sections and the Drawings, furnish the higher performance requirements. The higher performance requirement shall be considered the equipment, material, device or installation method which represents the most stringent option, the highest quality or the largest quantity.

B. In all cases, figured dimensions shall govern over scaled dimensions, but work not dimensioned shall be as directed by the Engineer and work not particularly shown, identified, sized, or located shall be the same as similar work that is shown or specified.

C. Detailed Drawings shall govern over general drawings, larger scale Drawings take precedence over smaller scale Drawings, Change Order Drawings shall govern over Contract Drawings and Contract Drawings shall govern over Shop Drawings.

D. If the issue of priority is due to a conflict or discrepancy between the provisions of the Contract Documents and any referenced standard, or code of any technical society, organization or association, the provisions of the Contract Documents will take precedence if they are more stringent or presumptively cause a higher level of performance. If there is any conflict or discrepancy between standard specifications, or codes of any technical society, organization or association, or between Laws and Regulations, the higher performance requirement shall be binding on the Contractor, unless otherwise directed by the Engineer.

E. In accordance with the intent of the Contract Documents, the Contractor accepts the fact that compliance with the priority order specified shall not justify an increase in Contract Price or an extension in Contract Time nor limit in any way, the Contractor's responsibility to comply with all Laws and Regulations at all times

5.1 SERVICE AND METERING

A. Service will be obtained at 208 Volts, 3Phase, 4Wire, 60 Hz.

B. The Contractor shall be responsible for the following work:

1. Obtain an estimate from the power company for the work described above and include the cost of the power company work in the Bid Price.

2. Make all arrangements with the power company for obtaining electrical service, pay all power company charges.

6.1 CODES, INSPECTION AND FEES

A. Equipment, materials and installation shall comply with the requirements of the local authority having jurisdiction.

B. Obtain all necessary permits and pay all fees required for permits and inspections.

7.1 INTERPRETATION OF DRAWINGS

A. Unless specifically stated to the contrary, the Drawings do not show exact locations of conduit runs. Coordinate the conduit installation with other trades and the actual supplied equipment.

B. Install each 3 phase circuit in a separate conduit unless otherwise shown on the Drawings.

C. Conduit shown exposed shall be installed exposed; conduit shown concealed shall be installed concealed. Unless otherwise indicated install branch circuit conduits exposed in process/ industrial type spaces and concealed in finished spaces.

D. Where circuits are shown as "home-runs" all necessary fittings and boxes shall be provided for a complete raceway installation. Where home-runs indicate conduit is to be installed concealed or exposed the entire branch circuit shall be installed in the same manner.

E. Verify the exact locations and mounting heights of lighting fixtures, switches and receptacles prior to installation.

F. Except where dimensions are shown, the locations of equipment, fixtures, outlets and similar devices shown on the Drawings are approximate only. Exact locations shall be determined by the Contractor and approved by the Engineer during construction. Obtain information relevant to the placing of electrical work and in case of any interference with other work, proceed as directed by the Engineer and furnish all labor and materials necessary to complete the work in an approved manner.

G. Circuit layouts are not intended to show the number of fittings, or other installation details. Furnish all labor and materials to install and place in satisfactory operation all power, lighting and other electrical systems shown.

H. Redesign of electrical or mechanical work, which is required due to the Contractor's use of an alternate item, arrangement of equipment and/or layout other than specified herein, shall be done by the Contractor at his/her own expense. Redesign and detailed plans shall be submitted to the Engineer for approval. No additional compensation will be provided for changes in the work, either his/her own or others, caused by such redesign.

I. Raceways and conductors for low voltage (120 Volts) thermostats controlling HVAC unit heaters, exhaust fans and similar equipment are not shown on the Drawings. Provide raceways and conductors between the thermostats, the HVAC equipment and the motor starters for a complete and operating system. Raceways shall be installed concealed in all finished space and may be installed concealed or exposed in process spaces. Refer to the HVAC drawings for the locations of the thermostats.

8.1 SIZE OF EQUIPMENT

A. Investigate each space in the structure through which electrical equipment furnished under Division 26 must pass to reach its final location. Coordinate shipping splits with the manufacturer to permit safe handling and passage through restricted areas in the structure.

B. The equipment shall be kept upright at all times during storage and handling. When equipment must be tilted for passage through restricted areas, brace the equipment to ensure that the tilting does not impair the functional integrity of the equipment.

9.1 RECORD DRAWINGS

A. As the work progresses, legibly record all field changes on a set of Project Contract Drawings, hereinafter called the "Record Drawings."

10.1 MATERIALS AND EQUIPMENT

A. Materials and equipment furnished under this contract shall be new.

B. Material and equipment of the same type shall be the product of one manufacturer and shall be UL listed.

11.1 EQUIPMENT IDENTIFICATION

A. Identify equipment, disconnect switches, separately mounted motor starters, control stations, etc. furnished under Division 26 with the name of the equipment it serves. Motor control centers, control panels, panelboards, switchboards, switchgear, junction or terminal boxes, transfer switches, etc, shall have nameplate designations as shown on the Drawings.

B. Nameplates shall be engraved, laminated plastic, not less than 1/16-in thick by 3/4-in by 2-1/2-in with 3/16-in high white letters on a black background.

C. Nameplates shall be screw mounted to NEMA 1 enclosures. Nameplates shall be bonded to all other enclosure types using an epoxy or similar permanent waterproof adhesive. Two sided foam adhesive tape is not acceptable. Where the equipment size does not have space for mounting a nameplate the nameplate shall be permanently fastened to the adjacent mounting surface.

PART 2 EXECUTION

1.1 INSTALLATION

A. Work not installed according to the Drawings and Specification shall be subject to change as directed by the Engineer at Contractor's expense.

B. Electrical equipment shall be protected against mechanical and water damage. Store all electrical equipment in dry permanent shelters. Do not install electrical equipment in place until structures are weather-tight.

C. Damaged equipment shall be replaced or repaired by the equipment manufacturer, at the Engineer's discretion and at the Contractor's expense.

D. Repaint any damage to factory applied paint finish using touch-up paint furnished by the equipment manufacturer.

2.1 WORK SUPERVISION

A. The Contractor shall designate in writing the qualified electrical supervisor who shall provide supervision to all electrical work on this project. The minimum qualifications for the electrical supervisor shall be a master electrician as defined by the Arkansas Board of Electrical Examiners. The supervisor or his appointed alternate possessing at least a journeyman electrician license shall be on site whenever electrical work is being performed. The qualifications of the electrical supervisor shall be subject to approval of the Owner and the Engineer.

B. All master and journeyman electricians shall be licensed in accordance with Arkansas Code Title 17 Chapter 28 - Electricians. The website located at http://www.arkleg.state.ar.us publishes the text of this statutory requirement. No unlicensed electrical workers shall perform work on this project. Apprentice electricians in a ratio of not more than one apprentice per journeyman electrician will be allowed if the apprentices are licensed and actively participating in an apprenticeship program recognized and approved by the Arkansas Board of Electrical Examiners.

END OF SECTION 260000

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Copper building wire rated 600 V or less.
2. Connectors, splices, and terminations rated 600 V and less.

B. Related Requirements:

1. Section 260523 "Control-Voltage Electrical Power Cables" for control systems communications cables and Classes 1, 2, and 3 control cables.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Product Schedule: Indicate type, use, location, and termination locations.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 COPPER BUILDING WIRE

A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.

B. 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. Cerro Wire LLC.
2. General Cable Technologies Corporation.
3. Okonite Company (The).
4. Southwire Company.

C. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. RoHS compliant.

3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.

E. Conductor Insulation:

1. Type NM: Comply with UL 83 and UL 719.
2. Type RHH and Type RHW-2: Comply with UL 44.
3. Type USE-2 and Type SE: Comply with UL 854.
4. Type THHN and Type THWN-2: Comply with UL 83.
5. Type THW and Type THW-2: Comply with NEMA WC-70/ICEA S-95-658 and UL 83.
6. Type XHHW-2: Comply with UL 44.

2.2 CONNECTORS AND SPLICES

A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

B. Jacketed Cable Connectors: For steel and aluminum jacketed cables, zinc die-cast with set screws, designed to connect conductors specified in this Section.

C. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.

1. Material: Copper.
2. Type: One hole with long barrels.
3. Termination: Compression.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger. Branch Circuits: Copper. Solid for No. 12 AWG and smaller; stranded for No. 10 AWG and larger.

B. Power-Limited Fire Alarm and Control: Solid for No. 12 AWG and smaller.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type THHN/THWN-2, single conductors in raceway.

B. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway.

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN/THWN-2, single conductors in raceway.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.

E. Feeders in Cable Tray: Type THHN/THWN-2, single conductors in raceway.

F. Exposed Branch Circuits, Including in Crawlspaces: Type THHN/THWN-2, single conductors in raceway.

G. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway

H. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.5 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."

B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies.

3.7 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly.

END OF SECTION 260519

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes grounding and bonding systems and equipment.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article.

B. Qualification Data: For testing agency and testing agency's field supervisor.

C. Field quality-control reports.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

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.

B. Comply with UL 467 for grounding and bonding materials and equipment.

2.2 MANUFACTURERS

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. Burndy; Part of Hubbell Electrical Systems.
2. O-Z/Gedney; a brand of Emerson Industrial Automation.
3. Thomas & Betts Corporation; A Member of the ABB Group.

2.3 CONDUCTORS

A. Conductors shall be as specified under Section 260519 “Low-Voltage Electrical Power Conductors and Cables.”

2.4 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

C. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

D. Beam Clamps: Mechanical type, terminal, ground wire access from four directions, with dual, tin-plated or silicon bronze bolts.

E. Cable-to-Cable Connectors: Compression type, copper or copper alloy.

F. Conduit Hubs: Mechanical type, terminal with threaded hub.

G. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.

H. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.

I. Lay-in Lug Connector: Mechanical type, copper rated for direct burial terminal with set screw.

J. Water Pipe Clamps:

1. Mechanical type, two pieces with stainless-steel bolts.

a. Material: Die-cast zinc alloy.
b. Listed for direct burial.

2.5 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel; 3/4 inch by 10 feet.

B. Ground Plates: 1/4 inch thick, hot-dip galvanized.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

B. Underground Grounding Conductors: Install barecopper conductor, **No. 4/0** AWG minimum.

1. Bury at least 24 inches below grade.

C. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING AT THE SERVICE

A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.3 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

3.4 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

C. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.

D. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

E. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells, and at individual ground rods. Make tests at ground rods before any conductors are connected.

    a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
    b. Perform tests by fall-of-potential method according to IEEE 81.

C. Grounding system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

E. Report measured ground resistances that exceed 5 ohms.

F. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Engineer promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel slotted support systems.
2. Conduit and cable support devices.
3. Support for conductors in vertical conduit.
4. Structural steel for fabricated supports and restraints.
5. Mounting, anchoring, and attachment components, including powder-actuated fasteners, mechanical expansion anchors, concrete inserts, clamps, through bolts, toggle bolts, and hanger rods.
6. Fabricated metal equipment support assemblies.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For fabrication and installation details for electrical hangers and support systems.

1. Hangers. Include product data for components.
2. Slotted support systems.
3. Equipment supports.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Preformed steel channels and angles with minimum 13/32-inch-(10-mm-) diameter holes at a maximum of 8 inches (200 mm) o.c. in at least one surface.
1. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
2. Material for Channel, Fittings, and Accessories: Galvanized steel.
3. Channel Width: 1-5/8 inches.
4. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
5. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
6. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
7. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

C. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be made of malleable iron.

D. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M steel plates, shapes, and bars; black and galvanized.

E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Section 055000 "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with the following standards for application and installation requirements of hangers and supports, except where requirements on Drawings or in this Section are stricter:

1. NECA 1.
2. NECA 101

B. Comply with requirements in "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.

C. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this article.

B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

C. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.
6. To Steel: Beam clamps (MSS SP-58,Type 19, 21, 23, 25, or 27), complying with MSS SP-69.
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate

D. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

B. Field Welding: Comply with AWS D1.1/D1.1M.

END OF SECTION 260529

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SECTION 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal conduits and fittings.
2. Nonmetallic conduits and fittings.
3. Metal wireways and auxiliary gutters.
4. Nonmetal wireways and auxiliary gutters.
5. Boxes, enclosures, and cabinets.
6. Handholes and boxes for exterior underground cabling.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

PART 2 - PRODUCTS

2.1 METAL CONDUITS AND FITTINGS

A. Metal Conduit:

1. 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:

a. Allied Tube & Conduit; a part of Atkore International.
b. Republic Conduit.
c. Thomas & Betts Corporation; A Member of the ABB Group.

2. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

3. GRC: Comply with ANSI C80.1 and UL 6.
4. IMC: Comply with ANSI C80.6 and UL 1242.
5. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.

a. Comply with NEMA RN 1.
b. Coating Thickness: 0.040 inch, minimum.

6. EMT: Comply with ANSI C80.3 and UL 797.
7. FMC: Comply with UL 1; zinc-coated steel.
8. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

B. Metal Fittings: Comply with NEMA FB 1 and UL 514B.

1. 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:

   a. Allied Tube & Conduit; a part of Atkore International.
   b. Republic Conduit.
   c. Thomas & Betts Corporation; A Member of the ABB Group.

2. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

3. Fittings, General: Listed and labeled for type of conduit, location, and use.
4. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 1203 and NFPA 70.
5. Fittings for EMT:

   a. Material: Steel.
   b. Type: Compression.

6. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
7. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.

C. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS AND FITTINGS

A. Nonmetallic Conduit:

1. 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:

   a. CANTEX INC.
   b. RACO; Hubbell.
   c. Thomas & Betts Corporation; A Member of the ABB Group.

B. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1. ENT: Comply with NEMA TC 13 and UL 1653.
2. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
3. LFNC: Comply with UL 1660.

C. Nonmetallic Fittings:

1. 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:

   a. CANTEX INC.
   b. RACO; Hubbell.
   c. Thomas & Betts Corporation; A Member of the ABB Group.

2. Fittings, General: Listed and labeled for type of conduit, location, and use.

3. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.
4. Fittings for LFNC: Comply with UL 514B.
5. Solvents and Adhesives: As recommended by conduit manufacturer.

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1, Type 3R, Type 4, or Type 12 based on installation location, and sized according to NFPA 70.

1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

2.4 BOXES, ENCLOSURES, AND CABINETS

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. Crouse-Hinds, an Eaton business.
2. Hoffman; a brand of Pentair Equipment Protection.
3. Hubbell Incorporated; Wiring Device-Kellems.
4. Thomas & Betts Corporation; A Member of the ABB Group.
5. Wiremold / Legrand.

B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

E. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

F. Metal Floor Boxes:

1. Material: Cast metal.
2. Type: Fully adjustable.
3. Shape: Rectangular.
4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

G. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.

H. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

I. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, galvanized, cast iron with gasketed cover.

J. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

K. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.

L. Gangable boxes are prohibited.

2.5 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. General Requirements for Handholes and Boxes:

1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.

1. 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:

a. Quazite: Hubbell Power Systems, Inc.

2. Standard: Comply with SCTE 77.
3. Configuration: Designed for flush burial with closed bottom unless otherwise indicated.

4. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
6. Cover Legend: Molded lettering, "ELECTRIC.".
7. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: GRC.
2. Concealed Conduit, Aboveground: GRC.
3. Underground Conduit: RNC, Type EPC-40-PVC, direct buried
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Indoors: Apply raceway products as specified below unless otherwise indicated.
1. Exposed and Subject to Severe Physical Damage: GRC. Raceway locations include the following:

    a. Loading dock.
    b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
    c. Mechanical rooms.
    d. Electrical rooms
    e. Gymnasiums.

2. Concealed in Ceilings and Interior Walls and Partitions: EMT.
3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
4. Damp or Wet Locations: GRC.
5. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.

C. Minimum Raceway Size: 3/4-inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
3. EMT: Use compression, steel fittings. Comply with NEMA FB 2.10.

4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

F. Install surface raceways only where indicated on Drawings.

G. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

H. Panel feeders shall not be installed on roofs unless specifically noted on plans or approve via RFI to engineer.

3.2 INSTALLATION

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.

B. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

C. Raceways installed on roof shall be kept a minimum of 1” above roof deck and shall be supported using Dura-Blok rooftop supports with maximum spacing of 10’ between supports.

D. Do not install raceways or electrical items on any "explosion-relief" walls or rotating equipment.

E. Do not fasten conduits onto the bottom side of a metal deck roof.

F. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

G. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.

H. Arrange stub-ups so curved portions of bends are not visible above finished slab.

I. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.

J. Make bends in raceway using large-radius preformed ells. Field bending shall be according to NFPA 70 minimum radii requirements. Use only equipment specifically designed for material and size involved.

K. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

L. Support conduit within 12 inchesof enclosures to which attached.

M. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot intervals.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
3. Arrange raceways to keep a minimum of 2 inches of concrete cover in all directions.
4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
5. Change from ENT to GRC before rising above floor.

N. Stub-ups to Above Recessed Ceilings:

1. Use EMT, IMC, or RMC for raceways.
2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

O. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

P. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.

Q. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

R. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

S. Expansion-Joint Fittings:

1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F and that has straight-run length that exceeds 25 feet.
2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:

    a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
    b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
    c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
    d. Attics: 135 deg F temperature change.

3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per degree F of temperature change for PVC conduits.

4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

T. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC in damp or wet locations not subject to severe physical damage.

U. Mount boxes at heights indicated on Drawings or in Specification 262726 “Wiring Devices”. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

V. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between the box and cover plate or the supported equipment and box.

W. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

X. Locate boxes so that cover or plate will not span different building finishes.

Y. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

Z. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

AA. Set metal floor boxes level and flush with finished floor surface.

BB. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit.
2. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified.
3. Install manufactured duct elbows for stub-up at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.

4. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.

    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete for a minimum of 12 inches on each side of the coupling.
    b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.

5. Underground Warning Tape: Comply with requirements in Section 260553 "Identification for Electrical Systems."

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.

D. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies.

3.6 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies.

3.7 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533

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260548 - SEISMIC RESTRAINT FOR ELECTRICAL COMPONENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

The work under this section is subject to the requirements of the Contract Documents, including General and Supplementary Conditions and Division 01 General Requirements.

Specifications throughout all Divisions are directly applicable to this Section, and this Section is directly applicable to them. In the event that this section conflicts with the requirements of other Sections, the more stringent criteria shall apply.

1.2 DESCRIPTION

This section includes requirements for vibration isolation and seismic restraint of nonstructural components in Risk Category I, II, III, & IV structures, including, but not limited to:

1. Electrical Components: Transformers, Switchboards, UPS, ATS, Panel Boards, Generators, Mufflers, Day Tanks, Switchgear, Lighting, etc.

Work in this section includes the restraint design and/or equipment/product certifications to be submitted for review by the registered design professional.

1.3 DEFINITIONS

Active Equipment: Equipment with dynamic moving or rotating parts or parts that are energized.

Attachments / Anchorage: Means by which nonstructural components or supports for nonstructural components are secured or connected to the seismic-force resisting system of the structure. Such attachments may include anchor bolts, welded connections, mechanical fasteners or other approved attachment devices. Friction attachments do not constitute positive attachments.

Bracing: Struts, braces, cables, anchors or other structural elements providing restraint for nonstructural components to prevent excessive movement.

Certificate of Compliance: A certificate, supplied by the component manufacturer, stating that materials and products meet specified standards and project specific requirements.

Component Importance Factor (I_p): Factor applied to a component that defines the criticality of that component. This factor can be 1.0 or 1.5 in accordance with ASCE 7, Section 13.1.3.

Consequential Damage: Failure of an essential component caused by the failure of a separate essential or non-essential component due to the functional and physical interrelationship of the components, their supports, and their effect on each other.

Designated Seismic System: Those nonstructural components that require design in accordance with Chapter 13 of ASCE 7, for which the Component Importance Factor (Ip) is 1.5 in accordance with Section 13.1.3 of ASCE 7.

Special Seismic Certification: A certificate of compliance, supplied by the manufacturer of Active Designated Seismic Systems, which certifies that the equipment will remain operable during the design seismic event. Components with hazardous contents shall be certified as maintaining containment following the design seismic event.

Structure: The load-bearing building elements designed by the Structural Engineer of Record. Non-load bearing partition walls, unreinforced slabs or other building elements that do not provide direct load transfer to the load-bearing building elements shall not be defined as part of the Structure and cannot be used for attachment of seismic restraints.

Supports: Those members, assemblies of members, or manufactured elements, including braces, frames, legs, snubbers, curbs, rails, hangers, saddles or struts, and associated fasteners that transmit loads between non-structural components and their attachments to the structure.

1.4 REGULATORY REQUIREMENTS

Comply with the 2018 International Building Code (IBC) and applicable local adopted amendments, and the 2010 Edition on ASCE 7 (ASCE 7-16).

1.5 DESIGN PERFORMANCE CRITERIA

Provide seismic restraint of components to withstand seismic forces and displacements without displacing or overturning. Design of seismic restraint shall be performed in accordance with the 2018 International Building Code and ASCE 7-16, as follows.

1. Seismic forces shall be determined in accordance with Chapter 13 of ASCE 7-16. The seismic design parameters shall be as noted in the project Structural drawing. The assigned Component Importance Factors (Ip) for each component, shall be as noted on the project drawings and/or specifications.

2. For components installed on the exterior of the building, wind forces shall be determined in accordance with Chapter 29 of ASCE 7-16, except that the uplift forces per Equation 29.5-3 shall be considered regardless of the building height. Reference the Structural drawings for wind design criteria.

3. In addition to seismic and wind loads, consideration shall be given to other loads, including but not limited to dead, live, snow, etc., as applicable. All restraint design shall be based on the "worst case" combination of the applicable loads as prescribed by the referenced code and standards.

4. Consideration shall also be given to thermal stresses and expansion. Where thermal expansion applies, seismic restraint design shall be in accordance with the requirements of ASME B31.1 in addition to ASCE 7.

1.6 SUBMITTALS

Submit under the provisions of Division 1. Submittals shall include Product Data, Shop Drawings and the required Certificates of Compliance as described below.

Shop drawings shall be prepared and sealed by a professional engineer licensed in the state of the project, with a minimum of 5 years of experience in the design of vibration isolation and seismic restraint.

Vibration Isolation: submit the following, at a minimum, as applicable.

1. Detailed schedules of equipment requiring isolation, including clearly identified equipment identification or tag and equipment weight, and corresponding isolator type, manufacturer and model number.

2. Detailed drawings showing equipment, isolator bases and isolator spacing.

3. Descriptive data or cut sheets for each type of isolation mounting, including:

    a. Dimensional data

    b. Materials and finish

    c. Rated loads

    d. Rated deflection

    e. Isolator free and operating heights

    f. Detailed installations instructions

Seismic Restraint: submit the following, at a minimum, as applicable.

4. Catalog cut or data sheets on specific restraints detailing compliance with the project drawings and specifications.

5. Detailed schedules of components, showing seismic restraints by referencing numbered descriptive drawings.

6. Description, layout and location of items to be restrained with anchorage or brace points noted and dimensioned.

7. Details of anchorage or bracing at large scale with all members, parts brackets shown, together with all connections, fasteners, bolts, welds etc. clearly identified and specified.

8. Numerical value of design seismic restraint loads, or controlling loads if different than load combinations with seismic, with all supporting calculations.

9. Detailed installation instructions for seismic restraints.

10. Acceptable attachment methods of seismic restraints to structural members.

11. Fabrication details for equipment bases including dimensions, structural member sizes and support point locations.

12. Details for housekeeping pads for base-mounted equipment, including reinforcing and doweling requirements to the building structure.

13. Documentation verifying seismic prequalification for anchors in concrete per ACI 318 Appendix D.

14. Additional information as required to substantiate adequate design and installation of seismic restraints.

15. Manufacturer's Seismic Certificate of Compliance: Each manufacturer of a Designated Seismic System (with a Component Importance Factor, Ip = 1.5) shall submit a ***Certificate of Compliance*** for review and acceptance by the design professional in responsible charge and the authority having jurisdiction, prior to installation.

PART 2 - PRODUCTS

2.1 GENERAL

All materials and devices shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

Refer to the “Selection Guide” table in Section 4 to correlate the specification references listed below with the appropriate components.

2.2 MANUFACTURERS

Isolators and seismic restraints shall be from the following manufacturers, or approved equals. Unless otherwise noted, the isolators and seismic restraint systems listed in the following sections are as manufactured by Gripple and California Dynamics.

1. Gripple
2. California Dynamics
3. The VMC Group
4. Mason Industries
5. Kinetics Noise Control
6. Cooper B-Line
7. CADDY
8. Hilti
9. Twin City Hose
10. ASC Equipment

2.3 VIBRATION ISOLATION

Specification V-1 (Pad Type Elastomer Isolator): A pad type mounting consisting of two layers of ribbed elastomeric pads with a 1” sandwich pad in between. Where the equipment foot is less than 80 percent of the surface of the pad a load distribution plate must be added to the top of the pad. Pads shall be VT as manufactured by California Dynamics Corporation or approved equal.

Specification V-6 (Combination Spring/Elastomer Hanger Isolator): Hangers shall consist of rigid steel frames containing double deflection Neoprene element at the top and a steel spring and a Neoprene sleeve on bottom to position spring and prevent steel to steel contact. Spring diameters and hanger box lower hole sizes shall be large enough to permit the hanger rod to swing through a 30^{o} arc from side to side. Hangers shall be type HH30 as manufactured by California Dynamics Corporation or approved equal.

2.4 VIBRATION ISOLATION WITH SEISMIC RESTRAINT

Specification SV-2 (Seismically Restrained Spring Isolator): Restrained spring isolators shall be free standing, laterally stable, springs with seismic restraints. A welded housing with cushioned lateral and vertical limit stops to restrict spring extension due to wind loads, or when weight is removed. A clearance of ¼" maximum shall be maintained around restraining bolts and between the housing and the spring so as not to interfere with the spring action. Limit stops shall be out of contact during normal operation. Outside spring diameter not less than 80 percent of the compressed height of the spring at rated load. Minimum additional travel 50 percent of the required deflection at rated load. Isolator/Restraint shall be DLK as manufactured by California Dynamics Corporation or approved equal.

2.5 SEISMIC RESTRAINTS

Specification S-1 (Seismic Snubbers): All directional seismic restraints shall consist of interlocking steel members. Neoprene shall have a minimum thickness of ¼". Incorporate a minimum air gap of 1/8", and a maximum air gap of ¼" in the design, before contact is made between the rigid and resilient surfaces. Provide removable end plate to allow inspection of internal clearances. Restraints shall be type RL-A/ RL-C as manufactured by California Dynamics Corporation.

Specification S-2 (Seismic Cable Restraints): A restraint assembly for suspended equipment, piping or ductwork consisting of high strength galvanized steel aircraft cable. Secure cable to structure and braced component through bracket or stake eye specifically designed to meet or exceed cable restraint rated capacity. Cable must be manufactured to meet or exceed minimum materials and standard requirements per ASTM A1023 or EN-12385 or other approved equivalent. Cables shall be installed to prevent excessive seismic motion and so arranged that they do not engage during normal operation. Restraint shall be Gripple Inc. GS series.

Specification S-3 (Rigid Brace Restraints): A restraint assembly for suspended equipment, piping or ductwork consisting of steel angles or channels. Rigid braces and connecting elements shall be sized for the applied seismic loads. Connecting elements shall be steel assemblies that swivel to the final installation angle and utilize two anchor bolts to provide proper attachment. Restraint shall be CADDY Strut Seismic Hinge.

PART 3 - EXECUTION

3.1 EXAMINATION

All areas that will receive components requiring vibration isolation and seismic restraint shall be thoroughly examined for deficiencies that will affect the installation or performance of the installed devices. Such deficiencies shall be corrected prior to the installation.

3.2 INSTALLATION, GENERAL

Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.

All installation shall be in accordance with the requirements set forth in the project drawings and specifications, as well as the manufacturer's published instructions and all approved submittal data.

Do not anchor components to gypsum wallboard, plaster or other wall or ceiling finish that has not been engineered to resist imposed loads.

3.3 SEISMIC RELATIVE DISPLACEMENTS

Provide joints with sufficient flexibility capable of accommodating seismic relative displacements as follows.

1. Vertical conduit, cable tray, bus duct, etc. that pass between floors of the building,
2. Systems that pass through a building seismic or expansion joint,
3. Rigidly supported components that connect to other components.

3.4 POST-INSTALLED ANCHORS:

Install all anchors in accordance with the manufacturer's written instructions for seismic applications.

Post-installed anchors in concrete shall be seismically prequalified for use in cracked concrete based on seismic testing in accordance with ACI 355.2 for mechanical anchors or ACI 355.4 for adhesive anchors.

3.5 HOUSEKEEPING PADS

Housekeeping pads shall be designed by the seismic restraint vendor with adequate reinforcing and doweling to the building structure, so as to withstand calculated seismic or wind forces. Frictional resistance due to the effects of gravity shall be neglected.

The size & thickness of the housekeeping pad shall be determined to ensure adequate edge distances & embedment depths in order to obtain the desired equipment anchor capacities.

1. If cast-in-place anchors are used, the housekeeping pads shall be sized to accommodate the ACI requirements for bolt coverage and embedment.
2. If post-installed anchors are used, the minimum edge distances, embedment depths and concrete/masonry member thicknesses specified by the anchor manufacturer shall be maintained.

3.6 ELECTRICAL COMPONENTS

Floor and base-mounted components, vibration isolated equipment and associated system vibration and seismic controls for connections.

1. Design equipment anchorage to resist seismic design force in any direction.
2. Design vibration and seismic controls for equipment to include base and isolator requirements.
3. Provide flexible connections between equipment and interconnected conduit to account for seismic relative displacements.
4. Where equipment is mounted on vibration isolators, use isolators designed for amplified code forces per ASCE 7 and with demonstrated ability to resist required forces including gravity, operational and seismic forces.
5. Provide supplemental steel or concrete base as required for mounting equipment on isolators. Where equipment is not designed to be point loaded, provide base capable of transferring gravity and seismic demands from equipment to isolator base plate anchorage.

6. Where concrete floor thickness is less than required for expansion anchor installation per ICC-ESR, install through bolt in lieu of expansion anchor. Where timber/wood floor or other substrate is inadequate for installation of lag bolts, screws or other mechanical fasteners, furnish and install supplemental framing or blocking to transfer loads to structural elements.

7. Housekeeping pads shall be coordinated with the seismic restraint vendor based on the equipment anchorage specified in the seismic design.

Suspended electrical equipment

8. Design support and bracing to resist seismic design force in any direction.

9. Provide flexible connections between equipment and interconnected conduit to account for seismic relative displacements.

10. Brace equipment hung from spring mounts using cable or other bracing that will not transmit vibration to the structure.

Wall-mounted electrical equipment

11. Design attachments to resist seismic design force in any direction.

12. Install backing plates or blocking as required to deliver load to primary wall framing members. Do not anchor to gypsum wallboard, plaster or other wall finish that has not been engineered to resist imposed loads.

Conduit/Cable Tray/Bus Duct

13. Provide supports, braces and anchors to resist gravity and seismic design forces.

14. Design risers to accommodate interstory drift. Provide flexible connections wherever relative differential movements could damage distributed system in an earthquake.

15. Brace every run (5’ or more in length) with two transverse and one longitudinal bracing locations. Provide transverse bracing at not more than 40 feet on center and longitudinal bracing at spacing not more than 80 feet on center.

16. Provide lateral restraint for risers at not more than 30 feet on center or as required for horizontal runs, whichever is less.

17. Where distributed system is explicitly exempt from seismic bracing requirements,

    a. Install such that swinging of the system will not cause damaging impact with adjacent components. This will be considered satisfied if there is horizontal clear distance of at least 2/3 the hanger length between subject components.

    b. Provide flexible connections between system and connected equipment.

3.7 QUALITY CONTROL

Do not install vibration isolators or seismic restraints until submittals have been reviewed and approved by the registered design professional in responsible charge.

Verify that multiple systems installed in the same vicinity can be installed without conflict.

Verify tolerances between installed items to confirm that unbraced components will not come into contact with restrained equipment or structural members during an earthquake. When contact is possible, provide seismic restraint or provide justification to the satisfaction of the registered design professional in responsible charge of the project that contact will not cause unacceptable damage to the components in contact, their supports, finishes or other elements that are contacted.

Coordinate with the Structural Engineer of Record for confirming that the structure is capable of supporting the loads imposed by nonstructural components.

No work shall be concealed by the Contractor prior to the required inspections being performed and all discrepancies resolved. The Contractor shall be responsible for all repairs required to uncover uninspected or unapproved work.

Where Special Inspections are required per Sections 1704 and 1705 of the 2018 International Building Code, the owner shall engage a qualified agency to perform the required inspections for components listed in the project-specific Statement of Special Inspections.

PART 4 - EQUIPMENT ISOLATION AND SEISMIC RESTRAINT SCHEDULE

ELECTRICAL EQUIPMENT

EQUIPMENT TAG	**Ip (Note 3, 4)**	**ISOLATION SPEC.**	**ISOLATION DEFL.**	**SEISMIC REST. SPEC. (NOTE 1)**
ENGINE-DRIVEN GENERATORS	1.5	SPEC SV-2	2”	SPEC SV-2
TRANSFORMERS (Base Mounted)	1.0	SPEC V-1	.15”	NOTE 2
TRANSFORMERS (Suspended)	1.0	SPEC V-6	1.5”	SPEC S-2
SWITCHGEAR	1.0	N/A	N/A	NOTE 2
SWITCHBOARD	1.0	N/A	N/A	NOTE 2
ATS	1.0	N/A	N/A	NOTE 2
LIGHTING (NON-EMERGENCY)	1.0	N/A	N/A	NOTE 5
LIGHITNG (EMERGENCY)	1.5	N/A	N/A	NOTE 5

EQUIPMENT TAG	Ip (Note 3, 4)	ISOLATION SPEC.	ISOLATION DEFL.	SEISMIC REST. SPEC. (NOTE 1)
DAY TANKS	1.5	N/A	N/A	NOTE 2
GENERATOR MUFFLER	1.5	SPEC V-6	1.5”	SPEC S-2
CONDUIT/CABLE TRAY/BUS DUCT	1.0	N/A	N/A	SPEC S-2

NOTES

1. Seismic restraint to be provided only where required in the project drawings.
2. Anchor bolts for non-isolated and internally isolated equipment shall be sized by the seismic engineer. If required, Spec. S-1 snubbers or Spec. S-2 cable kits shall be provided.
3. All components in a Risk Category IV building are assigned a Component Importance Factor I_p equal to 1.5.
4. All components included as part of a Life Safety System must be assigned a Component Importance Factor I_p equal to 1.5.
5. Means of support to follow section 410.16 of NEC. ASCE 7-16 Section 13.5.6.2 references ASTM C635, C636, and E580 for the requirements for the construction of ceilings for seismic applications and includes specific requirements for electrical fixtures included in an acoustical ceiling.

END OF SECTION 260548

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SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Color and legend requirements for raceways, conductors, and warning labels and signs.
2. Labels.
3. Tapes and stencils.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with NFPA 70.

B. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

C. Comply with ANSI Z535.4 for safety signs and labels.

2.2 COLOR AND LEGEND REQUIREMENTS

A. Color-Coding for Phase- and Voltage-Level Identification, 600 V or Less: Use colors listed below for ungrounded service feeder and branch-circuit conductors.

1. Color shall be factory applied or field applied for sizes larger than No. 8 AWG if authorities having jurisdiction permit.

2. Colors for 208/120-V Circuits:
   a. Phase A: Black.
   b. Phase B: Red.
   c. Phase C: Blue.

3. Color for Neutral: White.
4. Color for Equipment Grounds: Green.
5. Colors for Isolated Grounds: Green with white stripe.

B. Warning Label Colors:

1. Identify system voltage with black letters on an orange background.

C. Equipment Identification Labels:

1. Black letters on a white field.

2.3 TAPES AND STENCILS

A. Underground-Line Warning Tape:
1. Tape:

a. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
b. Printing on tape shall be permanent and shall not be damaged by burial operations.
c. Tape material and ink shall be chemically inert and not subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.

2. Color and Printing:

a. Comply with ANSI Z535.1, ANSI Z535.2, ANSI Z535.3, ANSI Z535.4, and ANSI Z535.5.
b. Inscriptions for Red-Colored Tapes: "ELECTRIC LINE, HIGH VOLTAGE"
c. Inscriptions for Orange-Colored Tapes: "TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE"

2.4 SIGNS

A. Laminated Acrylic or Melamine Plastic Signs:
1. Engraved legend.
2. Thickness:

a. For signs up to 20 sq. in. (129 sq. cm), minimum 1/16 inch (1.6 mm) thick.
b. For signs larger than 20 sq. in. (129 sq. cm), 1/8 inch (3.2 mm) thick.
c. Engraved legend with black letters on white face.
d. Self-adhesive.
e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.5 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.

B. Install identifying devices before installing acoustical ceilings and similar concealment.

C. Verify identity of each item before installing identification products.

D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.

E. Apply identification devices to surfaces that require finish after completing finish work.

F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.

G. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

H. System Identification for Raceways and Cables under 600 V: Identification shall completely encircle cable or conduit. Place identification of two-color markings in contact, side by side.

1. Secure tight to surface of conductor, cable, or raceway.

I. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

J. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.

K. Underground Line Warning Tape:

1. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at 6 to 8 inches (150 to 200 mm) below finished grade. Use

multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches (400 mm) overall.

2. Install underground-line warning tape for direct-buried cables and cables in raceways.

3.2 IDENTIFICATION SCHEDULE

A. Equipment Identification Labels:

1. Indoor Equipment: Self-adhesive label.
2. Outdoor Equipment: Laminated acrylic or melamine sign.

END OF SECTION 260553

SECTION 260573 - ARC-FLASH HAZARD ANALYSIS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Computer-based, arc-flash study to determine arc-flash hazard distance and incident energy to which personnel could be exposed during work on or near electrical equipment.

1.2 DEFINITIONS

A. p.u.: Per unit. The reference unit, established as a calculating convenience, for expressing all power system electrical parameters on a common reference base.

1.3 ACTION SUBMITTALS

A. Product Data:

1. For power system analysis software to be used for studies.

B. Study Submittals:

1. Submit the following after approval of system protective devices submittals. Submittals may be in digital form:

a. Arc-flash study input data, including completed computer program input data sheets.
b. Submit study report for action prior to receiving final approval of distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that selection of devices and associated characteristics is satisfactory.
c. Revised one-line diagram, reflecting field investigation results and results of arc-flash study.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For arc-flash hazard analysis software, certifying compliance with IEEE 1584 and NFPA 70E.

1.5 QUALITY ASSURANCE

A. Study must be performed using commercially developed and distributed software designed specifically for power system analysis.

B. Software algorithms must comply with requirements of standards and guides specified in this Section.

C. Manual calculations are unacceptable.

PART 2 - PRODUCTS

2.1 COMPUTER SOFTWARE

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. SKM Systems Analysis, Inc.

B. Comply with IEEE 1584 and NFPA 70E.

C. Analytical features of device coordination study computer software program must have capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

2.2 ARC-FLASH STUDY REPORT CONTENT

A. Executive summary of study findings.

B. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.

C. One-line diagram, showing the following:

1. Protective device designations and ampere ratings.
2. Conductor types, sizes, and lengths.
3. Transformer kVA and voltage ratings, including derating factors and environmental conditions.
4. Motor and generator designations and kVA ratings.
5. Switchgear, switchboard, motor-control center, panelboard designations, and ratings.

D. Study Input Data: As described in "Power System Data" Article.

E. Short-Circuit Study Output Data

F. Arc-Flash Study Output Reports:

1. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each equipment location included in report:

a. Voltage.
b. Calculated symmetrical fault-current magnitude and angle.
c. Fault-point X/R ratio.
d. No AC Decrement (NACD) ratio.
e. Equivalent impedance.
f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on symmetrical basis.
g. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on total basis.

G. Incident Energy and Flash Protection Boundary Calculations:

1. Arcing fault magnitude.
2. Protective device clearing time.
3. Duration of arc.
4. Arc-flash boundary.
5. Restricted approach boundary.
6. Limited approach boundary.
7. Working distance.
8. Incident energy.
9. Hazard risk category.
10. Recommendations for arc-flash energy reduction.

H. Fault study input data, case descriptions, and fault-current calculations including definition of terms and guide for interpretation of computer printout.

2.3 ARC-FLASH WARNING LABELS

A. Comply with requirements in Section 260553 "Identification for Electrical Systems" for self-adhesive equipment labels. Produce 3.5 by 5 inch self-adhesive equipment label for each work location included in analysis.

B. Label must have orange header with wording, "WARNING, ARC-FLASH HAZARD," and must include the following information taken directly from arc-flash hazard analysis:

1. Location designation.
2. Nominal voltage.
3. Protection boundaries.

a. Arc-flash boundary.
b. Restricted approach boundary.
c. Limited approach boundary.

4. Arc flash PPE category.
5. Required minimum arc rating of PPE in Cal/cm squared.
6. Available incident energy.
7. Working distance.
8. Engineering report number, revision number, and issue date.

C. Labels must be machine printed, with no field-applied markings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine Project overcurrent protective device submittals. Proceed with arc-flash study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to arc-flash study may not be used in study.

3.2 ARC-FLASH HAZARD ANALYSIS

A. Comply with NFPA 70E and its Annex D for hazard analysis study.

B. Preparatory Studies: Perform Short-Circuit study prior to starting Arc-Flash Hazard Analysis.

C. Calculate maximum and minimum contributions of fault-current size.

1. Maximum calculation must assume maximum contribution from utility and must assume motors to be operating under full-load conditions.
2. Calculate arc-flash energy at 85 percent of maximum short-circuit current according to IEEE 1584 recommendations.

D. Calculate arc-flash protection boundary and incident energy at locations in electrical distribution system where personnel could perform work on energized parts.

E. Include medium- and low-voltage equipment locations, except equipment fed from transformers smaller than 75 kVA.

F. Calculate limited, restricted, and prohibited approach boundaries for each location.

G. Incident energy calculations must consider accumulation of energy over time when performing arc-flash calculations on buses with multiple sources. Iterative calculations must take into account changing current contributions, as sources are interrupted or decremented with time. Fault contribution from motors and generators must be decremented as follows:

1. Fault contribution from induction motors must not be considered beyond three to five cycles.
2. Fault contribution from synchronous motors and generators must be decayed to match actual decrement of each as closely as possible (for example, contributions from permanent magnet generators will typically decay from 10 p.u. to 3 p.u. after 10 cycles).

H. Arc-flash energy must generally be reported for maximum of line or load side of circuit breaker. However, arc-flash computation must be performed and reported for both line and load side of circuit breaker as follows:

1. When circuit breaker is in separate enclosure.
2. When line terminals of circuit breaker are separate from work location.

I. Base arc-flash calculations on actual overcurrent protective device clearing time. Cap maximum clearing time at two seconds based on IEEE 1584, Section B.1.2.

3.3 POWER SYSTEM DATA

A. Obtain data necessary for conduct of arc-flash hazard analysis.

1. Verify completeness of data supplied on one-line diagram on Drawings. Call discrepancies to Architect's attention.
2. For new equipment, use characteristics from approved submittals under provisions of action submittals and information submittals for this Project.

3.4 LABELING

A. Apply one arc-flash label on front cover of each section of equipment for each equipment included in study. Base arc-flash label data on highest values calculated at each location.

B. Each piece of equipment listed below must have arc-flash label applied to it:

1. Medium-voltage switchgear.
2. Medium-voltage switches.
3. Medium voltage transformers
4. Low-voltage switchgear
5. Switchboards.
6. Panelboards.
7. Motor-control centers.
8. Low voltage transformers.
9. Safety switches.
10. Control panels.

C. Note on record Drawings location of equipment where personnel could be exposed to arc-flash hazard during their work.

1. Indicate arc-flash energy.
2. Indicate protection level required.

3.5 APPLICATION OF WARNING LABELS

A. Install arc-flash warning labels under direct supervision and control of qualified electrical professional engineer.

END OF SECTION 260573

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SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.

1.2 DEFINITIONS

A. MCCB: Molded-case circuit breaker.

B. SPD: Surge protective device.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of panelboard.

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details.
2. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.
3. Detail bus configuration, current, and voltage ratings.
4. Short-circuit current rating of panelboards and overcurrent protective devices.
5. Include evidence of NRTL listing for series rating of installed devices.
6. Include evidence of NRTL listing for SPD as installed in panelboard.
7. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
8. Include wiring diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Panelboard schedules for installation in panelboards.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.6 FIELD CONDITIONS

A. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet.

1.7 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards that fail in materials or workmanship within specified warranty period.

1. Panelboard Warranty Period: 18 months from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PANELBOARDS COMMON REQUIREMENTS

Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Section 260548.16 "Seismic Controls for Electrical Systems."

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.

B. Comply with NEMA PB 1.

C. Comply with NFPA 70.

D. Enclosures: Flush or Surface-mounted, dead-front cabinets.

1. Rated for environmental conditions at installed location.

a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
b. Outdoor Locations: NEMA 250, Type 3R.
c. Wash-Down Areas: NEMA 250, Type 4X,.
d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
e. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

2. Height: 84 inches maximum.
3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Trims shall cover all live parts and shall have no exposed hardware.

E. Phase, Neutral, and Ground Buses: Hard-drawn copper, 98 percent conductivity.

F. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.

2. Main and Neutral Lugs: Mechanical type, with a lug on the neutral bar for each pole in the panelboard.
3. Ground Lugs and Bus-Configured Terminators: Mechanical type, with a lug on the bar for each pole in the panelboard.
4. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.

G. Future Devices: Panelboards shall have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

H. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed by an NRTL for 100 percent interrupting capacity.

2.2 PERFORMANCE REQUIREMENTS

A. Surge Suppression: Factory installed as an integral part of indicated panelboards, complying with UL 1449 SPD Type 1 or Type 2 as shown on drawings.

2.3 POWER PANELBOARDS

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. Eaton.
2. SIEMENS Industry, Inc.; Energy Management Division.
3. Square D; by Schneider Electric.
    a. If Square D, project shall be quoted, ordered, and managed by Randall Robinette in Little Rock Field Office. Phone# 501-803-9494.

B. Panelboards: NEMA PB 1, distribution type.

2.4 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

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. Eaton.
2. SIEMENS Industry, Inc.; Energy Management Division.
3. Square D; by Schneider Electric.
    a. If Square D, project shall be quoted, ordered, and managed by Randall Robinette in Little Rock Field Office. Phone# 501-803-9494.

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

2.5 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton.
2. SIEMENS Industry, Inc.; Energy Management Division.
3. Square D; by Schneider Electric.
    a. If Square D, project shall be quoted, ordered, and managed by Randall Robinette in Little Rock Field Office. Phone# 501-803-9494.

B. All circuit breakers 1200A and higher shall be equipped with energy-reducing maintenance switching with local status in order to provide arc energy reduction per NEC 240.87

C. MCCB: Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers:

    a. Inverse time-current element for low-level overloads.
    b. Instantaneous magnetic trip element for short circuits.
    c. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic Trip Circuit Breakers:

    a. RMS sensing.
    b. Field-replaceable rating plug or electronic trip.
    c. Field-Adjustable Settings:

        1) Instantaneous trip.
        2) Long- and short-time pickup levels.
        3) Long and short time adjustments.
        4) Ground-fault pickup level, time delay, and I squared T response.

4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
5. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).
6. Subfeed Circuit Breakers: Vertically mounted.
7. MCCB Features and Accessories:

    a. Standard frame sizes, trip ratings, and number of poles.
    b. Breaker handle indicates tripped status.

2.6 IDENTIFICATION

A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.

B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.

C. Circuit Directory: Directory card inside panelboard door, mounted in transparent card holder.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1.

B. Install panelboards and accessories according to NEMA PB 1.1.

C. Mount panelboard cabinet plumb and rigid without distortion of box.

D. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

E. Install overcurrent protective devices and controllers not already factory installed.

F. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.

G. Install filler plates in unused spaces.

H. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

3.2 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads; incorporate Owner's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

D. Install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems" identifying source of remote circuit.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. Tests and Inspections:
1. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

END OF SECTION 262416

SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Straight-blade convenience receptacles.
2. USB charger devices.
3. GFCI receptacles.
4. Toggle switches.
5. Wall plates.

1.2 DEFINITIONS

A. Abbreviations of Manufacturers' Names:

1. Cooper: Copper Wiring Devices; Division of Cooper Industries, Inc.
2. Hubbell: Hubbell Incorporated: Wiring Devices-Kellems.
3. Leviton: Leviton Mfg. Company, Inc.
4. Pass & Seymour: Pass& Seymour/Legrand.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:

1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
2. Devices shall comply with the requirements in this Section.

D. Devices for Owner-Furnished Equipment:

1. Receptacles: Match plug configurations.

E. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 STRAIGHT-BLADE RECEPTACLES

A. Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.

1. 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:

a. Hubbell Incorporated; Wiring Device-Kellems.
b. Leviton Manufacturing Co., Inc.
c. Pass & Seymour/Legrand (Pass & Seymour).

2. All receptacle devices in childcare facilities and all education facilities shall be tamper-resistant. All devices shall meet requirements of NEC 406.12.

2.3 USB CHARGER DEVICES

A. Tamper-Resistant, USB Charger Receptacles: 12 V, 2.0 A, USB Type A and 20V, 3A, Type C; Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498 Supplement sd, UL 1310, and FS W-C-596.

1. 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:

a. Hubbell Incorporated; Wiring Device-Kellems.
b. Leviton Manufacturing Co., Inc.
c. Pass & Seymour/Legrand (Pass & Seymour).

2. Description: Single-piece, rivetless, nickel-plated, all-brass grounding system. Nickel-plated, brass mounting strap.

3. USB Receptacles: Dual, Type A and Type C.
4. Line Voltage Receptacles: Dual, two pole, three wire, and self-grounding.

2.4 GFCI RECEPTACLES

A. General Description:

1. 125 V, 20 A, straight blade, feed-through type.
2. Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, UL 943 Class A, and FS W-C-596.
3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.

B. Duplex GFCI Convenience Receptacles:

1. 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:

a. Hubbell Incorporated; Wiring Device-Kellems.
b. Leviton Manufacturing Co., Inc.
c. Pass & Seymour/Legrand (Pass & Seymour).

C. Tamper-Resistant, Duplex GFCI Convenience Receptacles:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Hubbell Incorporated; Wiring Device-Kellems.
b. Pass & Seymour/Legrand (Pass & Seymour).

D. Locations:

1. Install GFCI devices at all locations required by NEC Article 210.8, whether or not indicated on plans. These locations include:
   a. Dwelling Units:
      1) Bathrooms
      2) Garages and similar accessory buildings
      3) Outdoors
      4) Crawl Spaces
      5) Basements
      6) Kitchens where receptacles are installed to serve countertop surfaces
      7) Within 6’ of the top inside edge of the bowl of a sink
      8) Boathouses
      9) Within 6’ of bathtubs or shower stalls
      10) Laundry areas
      11) Indoor damp and wet locations
   b. Other than dwelling units:
      1) Bathrooms
      2) Kitchens or areas with sink and permanent provisions for food prep or cooking
      3) Rooftops
      4) Outdoors
      5) Within 6’ of the top inside edge of the bowl of a sink
      6) Indoor damp and wet locations

7) Locker rooms with associated showering facilities
8) Garages, accessory buidlngs, service bays, and similar areas
9) Crawl Spaces
10) Unfinished areas of basements
11) Laundry areas
12) Within 6’ of bathtubs or shower stalls

2.5 TOGGLE SWITCHES

A. Comply with NEMA WD 1, UL 20, and FS W-S-896.

B. Switches, 120/277 V, 20 A:

1. Single Pole:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Hubbell Incorporated; Wiring Device-Kellems.
2) Leviton Manufacturing Co., Inc.
3) Pass & Seymour/Legrand (Pass & Seymour).

2. Two Pole:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Hubbell Incorporated; Wiring Device-Kellems.
2) Leviton Manufacturing Co., Inc.
3) Pass & Seymour/Legrand (Pass & Seymour).

3. Three Way:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Hubbell Incorporated; Wiring Device-Kellems.
2) Leviton Manufacturing Co., Inc.
3) Pass & Seymour/Legrand (Pass & Seymour).

2.6 WALL PLATES

A. Single and combination types shall match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: Type 302/304 stainless steel, brushed satin finish, minmum 20-gauge thick.
3. Material for Unfinished Spaces: Galvanized steel.
4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.

B. Wet-Location, Weatherproof While-In-Use Cover Plates: NEMA 250, complying with Type 3R, weather-proof while in use, die-cast aluminum with lockable cover.

2.7 FINISHES

A. Device Color:

1. Wiring Devices Connected to Normal Power System: As selected by Architect unless otherwise indicated or required by NFPA 70 or device listing.
2. Wiring Devices Connected to Emergency Power System: Red.
3. SPD Devices: Blue.
4. Isolated-Ground Receptacles: Orange.

B. Wall Plate Color: Stainless steel

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1 unless otherwise indicated.

B. ARC-FAULT CIRCUIT-INTERRUPTER PROTECTION:
1. Provide arc-fault circuit interrupter protection at all locations required per 210.12 whether indicated on plans or not.
2. This includes any circuits serving outlets or devices in
   a. dwelling units
   b. dormitory units and their associated bedrooms, living rooms, hallways, closets, bathrooms, and similar rooms
   c. guest rooms, guest suites, and patient sleeping rooms
   d. For purposes of this requirement, all circuits serving outlets in bunk rooms or other associated sleeping rooms shall have AFCI protection

C. Mount Devices at the heights listed below unless listed specifically on drawings:
1. Exterior Outlet Boxes: 24” Above Finished Grade
2. Interior Outlet Boxes: 18” Above Finished Floor (AFF)
3. Device Boxes for Switches, Fire Alarm Pull Stations, Intercom Call Stations, etc.: 48” AFF
4. Outlet Boxes for Wall-mounted clocks: 96” AFF or 6” below the ceiling when not possible. Center clock outlets located above doors between the ceiling and the top of the door trip.
5. Above Counter Outlet and Junction Boxes: 8” above countertop surfaces or at backsplash level.
6. Coordinate mounting height of specific-use receptacles with equipment and finishes.
7. Coordinate mounting height to match mechanical devices (thermostats).

D. Coordination with Other Trades:

1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

E. Conductors:

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.

F. Device Installation:

1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

G. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

H. Dimmers:

1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan-speed control are listed for that application.
3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

I. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

J. GFCI Receptacles: Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.2 FIELD QUALITY CONTROL

A. Test Instruments: Use instruments that comply with UL 1436.

B. Perform the following tests and inspections:

1. Tests for Convenience Receptacles:

a. Line Voltage: Acceptable range is 105 to 132 V.
b. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
c. Ground Impedance: Values of up to 2 ohms are acceptable.
d. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
e. Using the test plug, verify that the device and its outlet box are securely mounted.
f. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

C. Wiring device will be considered defective if it does not pass tests and inspections.

END OF SECTION 262726

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SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fusible switches.
2. Nonfusible switches.
3. Molded-case circuit breakers (MCCBs).
4. Molded-case switches.
5. Horsepower Rated Toggle Disconnect Switch
6. Enclosures.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include nameplate ratings, dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

B. Shop Drawings: For enclosed switches and circuit breakers.

1. Include plans, elevations, sections, details, and attachments to other work.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.4 WARRANTY

A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: One year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single manufacturer.

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

D. Comply with NFPA 70.

2.2 FUSIBLE SWITCHES

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. Eaton.
2. SIEMENS Industry, Inc.; Energy Management Division.
3. Square D; by Schneider Electric.
    a. If Square D, project shall be quoted, ordered, and managed by Randall Robinette in Little Rock Field Office. Phone# 501-803-9494.

B. Type HD, Heavy Duty:

1. Single throw.
2. Three pole.
3. 600-V ac.
4. 1200 A and smaller.
5. UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses.
6. Lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories (as required per plans):

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Isolated Ground Kit: Internally mounted; insulated, labeled for copper and aluminum neutral conductors.
4. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
5. Service-Rated Switches: Labeled for use as service equipment.

2.3 NONFUSIBLE SWITCHES

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. Eaton.
2. SIEMENS Industry, Inc.; Energy Management Division.

3. Square D; by Schneider Electric.
    a. If Square D, project shall be quoted, ordered, and managed by Randall Robinette in Little Rock Field Office. Phone# 501-803-9494.

B. Type HD, Heavy Duty, Three Pole, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories (as required per plans):

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Isolated Ground Kit: Internally mounted; insulated, labeled for copper and aluminum neutral conductors.
4. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
5. Service-Rated Switches: Labeled for use as service equipment.

2.4 MOLDED-CASE CIRCUIT BREAKERS

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. Eaton.
2. SIEMENS Industry, Inc.; Energy Management Division.
3. Square D; by Schneider Electric.
    a. If Square D, project shall be quoted, ordered, and managed by Randall Robinette in Little Rock Field Office. Phone# 501-803-9494.

B. Circuit breakers shall be constructed using glass-reinforced insulating material. Current carrying components shall be completely isolated from the handle and the accessory mounting area.

C. Circuit breakers shall have a toggle operating mechanism with common tripping of all poles, which provides quick-make, quick-break contact action. The circuit-breaker handle shall be over center, be trip free, and reside in a tripped position between on and off to provide local trip indication. Circuit-breaker escutcheon shall be clearly marked on and off in addition to providing international I/O markings. Equip circuit breaker with a push-to-trip button, located on the face of the circuit breaker to mechanically operate the circuit-breaker tripping mechanism for maintenance and testing purposes.

D. The maximum ampere rating and UL, IEC, or other certification standards with applicable voltage systems and corresponding interrupting ratings shall be clearly marked on face of circuit breaker. Circuit breakers shall be 100 percent rated or series rated as indicated on the Drawings. combinations for series connected interrupting ratings shall be listed by UL as recognized component combinations. Any series rated combination used shall be marked on the end-use equipment along with the statement "Caution - Series Rated System. _____ Amps Available. Identical Replacement Component Required."

E. MCCBs shall be equipped with a device for locking in the isolated position.

F. Lugs shall be suitable for 167 deg F rated wire.

G. Standards: Comply with UL 489 with interrupting capacity to comply with available fault currents.

H. Thermal-Magnetic Circuit Breakers: Inverse time-current thermal element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

I. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.

J. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the field-adjustable settings as indicated on drawings.

K. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.

2.5 Horsepower Rated, Toggle Switch Type Disconnect Switch

A. Toggle type disconnect switches shall be manufactured of thermoplastic materials with screw-type terminals. The switches shall be rated 600 VAC and 20A at 600 VAC.

B. Toggle type disconnect switches shall be similar to a manual non-reversing starter without overloads and shall be 3 Pole, capable of “on-off” control of a 10 horsepower motor at 460 VAC.

C. Enclosure shall be provided with lock off provisions.

D. NEMA 4 enclosures shall be die-cast zinc.

E. Switches shall be as manufactured by the Square D Co.; Siemens Electrical Products; Cutler-Hammer or equal.

2.6 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: UL 489, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

B. Enclosure rating shall be equal to or greater than the fuse or circuit breaker rating.

C. Enclosure Finish: The enclosure shall be as indicated on drawings.

D. Conduit Entry: NEMA 250 Types 4, 4X, and 12 enclosures shall contain no knockouts. NEMA 250 Types 7 and 9 enclosures shall be provided with threaded conduit openings in both endwalls.

E. Operating Mechanism: The circuit-breaker operating handle shall be externally operable with the operating mechanism being an integral part of the box, not the cover. The cover interlock mechanism shall have an externally operated override. The override shall not permanently disable the interlock mechanism, which shall return to the locked position once the override is released. The tool used to override the cover interlock mechanism shall not be required to enter the enclosure in order to override the interlock.

F. Enclosures designated as NEMA 250 Type 4, 4X stainless steel, 12, or 12K shall have a dual cover interlock mechanism to prevent unintentional opening of the enclosure cover when the circuit breaker is ON and to prevent turning the circuit breaker ON when the enclosure cover is open.

G. NEMA 250 Type 7/9 enclosures shall be furnished with a breather and drain kit to allow their use in outdoor and wet location applications.

PART 3 - EXECUTION

3.1 ENCLOSURE ENVIRONMENTAL RATING APPLICATIONS

A. Enclosed Switches and Circuit Breakers: Provide enclosures at installed locations with the following environmental ratings.

1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
2. Outdoor Locations: NEMA 250, Type 3R.
3. Wash-Down Areas: NEMA 250, Type 4X, stainless steel.
4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

3.2 INSTALLATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

C. Comply with mounting and anchoring requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."

D. Temporary Lifting Provisions: Remove temporary lifting of eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

E. Install fuses in fusible devices. Fuse Ratings for mechanical equipment or transformers shall match the rating of the upstream circuit breaker feeding the equipment.

F. Comply with NFPA 70 and NECA 1.

3.3 IDENTIFICATION

A. Comply with requirements in Section 260553 "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved metal or laminated-plastic nameplate.
    a. Label on each disconnect means shall include both purpose and source, such as “AHU-1. Fed from Panel MDP”

3.4 FIELD QUALITY CONTROL

A. Tests and Inspections for Switches:

1. Visual and Mechanical Inspection:

    a. Inspect physical and mechanical condition.
    b. Inspect anchorage, alignment, grounding, and clearances.
    c. Verify that the unit is clean.
    d. Verify blade alignment, blade penetration, travel stops, and mechanical operation.
    e. Verify that fuse sizes and types match the Specifications and Drawings.
    f. Verify that each fuse has adequate mechanical support and contact integrity.
    g. Inspect bolted electrical connections for high resistance using one of the two following methods:

        1) Use a low-resistance ohmmeter.

            a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.

        2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.

            a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.

    h. Verify that operation and sequencing of interlocking systems is as described in the Specifications and shown on the Drawings.
    i. Verify correct phase barrier installation.
    j. Verify lubrication of moving current-carrying parts and moving and sliding surfaces.

B. Tests and Inspections for Molded Case Circuit Breakers:

1. Visual and Mechanical Inspection:

a. Verify that equipment nameplate data are as described in the Specifications and shown on the Drawings.
b. Inspect physical and mechanical condition.
c. Inspect anchorage, alignment, grounding, and clearances.
d. Verify that the unit is clean.
e. Operate the circuit breaker to ensure smooth operation.
f. Inspect bolted electrical connections for high resistance using one of the two following methods:

    1) Use a low-resistance ohmmeter.

        a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.

    2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.

        a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.

g. Inspect operating mechanism, contacts, and chutes in unsealed units.
h. Perform adjustments for final protective device settings in accordance with the coordination study.

C. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

END OF SECTION 262816

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SECTION 265119 - GENERAL LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes the following types of LED luminaires:

1. Cylinder.
2. Downlight.
3. Lowbay.
4. Recessed linear.
5. Strip light.
6. Surface mount, linear.
7. Surface mount, nonlinear.
8. Suspended, linear.
9. Suspended, nonlinear.
10. Materials.
11. Finishes.
12. Luminaire support.
13. Exit and Emergency Lighting

1.2 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color Rendering Index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. LED: Light-emitting diode.

F. Lumen: Measured output of lamp and luminaire, or both.

G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product, arranged by designation.

B. Product Schedule: Refer to light fixture schedule on the plans.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

B. Warranty Period: Five year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Product Schedule: Refer to light fixture schedule on the plans.

B. Fixture Schedule included in plans is basis of design. Equivalent alternates that meet all technical and aesthetics requirements are allowed and will be reviewed for equivalence by A/E team during submittal phase. Alternates shall include the following with their submittal, in addition to standard product data:
   1. Photometric lighting calculations for each space and exterior area.
   2. Control Device Layout showing part numbers and device locations.
   3. Lighting Fixture schedule including substituted fixture model number, voltage, wattage, and color temperature

C. Metal Parts:

   1. Free of burrs and sharp corners and edges.
   2. Sheet metal components shall be steel unless otherwise indicated.
   3. Form and support to prevent warping and sagging

D. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

E. Diffusers, and Globes:

   1. Acrylic: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
   2. Glass: Annealed crystal glass unless otherwise indicated.
   3. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

2.2 METAL FINISHES

A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.3 LUMINAIRE SUPPORT

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.

C. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 12 gage.

D. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1.

B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

C. Install lamps in each luminaire.

D. Supports: Sized and rated for luminaire weight.

E. Exit Signs: Exit signs shall be roughed-in to be centered over or above door they are indicating as exit, or in hallways they are installed in. Exit signs in hallways shall be aligned with other lights in the area. Exit signs observed to be installed and not centered with doors or hallways shall be relocated at no additional cost.

F. Flush-Mounted Luminaire Support: Secured to outlet box.

G. Wall-Mounted Luminaire Support:

1. Attached to structural members in walls.
2. Do not attach luminaires directly to gypsum board.

H. Ceiling-Mounted Luminaire Support:

1. Ceiling mount per manufacturer’s recommendations.

I. Suspended Luminaire Support:

1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
3. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and tubing, rod, or wire support for suspension for each unit length of luminaire chassis, including one at each end.
4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

J. Ceiling-Grid-Mounted Luminaires:

1. Secure to any required outlet box.
2. Secure luminaire using approved fasteners in a minimum of four locations, spaced near corners of luminaire.

K. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

L. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 16553 "Identification for Electrical Systems."

M. Where 0-10V dimming is indicated in controls requirements, contractor shall furnish and install 0-10V dimming cabling to each fixture to accomplish dimming control.

N. Where a light fixture is indicated via plan or fixture schedule to be an emergency fixture, contractor shall route unswitched power to light fixture in addition to normal circuit such that fixture will sense an outage and automatically illuminate in an emergency situation.

O. All site lighting pole lights shall be installed to maintain 36” clear from back of curb to edge of concrete pole-base. Field verify final locations with final civil plan and edge of parking lots.

3.2 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

B. Luminaire will be considered defective if it does not pass operation tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 265119

SECTION 266650 - LIGHTNING PROTECTION SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes lightning protection for the building(s) or structures included on the contract drawings. Master Labeled system shall consist of air terminals on roofs, roof-mounted mechanical equipment, chimneys and stacks, and penthouse roofs; bonding of structure and other metal objects; grounding electrodes; and interconnecting conductors

B. The lightning protection system shall be installed by a firm actively engaged in the installation of Master Labeled Lightning Protection Systems and shall be so listed by Underwriters Laboratories Inc. The completed system shall comply with the latest editions of the Installation Requirements for Lightning Protection Systems, UL96A and of the National Fire Protection Association's Lightning Protection Standard NFPA 780.

1.2 ACTION SUBMITTALS

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

B. Shop Drawings: For air terminals and mounting accessories.

1. Layout of the lightning protection system, along with details of the components to be used in the installation.
2. Include indications for use of raceway, data on how concealment requirements will be met, and calculations required by NFPA 780 for bonding of grounded and isolated metal bodies.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Certified by UL, trained and approved for installation of units required for this Project.

B. System Certificate:

1. UL Master Label.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 780, "Definitions" Article.

PART 2 - PRODUCTS

2.1 LIGHTNING PROTECTION SYSTEM COMPONENTS

A. Comply with UL 96 and NFPA 780, LPI 175, and UL 96A..

B. Materials:
1. Copper materials shall not be mounted on aluminum surfaces including Galvalume, galvanized steel and zinc; this includes these materials that have been painted.
2. Aluminum materials shall not come into contact with earth or where rapid deterioration is possible. Aluminum materials shall not come into contact with copper surfaces.

C. Roof-Mounted Air Terminals: NFPA 780, Class I copper unless otherwise indicated.

1. Manufacturers: Subject to compliance with requirements, provide product by one of the following:
a. ERICO International Corporation.
b. Harger.
c. Robbins Lightning, Inc.
d. Thompson Lightning Protection, Inc.

2. Air Terminals More than 24 Inches Long: With brace attached to the terminal at not less than half the height of the terminal.
3. Single-Membrane, Roof-Mounted Air Terminals: Designed specifically for single-membrane roof system materials. Comply with requirements in roofing Sections.
4. Air terminals shall project a minimum of 12 inches above the area protected and shall be located at intervals not exceeding 20'-0" along ridges and around the perimeter of flat or gently sloping roofs. Flat or gently sloping roofs exceeding 50'-0" in width shall be protected with additional air terminals located at intervals into exceeding 50'-0" in the flat or gently sloping area. Air terminals shall be located within two feet or roof edges and outside corners of protected areas. Air terminal spacing exceeding these dimensions are permitted so long as the area protected lies within a zone of protection.
a. Air terminals shall not be less than 12 inches above the object to be protected.
5. Air terminals shall be installed for stacks, flues, mechanical equipment, and other objects not located within a zone of protection. Non-metallic objects or metal objects having a metal thickness of less than 3/16" require the installation of air terminals and required conductors. Objects having a metal thickness 3/16" or greater shall be connected to the lightning protection system per code requirements using main size conductor and connector fittings having 3 square inches of surface contact area.
6. Air terminal mounting bases shall be of cast construction and securely fastened to the structure in accordance with code requirements.
7.

D. Main and Bonding Conductors: Copper
1. Main conductors shall be sized in accordance with the material requirements above and shall provide a two-way path from each air terminal horizontally or downward to connections with ground terminals. Conductors shall be free of excessive splices and sharp bends. No bend of a conductor shall form an included angle of less than 90 degrees nor have a radius of bend of less than 8 inches. Conductors shall be secured to the structure at intervals not exceeding 3'-0".

2. Down conductors shall be copper and shall be concealed in the exterior wall construction. Down conductors shall be spaced at intervals averaging not more than 100 feet around the perimeter of the structure. In no case shall a structure have fewer than two down conductors.
3. In the case of structural steel frame construction, down conductors may be omitted and roof conductors shall be connected to the structural steel frame at intervals averaging not more than 100 feet around the perimeter of the structure. Connections to the steel frame shall be made with bonding plates having 8 square inches of contact or by exothermic weld connections.

E. Ground Loop Conductor: The same size and type as the main conductor except tinned.

F. Ground Rods: Copper-clad 3/4 inch (19 mm) in diameter by 10 feet (3 m) long.

G. Fasteners: Conductor fasteners shall be an approved type of non-corrosive metal, having ample strength to support conductors and shall be spaced not to exceed 3'-0" center. Fasteners shall be suitable configuration of the intended application and of the same material as the conductor or of electrolytically compatible material. Galvanized or plate steels are not acceptable.

H. Roof Penetrations: Roof penetrations required for down conductors or for connections to structural steel framework shall be made using thru-roof assemblies with solid bars and appropriate roof flashing. Conductors shall not pass directly through the roof. Roof flashings compatible with the roofing system shall be furnished and installed by the roofing contractor.

I. Cable Connectors:
1. All above ground cable connectors shall be cast bronze with screw pressure type stainless steel bolts and nuts.
2. Exothermic welds.

J.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install lightning protection components and systems according to UL 96A and NFPA 780.

B. Conceal the following conductors:

1. System conductors.
2. Down conductors.
3. Interior conductors.
4. Conductors within normal view of exterior locations at grade within 200 feet (60 m) of building.

C. Cable Connections: Use exothermic-welded connections for all conductor splices and connections between conductors and other components.

1. Exception: In single-ply membrane roofing, exothermic-welded connections may be used only below the roof level.

D. Air Terminals on Single-Ply Membrane Roofing: Comply with roofing membrane and adhesive manufacturer's written instructions.

3.2 INTERCONNECTION OF METALS

A. All metal bodies within 6 feet of the conductor shall be bonded to the system with approved fittings and conductor. Connections between dissimilar metals shall be made with approved bi-metallic connections.
   1. Bonding of all metallic objects and systems at roof levels and elsewhere on the structure shall be complete. Primary bonds for metal bodies of conductance shall be bonded with appropriate fittings and fill-size conductor; and shall consist of, but not limited to the following: Roof exhaust fans, HVAC units with related piping ductwork, exhaust vents and any other roof piping systems, cooling towers, and rails systems, antenna mast for T.V., radio or microwave, roof ladders, skylights, metal plumbing stacks, etc.
   2. Metal bodies of inductance located within six feet of a conductor or object with secondary cable and fittings. Typical of these are: roof flashings, parapet coping caps, gravel guards, isolated metal building panels or siding, roof drains, down spouts, roof insulation vents and any other sizeable miscellaneous metals, etc.

3.3 GROUNDING

A. Grounding terminals shall be located at the base of the structure. Ground connections to the structural steel frame shall be made around the perimeter of the structure and in no case shall average over 60'-0" apart. Ground connections shall be made using bronze bonding plates having 8 square inches of contact or by exothermic (Cadweld) connections. Class II copper conductors shall be used from the ground connections to the ground rods.

B. Ground rods shall be not less than 3/4 inch diameter and not less than 8 feet long. Ground rods shall be driven to a minimum depth of 10 feet and more if necessary to reach permanent moisture. One ground shall have connection to the water system where the water supply enters the building - in addition to artificial ground.
   1. Ground rods shall be located 3 feet minimum/6 feet maximum from the building wall.

C. All ground terminals shall be interconnected with a ground loop conductor. Size No. 4/0 AWG minimum, unless otherwise noted on drawings.

D. All underground connections, other than inside an access well if provided, shall be exothermic welds.

3.4 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.5 CORROSION PROTECTION

A. Do not combine materials that can form an electrolytic couple that will accelerate corrosion in the presence of moisture unless moisture is permanently excluded from junction of such materials.

B. Use conductors with protective coatings where conditions cause deterioration or corrosion of conductors.

3.6 FIELD QUALITY CONTROL

A. Notify Architect at least 48 hours in advance of inspection before concealing lightning protection components.

B. UL Inspection: Meet requirements to obtain a UL Master Label for system.

END OF SECTION 266650

BLANK

SECTION 283113

FIRE ALARM SYSTEM

PART 1 GENERAL

1.01. WORK INCLUDED:

A. The work included in Division 26 is the installation of the electrical systems as indicated on the drawings and required by the specifications. All provisions of the General Conditiions, Special Conditions, and Instructions to Bidders apply to this work.

1.02. SUBSTITUTIONS:

A. Substitutions of the specified installation materials shall be requested not less than 10 working days prior to the bid date. Such requests for substitution shall detail exact material substitution requested, whether or not such substitution shall provide a cost reduction to the owner, and what material benefit, other than cost, shall accrue to the owner should they entertain this substitution.

B. Requests for substitution approval shall be submitted as follows:

1. Provde a letter of compliance from the equipment manufacturer indicating that the system being proposed meets the requirrements of this specification. Provide this letter of compliance on manufacturer's letterhead and signed by an official authorized to sign such documents.

2. Provide copy of company providing equipments Arkansas State License. Provide copy of Nicet Level III certification of individual within the company supervising this project.

C. SHOP DRAWINGS: The successful contractor shall provide electronic shop drawings immediately after award of the contract. Shop drawings shall be assumed to be "as specified" unless specifically identified as varying from contract requirements. Any variations from "as specified" status shall be specifically identified and their substitution approval status (as approved by B., Substitutions) shall be documented. Shop drawings shall include:

1. Provide equipment cut sheets and a project Bill of Material

2. Provide job specific riser diagram indicating, as a minimum, location of panels, initiating and signaling devices, wire requirements, and boxe sizes.

3. Provide system power and load calcualation documentation report. Show complete battery calculations for the system by panel or transponder. Show load calculations and voltage drop calculations for all notification appliance circuits and signaling line circuits.

4. Provide copy of Nicet Level III certification

5.

D. DRAWINGS AND SPECIFICATIONS: The contractor shall examine the drawings and specifications to ensure that they are familiar with the requirements of the specification as they apply to the intstallation site and the owner's requirements.

E. CODE COMPLIANCE: The contractor is responsible for compying with the proper state and local code authority's plan review and approval process. Copies of code approval submissions and approvals shall be provided to the engineer. The contractor is responsible for the cost of this process.

PART 2 EQUIPMENT

2.01. GENERAL

A. Fire Alarm Control Panel

B. System Front Panel Operation and Capabilities

C. Voice Evacuation Control

D. Multiple Addressable Peripheral Network (Kidde Signature Series SLC or Potter PAD SLC)/Addressable Devices

E. Peripheral Devices

F. Walktest Group Requirements

G. Project Specific Requirements

1. The system specified will constitute the building Life Safety System. The sytem will provide necessary fire and smoke detection as well as providing automatic and manual voice evacuation capability.

2. Each and all items of the Fire Alarm System shall be listed as a product of a SINGLE fire alarm system manufacturer under the appropriate category by Underwriters' Laboratories, Inc. (UL), and shall bear the "U.L." label. All control equipment shall be listed under UL category UOJZ as a single control unit. Partial listing shall NOT be acceptable. In addition to the UL-UOJZ requirement mentioned above, the system controls shall be UL listed for Power Limited Applications and all circuits must be marked in accordance with NEC article 760-23.

3. All control equipment must have transient protection to comply with UL864 requirements.

4. The control panel shall receive 120 VAC power (as noted on the plans) via a dedicated circuit.

5. The system shall be provided with sufficient standby capacity to operate the entire system upon loss of normal 120 VAC power in a normal supervisory mode for a period of twenty-four (24) hours with 15 minutes of alarm operation at the end of this period. The system shall automatically transfer to the standby power source upon power failure. All battery charging and recharging operations shall be automatic.

6. All external circuits requiring system operating power shall be 24VDC and shall be individually fused at the control panel.

2.02. MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include the following:

1. Kidde VM-Series or Potter IPA-4000V (Specified Equipment)

2.03. FIRE ALARM CONTROL PANEL - Kidde VM-Series or Potter IPA-4000V Voice Control Panel

A. Control Panel construction shall be modular with solid state, microprocessor based electronics. It shall display only those primary controls and displays essential to operation during a fire alarm condition. Keyboards or keypads shall not be required to operate the system during fire alarm conditions.

1. A local audible device shall sound during Alarm, Trouble or Supervisory conditions. This audible device shall sound differently during each condition to distinguish one condition from another without having to view the panel. This audible device shall also sound during each keypress to provide an audible feedback to ensure that the key has been pressed properly.

B. Primary Keys, LED's and LCD Display

1. The Control Panel shall have a 2 line x 40 character liquid crystal display which shall be backlit for enhanced readability. So as to conserve battery standby power, it shall not be lit during an AC power failure unless an alarm condition occurs or there is keypad activity.

2. The display shall support both upper and lower case letters. Lowercase letters shall be used for softkey titles and prompting the user. Uppercase letters shall be used for System Status Information. A cursor shall be visible when entering information.

3. The LCD display shall have the capability of annunciating up to 2500 points.

C. System Point Capacity

1. Point capacity shall support any combination of addressable monitor or control points, e.g., all points can be monitor, all points can be control, or any combination of monitor and control.

2.04. SYSTEM PANEL OPERATION AND CAPABILITIES

A. The system alarm operation subsequent to the alarm activation of any manual station, automatic detection device, or sprinkler flow switch shall be as follows:

1. A digitized emergency message shall be transmitted to all speaker zones activated for that alarm. The alarm message shall be preceded by a chime tone and then repeated three times This message sequence shall repeat at one minute intervals and a temporal chime pattern shall sound during the time between messages.

2. All visible alarm indicating appliances shall flash continuously until the the system is reset. To reduce the risk of seizure induced by an individual viewing more than 2 strobes flashing asynchronously the fire alarm strobes shall be synchronized. The strobes shall flash at the rate of once per second and all strobes at the same instant. This shall be accomplished in a UL listed manner.

3. Alarm indicating appliances shall operate selectively by area in a programmed sequence. Exact manner of operation will be detailed by the engineer prior to installation.

4. Any subsequent zone alarm shall reactivate the alarm indicating appliances.

B. The fire alarm control panel shall control and communicate with remote power supplies through a Networked Fiber Optic Backbone. At each remote power supply shown provide a break out panel for fiber optics terminations and provide fiber optic patch cords that will be connected to fiber optic modules in the remote power supply. This shall allow for distributed processing of alarm input and output functions. Each remote power supply shall provide 8 amps of power to be used for Audible and Visual circuits. Each remote power supply shall have battery backup for 24hr standby with 5 minutes of alarm.

C. The alarm shall be displayed on an 80 character LCD display. The top line of 40 characters shall be the point label and the second line shall be the device type identifier. The system alarm LED shall flash on the control panel until the alarm has been acknowledged. Once acknowledged, this same LED shall latch on. A subsequent alarm received from another zone shall flash the system alarm LED on the control panel. The LCD display shall show the new alarm information.

D. The system will monitor the smoke detection operation of the the system sensors to provide "two stage" operation. When an individual smoke sensor senses smoke at a .2%/.5% or 1% obscuration level (desired level will be indicated for each device by the owner) a supervisory notice shall be generated. This condition shall cause a message to be shown on the control panel indicating the need for investigation of this condition. This operation is designed to provide staff with the opportunity to investigate situations where very low amounts of smoke are generated, e.g., a smoldering fire condition that typically takes a long time to develop. When the sensor level reaches its programmed alarm level, 2.5% obcuration typical, the normal system alarm sequence will take place.

E. The system shall support the same multi-stage operation when used with heat sensors, e.g., a software selectable level for supervisory notification and a higher, alarm causing, temperature level.

F. The control panel shall have a dedicated supervisory service LED and a dedicated supervisory service acknowledge switch for the annunciation and acknowledgement of sprinkler supervisory functions (OS&Y, PIV, etc.).

G. History Logging

1. The system shall be capable of logging and storing 300 events in an alarm log and 300 events in a trouble log. These events shall be stored in a battery protected random access memory. Each recorded event shall include the time and date of that event's occurrence.

H. Audible Walktest

1. The system shall be capable of being tested by one person. When in the walk test mode the system shall announce the zone being tested or the digital address of the device being tested as each device or zone is activated. System shall announce that testing is completed when system is returned to normal.

I. Silent Walktest with History Logging

1. While in thistesting mode the alarm activation of an initiating device circuit shall be silently logged as an alarm condition in the historical data file. The panel shall automatically reset itself after logging of the alarm.

J. Visual Walktest with History Logging

1. While in a testing mode the activation of any initiating device will cause the system visual devices to flash in response to that activation. Visuals shall flash

twice each time a device is activated. A separate visual indication shall be provided for activation of trouble conditions or supervisory conditions.

2.05. ONE-WAY VOICE COMMUNICATION

A. Provide one-way voice communication and tone generating capabilities.

B. A central audio control module shall be provided for the necessary alarm message/tone generation, main and remote microphone connections, music inputs and mixer/pre-amplifier circuits. Continuous supervision shall be provided. Audio outputs shall have individual gain control.

C. A hand-held, push-to-talk microphone shall be provided recessed within a protective panel-mounted enclosure. The microphone shall be a dynamic communication type with a frequency range of 200 Hz to 4000 Hz and shall be equipped with a self-winding five foot coiled cable. An LED indicator shall be provided to indicate microphone push-to-talk button has been pressed and speaker circuits are ready for transmission. Microphone shall be supervised from disconnection.

D. An audio control switch module shall be furnished to provide manual control of the audio functions. These switches and associated LED indicators shall be supervised from disarrangement or failure.

E. Audio power amplifiers shall be furnished with self-contained filtered 24VDC power supply, transformer and, amplifier monitor circuits. Amplifiers shall provide a 25 VRMS or 75 VRMS output with a frequency response of 120Hz to 12,000Hz. Provide a sufficient quantity of amplifiers to operate, at rated wattage, all system speakers simultaneously plus twenty (20) percent spare capacity. For Sanctuary, Gymnasium and Pool area provide High DB Speakers rated at 116 DBA at 10 feet.

F. Tones. Digitized tones for alarm or auxiliary requirements shall be available. Tone requirements are as follows.

1. The Slow Whoop shall be a slowly ascending tone from 200 to 830 HZ in 2.5 seconds.

2. The Wail shall ascend and descend from 600 to 940 HZ.

3. The Beep shall be a 470 HZ tone. The time duration shall be 0.7 seconds on and 0.7 seconds off.

4. The Horn shall be a continuous 470 HZ tone.

5. The Stutter shall be a 470 HZ tone which is on for 100 milliseconds and off for 100 milliseconds.

6. The Chime shall be a 700 HZ tone with a 1.5 second delay time.

7. The Coded Horn shall be a 470 HZ tone designed specifically for use on a coded system.

8. The Hi/Lo shall be a free running tone with a high frequency of 544 HZ and a low frequency of 440 HZ. The "on time" (Hi) shall be 100 milliseconds while the "off time" (Lo) is 400 milliseconds.

G. A pre-recorded digitized voice message capability shall be provided for automatic transmission to building occupants during alarm conditions. Multiple messages specific to the condition and the area of the building shall be provided.

H. Message requirements for this project are detailed in 2.7, Project Specific Requirements. All clear messages shall be for each condition, e.g., "all clear fire alarm condition", "all clear severe weather condition"; blanket all clear statements are not acceptable.

I. Provide the alarm, severe weather, and all clear messages in English. Provide these messages in either a male or a female voice, or both, as the owner directs.

J. Messages shall be factory digitized from transcripts approved by the engineer. Manufacturer shall maintain digital archival records of the messages as an owner backup copy.

K. The message player shall not rely on a tape or other mechanical means of generating the system messages. The message player must be capable of transmitting a custom digital message of up to four minutes in length or a four minute long “string” of digitized tones, words and phrases that may be software “spliced” to create customized messages.

2.06. MULTIPLE ADDRESSABLE PERIPHERAL NETWORK (Kidde Signature Series SLC or Potter PAD SLC)

A. Communication with addressable devices. The system must provide communication with initiating and control devices individually. All of these devices will be individually annunciated at the control panel.

B. All addressable devices shall have the capability of being disabled or enabled individually.

C. Up to 250 addressable devices may be multidropped from a single pair of wires. Systems that require factory reprogramming to add or delete devices are unacceptable.

D. Format

1. The communication format must be a completely digital poll/response protocol to allow t-tapping of the circuit wiring. A high degree of communication reliability must be obtained by using parity data bit error checking routines for address codes and check sum routines for the data transmission portion of the protocol. Systems that do not utilize full digital transmission protocol are not acceptable.

E. Device Replacement

1. Both smoke and heat sensors must be able to be changed by the owner without the need to set addresses or perform other technical tasks to accomplish sensor changes. This requirement is to decrease long term maintenance costs as well as ensuring that the owner can utilize non-technical staff to change, for example, a dirty sensor in a timely fashion.

2. (Note) When a heat sensor is installed in a base programmed as a smoke sensor the system will initiate a trouble condition but will allow the heat detector to operate normally in this location. This functionality allows the owner to remove smoke detectors and install heat detectors in their place during periods of construction).

F. Addressable Device Types

G. General Requirements

1. The system control panel, must be capable of communicating with the types of addressable devices specified below. Addressable devices will be located as shown on the drawings and as required to meet code and all AHJ requirements.

The location of addressable devices will be selected along with conventional devices to optimize the system layout in order to provide the level of protection, zone identification and control as shown on the drawings.

2. All addressable smoke and heat detector heads as specified below will be pluggable into their bases. The base will contain electronics that communicate the detector status (normal, alarm, trouble) to the control panel over two wires. The same two wires shall also provide power to the base and detector. Different detector heads (smoke or heat) must be interchangeable. Upon removal of the head, a trouble signal will be transmitted to the control panel.Addressable Detector Bases – Kidde SIGA-SB (Signature Series Detector Base) or Potter PAD100-DB.

3. Photoelectric Detector Head – Kidde SIGA-PS (Signature Series Photoelectric Smoke Detector) or Potter PAD100-PS

    a. The Photoelectric type detector shall be a plug-in unit which mounts to a twist-lock base, and shall be UL approved.

    b. The detectors shall be of the solid state photoelectric type and shall contain no radioactive material. They will use a pulsed infrared LED light source and be sealed against rear air flow entry.

    c. The detector shall fit into a base that is common with both the heat detector and ionization type detector and shall be compatible with other addressable detectors, addressable manual stations, and addressable Zone Adapter Modules on the same circuit.

    d. There shall be no limit to the number of detectors or Zone Adapter Modules which may be activated or "in alarm" simultaneously.

4. Addressable Analog Thermal Detector Head – Kidde SIGA-HRS (Signature Series Multi-Sensor Heat Detector) or Potter PAD100-HD

    a. Thermal detector heads must be analog devices. They will be a programmable for fixed and/or rate of rise operation in accordance with the engineer's instructions.

5. Addressable Pull Stations – Kidde SIGA-270 or SIGA-278 (Signature Series Addressable Pull Station) or Potter PAD100-PD

    a. Provide addressable, push double action pull stations.

    b. Pull stations will be key reset, common keyed. Pull station locks and control panel locks shall be keyed alike.

    c. Provide protective wire guards for Gymnasium devices.

6. Addressable Photoelectric Duct Detector – Kidde GSA-SD (Signature Series SuperDuct Photoelectric Duct Detector) or Kidde DS-SD (SmartOne Addressable Duct Detector) or Potter PAD100-DD

    a. The detector shall be a non polarized 24VDC type which is compatible with the Fire Alarm Panel and obtains its operating power from the supervisory current in the fire alarm detection loop.

    b. Provide with appropriate length sampling tubes.

c. Provide unit with programmable relay for HVAC interface.

d. For concealed units provide a remote LED/Test remote device located below the ceiling level directly beneath the unit being monitored.

7. Individual Addressable Module – Kidde SIGA-CT1 (Signature Series Single Input Module) or Potter PAD100-IM

a. Zone Adapter Modules shall be used for monitoring of waterflow, valve tamper, Halon Control Panels, non-addressable detectors, and for control functions for elevators, etc.

8. Addressable Device Supervision

a. All devices shall be supervised for trouble conditions. The system control panel will be capable of displaying the type of trouble condition (open, short, device missing/failed).

b. Should a device fail, it will not hinder the operation of other system devices.

2.07. PERIPHERAL DEVICES

A. Fire Alarm Strobes – Kidde/Edwards (VM-Series) or Potter – 49VO-WWF/WRF

1. Where indicated on the drawings provide visible notification appliances. Units shall utilize a polycarbonate lens design incorporating a multi-surface relector providing symmetrical light output in key axis directions. Lens assembly shall lock on to the base to provide an impact and vandal resistant assembly. Strobe shall be UL listed to Standard 1971 and comply with the requirements of the Americans with Disabilities Act. Units shall be available in red or off-white style. Utilize red for this project.

2. All visible alarm indicating appliances (whether standalone or mounted to an AV) shall flash continuously until the system is silenced or reset as directed by the owner. To reduce the risk of seizure induced by an individual viewing multiple strobes flashing asynchronously the fire alarm strobes shall be synchronized. The strobes shall flash at the rate of once per second and all strobes on each individual signal circuit shall flash at the same instant. This shall be accomplished in a UL listed manner.

3. Visible alarm indicating appliances shall accept a coded input signal, e.g., it shall be possible through software to cause the strobes to flash in a temporal , march time, or other selected pattern.

B. Fire Alarm Speakers (High Ambient) – Kidde G4HF-SPKR (Genesis High-Fidelity Speaker, 25/70 VRMS) or Potter AVSP

1. Where indicated on the drawings provide high ambient fire alarm speaker.

2. Speaker shall be of die-cast contstruction providing wattage tap15 watts.

3. Speaker shall be capable of 116 dBA output at 10' when driven by a 1000 hz signal. Units shall be UL listed to Standard 1480.

4. Speaker shall be capable of either 25VRMS or 70VRMS inputs.

C. Fire Alarm Speaker/Strobes –Horn/Stobes Kidde or Potter – 49SV-APPLW

1. Where indicated on the drawings provide fire alarm speaker/strobe units.

2. These combination units shall be UL listed to Standards 1971 and 1480 and feature wattage taps of 1/4, 1/2, 1, and 2 watts.

3. Speaker shall be capable of a minimum 85 dBA output at 10' when driven with a 1000 hz signal.

4. The unit shall be available in red or off-white. Utilize Red or White for this project.

5. All other areas not considered assembly shall utilize combination Horn/Strobe units and shall meet requirements of visual strobe units in item A. Units shall be Red or White in color for this project.

D. Fire Alarm Speakers Kidde/Edwards or Potter – 49SO-APPLW (wall mount)

1. Where indicated on the drawings provide fire alarm wall mounted speaker units.

2. These units shall be UL listed to Standards 1971 and 1480 and feature wattage taps of 1/4, 1/2, 1, and 2 watts.

3. Speaker shall be capable of a minimum 85 dBA output at 10' when driven with a 1000 hz signal.

2.08. WALKTEST GROUP REQUIREMENTS

A. A. In order to facilitate testing of various areas and subsystems within the building, Walktest groups shall be provided. Walktest groups are software partitions within the fire alarm control software that allow testing of portions of the fire alarm system without a loss of protection in those areas not being tested.

2.09. PROJECT SPECIFIC REQUIREMENTS

A. The following are system requirements that apply to this project. Fiber Optic Network with break out panels for connecting the Main FACP with remote power supplies.

2.10. REMOTE ANNUNCIATOR Kidde/Edwards (VM-Series) or Potter – 4603-9101

A. Where indicated on the drawings provide a serial LCD remote annuciator. Remote annuciator shall have an 80 character display for ease of device location.

B. Remote annuciator shall have power on led, system trouble led and sounder.

C. Annuciator shall have capabilities of remote signal silence and remote reset, but shall be key activated, to control use of these functions. Remote annunciator shall have capability of 4 remote key commands, which could be used for remote bypass of system functions. These remote command keys shall also be key activated.

D. Unit shall mount in a standard wiremold six gang backbox.

PART 3 EXECUTION

3.01. INSTALLATION

A. Provide and install the system in accordance with the plans and specifications, all applicable codes and the manufacturer's recommendations. All wiring shall be installed in strict compliance with all the provisions of NEC - Article 760 A and C, Power-Limited Fire Protective Signaling Circuits or if required may be reclassified as non-power limited

and wired in accordance with NEC-Article 760 A and B. Upon completion, the contractor shall so certify in writing to the owner and general contractor.

B. Installation of equipment and devices that pertain to other work in the contract shall be closely coordinated with the appropriate subcontractors.

C. The contractor shall clean all dirt and debris from the inside and the outside of the fire alarm equipment after completion of the installation.

D. The manufacturer's authorized representative shall provide onsite supervision of installation.

3.02. TESTING

A. The completed fire alarm system shall be fully tested in accordance with NFPA-72H by the contractor in the presence of the owner's representative and the Local Fire Marshal. Upon completion of a successful test, the contractor shall so certify in writing to the owner and general contractor.

3.03. WARRANTY

A. The contractor shall warrant the completed fire alarm system wiring and equipment to be free from inherent mechanical and electrical defects for a period of one (1) year from the date of the completed and certified test or from the date of first beneficial use.

B. The equipment manufacturer shall make available to the owner a maintenance contract proposal to provide a minimum of two (2) inspections and tests per year in compliance with NFPA-72H guidelines.

END OF SECTION

GREENBRIER BAND HALL
GREENBRIER, AR

Civil Specifications

Feb. 27, 2026

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The Engineer of Record for the
Greenbrier Band Hall
Greenbrier, Arkansas is:



Date 02/27/2026

Crafton, Tull & Associates, Inc. Project # 25801201

SECTION 31 00 00

SITE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes

B. Section Includes
1. Demolition of structures, paving, and utilities.
2. Filling voids created as a result of removals or demolition.

C. Related Sections
1. Section 311000 - Site Clearing
2. Section 312000 - Earthwork

1.2 REGULATORY REQUIREMENTS

A. Conform to applicable State and local codes for demolition of structures, safety of adjacent structures, dust control, and runoff control.

B. Obtain required permits and licenses from appropriate authorities. Pay associated fees including disposal charges.

C. Notify affected utility companies before starting work and comply with their requirements.

D. Do not close or obstruct public or private roadways, sidewalks, or fire hydrants without appropriate permits or written authorization.

E. Conform to applicable regulatory procedures when hazardous or contaminated materials are discovered.

F. Test soils around buried tanks for contamination.

1.3 SUBMITTALS

A. Project Record Documents: Accurately record actual locations of capped utilities and subsurface obstructions that will remain after demolition. Submit record as part of closeout submittals.

1.4 PROJECT CONDITIONS

A. Structures to be demolished will be discontinued in use and vacated prior to start of work.

B. Owner assumes no responsibility for condition of structures to be demolished.

C. Conditions existing at time of inspection for bidding purposes will be maintained by Owner as reasonably practical. Variations within structures may occur by Owner's removal and salvage operations prior to start of demolition work.

D. Unless otherwise indicated in Contract Documents or specified by the Owner, items of salvageable value to Contractor shall be removed from site and structures. Storage or sale of removed items on site will not be permitted without consent of the Owner and shall not interfere with other work specified.

E. Explosives shall not be brought to site or used without written consent of authorities having jurisdiction. Such written consent will not relieve Contractor of total responsibility for injury to persons or for damage to property due to blasting operations. Performance of required blasting shall comply with governing regulations.

PART 2 - PRODUCTS

2.1 FILL MATERIALS

A. Fill material shall be aggregate fill materials as specified in Section 312000.

PART 3 - EXECUTION

3.1 PREPARATION

A. Provide, erect, and maintain erosion control devices, temporary barriers, and security devices at locations indicated on Construction Drawings.

B. Protect existing landscaping materials, appurtenances, and structures, which are not to be demolished. Repair damage to existing items to remain caused by demolition operations.

C. Prevent movement or settlement of adjacent structures. Provide bracing and shoring as necessary.

D. Mark location of utilities. Protect and maintain in safe and operable condition utilities that are to remain. Prevent interruption of existing utility service to occupied or used facilities, except when authorized in writing by authorities having jurisdiction. Provide temporary services during interruptions to existing utilities as acceptable to governing authorities and Owner.

E. Notify adjacent property owners of work that may affect their property, potential noise, utility outages, or other disruptions. Obtain written permission from adjacent property owners when demolition equipment wi

3.2 GENERAL DEMOLITION REQUIREMENTS

A. Conduct demolition to minimize interference with adjacent structures or pavements to remain.

B. Cease operations immediately if adjacent structures appear to be in danger. Notify authority having jurisdiction. Do not resume operations until directed by authority.

C. Conduct operations with minimum of interference to public or private access. Maintain ingress and egress at all times.

D. Sprinkle work with water to minimize dust. Provide hoses and water connections for this purpose.

E. Comply with governing regulations pertaining to environmental protection.

F. Clean adjacent structures and improvements of dust, dirt, and debris caused by demolition operations. Return adjacent areas to condition existing prior to start of work.

3.3 DEMOLITION

A. Demolish site improvements designated to be removed as shown on the drawings. Site improvements shall include but not be limited to structures, retaining walls, foundations, pavements, curbs and gutters, drainage structures, utilities, signage or landscaping.

B. Disconnect and cap or remove utilities to be abandoned as shown on the drawings.

C. Fill or remove underground tanks, piping, and appurtenances as shown.

D. Demolish buildings completely and remove from site using methods as required to complete work within limitations of governing regulations. Small structures may be removed intact when acceptable to Owner and authorities having jurisdiction.

E. Locate demolition equipment and remove materials to prevent excessive loading to supporting walls, floors, or framing.

F. Demolish concrete and masonry in small sections. Break up concrete slabs-on-grade that are 2-feet or more below proposed subgrade to permit moisture drainage. Remove slabs-on-grade and below grade construction within 2-feet of proposed subgrade.

3.4 FILLING BASEMENTS AND VOIDS

A. Completely fill below grade areas and voids resulting from demolition or removal of structures, underground fuel storage tanks, wells, cisterns, etc., using aggregate fill materials consisting of stone, gravel, or sand free from debris, trash, frozen materials, roots, and other organic matter.

B. Areas to be filled shall be free of standing water, frost, frozen or unsuitable material, trash, and debris prior to fill placement.

C. Place fill materials in accordance with Section 02300 unless subsequent excavation for new work is required.

D. Grade surface to match adjacent grades and to provide flow of surface drainage after fill placement and compaction.

3.5 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove from site debris, rubbish, and other materials resulting from demolition operations. Leave areas of work in clean condition.

B. No burning of any material, debris, or trash on-site or off-site will be allowed except when allowed by appropriate governing authority and Owner. If allowed as stated above, burning shall be performed in manner prescribed by governing authority. Attend burning materials until fires have burned out and have been completely extinguished.

C. Transport materials removed from demolished structures with appropriate vehicles and dispose off-site to areas that are approved for disposal by governing authorities and appropriate property owners.

END OF SECTION

SECTION 31 10 00

SITE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes
   1. Cleaning site of debris, grass, trees, and other plant life in preparation for site or building earthwork.
   2. Protection of existing structures, trees, or vegetation indicated on the Construction Drawings to remain.

B. Related Sections
   1. Section 310000 - Site Demolition
   2. Section 312000 - Earthwork

1.2 ENVIRONMENTAL REQUIREMENTS

A. Construct temporary erosion control systems as shown on Construction Drawings or as directed by the "Storm Water Pollution Prevention Plan" (SWPPP) to protect adjacent properties and water resources from erosion and sedimentation.

B. In event that sitework on this project will disturb 1 or more acres; Contractor shall not begin construction without "National Pollution Discharge Elimination System" (NPDES) permit governing discharge of storm water from site for entire construction period. NPDES permit requires SWPPP to be in place during construction.

C. Contractor shall conduct storm water management practices in accordance with NPDES permit and shall enforce action taken or imposed by Federal or State agencies, including cost of fines, construction delays, and remedial actions resulting from Contractor's failure to comply with provisions of NPDES permit.

1.3 PROJECT CONDITIONS

A. Conditions existing at time of inspection for bidding purposes will be maintained by Owner as reasonably practical.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 PREPARATION

A. Identify existing plant life that is to remain and verify clearing limits are clearly tagged, identified, and marked in such manner as to ensure their protection throughout construction operations.

3.2 PROTECTION

A. Locate, identify, and protect existing utilities that are to remain.

B. Protect trees, plant growth, and features designated to remain as part of final landscaping.

C. Conduct operations with minimum interference to public or private accesses and facilities. Maintain ingress and egress at all times and clean or sweep roadways daily as required by SWPPP or governing authority. Dust control shall be provided with sprinkling systems or equipment provided by Contractor.

D. Protect benchmarks, property corners, and other survey monuments from damage or displacement. If marker needs to be removed it shall be referenced by a licensed land surveyor and replaced, as necessary, in kind.

E. Provide traffic control as required, in accordance with the US Department of Transportation's "Manual on Uniform Traffic Control Devices" and applicable state highway department requirements.

3.3 EQUIPMENT

A. Material shall be transported to and from the project site using well-maintained and operating vehicles. Transporting vehicles operating on site shall stay on designated haul roads and shall not endanger improvements by rutting, overloading, or pumping.

3.4 CLEARING

A. Clear areas required for access to site and execution of work.

B. Unless otherwise indicated on Construction Drawings, remove trees, shrubs, grass, other vegetation, improvements, or obstructions interfering with installation of new construction. Removal includes digging out stumps and roots. Depressions caused by clearing and grubbing operations shall be filled to subgrade elevation to avoid ponding of water. Satisfactory fill material shall be placed in accordance with Section 312000.

C. Remove grass, trees, plant life, stumps, and other construction debris from site to dump site that is suitable for handling such material according to state laws and regulations.

D. Cut heavy growths of grass from areas before stripping and topsoil removal and remove cuttings with remainder of cleared vegetative material.

END OF SECTION

SECTION 31 20 00

EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Excavation, filling, and backfilling for structures and pavement.
2. Trenching and backfilling for utilities.
3. Dewatering.
4. Boring under crossings.

B. Related Sections
1. Section 312800 - Erosion Control and Sedimentation

C. Order of Precedence: Geotechnical Engineering Report specifies requirements for earthwork preparation and placement of fill. The foundation design and site grading recommendations shall take precedence over the provisions of this section whenever duplication or conflict occurs.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM)
5. ASTM D 422 - Standard Test Method For Particle Size Analysis of Soil
6. ASTM D 698 - Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN.m/m^3))
7. ASTM D 1557 - Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 Kn.m/m^3))
8. ASTM D 2922 - Density of Soil and Soil-Aggregate In Place by Nuclear Methods (Shallow Depth)
9. ASTM D 4318 - Liquid Limit, Plastic Limit, and Plasticity Index of Soils

B. American Association of State Highway and Transportation Officials (AASHTO)
1. AASHTO T 88 - Particle Size Analysis of Soils

C. State Department of Transportation (DOT):
1. Standard Specifications for Construction and Materials

D. National Fire Protection Association (NFPA)
1.NFPA 70 - National Electrical Code

E. American Water Works Association (AWWA)
1. AWWA C200 - Standard For Steel Water Pipe - 6 In. (150 Mm) And Larger
2. AWWA C206 - Field Welding Of Steel Water Pipe

1.3 QUALITY ASSURANCE

A. An independent testing laboratory, selected and paid for by the Contractor, will be retained to perform construction testing on site.

1. The independent testing laboratory shall prepare test reports that indicate test location, elevation data, and test results. Owner, Civil Engineering Consultant, and Owner shall be provided with copies of reports within 96 hours of time that test was performed. In event that test performed fails to meet Specifications,the independent testing laboratory shall notify Owner and Contractor immediately.
2. Costs related to retesting due to failures shall be paid for by the Contractor at no additional expense to Owner. Contractor shall provide free access to site for testing activities.
3. Quality assurance testing will be conducted in accordance with Paragraph "Field Testing" in Part 3 hereinafter.

1.4 DEFINITIONS

A. Satisfactory Soils: ASTM D 2487 soil classification groups GW, GP, GM, SW, SP, and SM, or a combination of these group symbols; free of rock or gravel larger than allowed for fill or backfill material as specified hereinafter or as shown on the drawings. Satisfactory soil shall contain no debris, waste, frozen materials, vegetation, and other deleterious matter.

B. Unsatisfactory Materials: Materials which do not comply with the requirements for satisfactory materials are unsatisfactory including materials classified in ASTM D 2487 soil classification groups GC, SC, ML, MH, CL, CH, OL, OH, and PT, or a combination of these group symbols.

1. Unsatisfactory materials also include man-made fills; trash; refuse; backfills from previous construction; and material classified as satisfactory which contains root and other organic matter or frozen material. The Contracting Officer shall be notified of any contaminated materials.
2. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

1.5 SUBMITTALS

A. Submit 30-pound sample of each type of off-site fill material that is to be used at the site in airtight containers to the independent testing laboratory or submit gradation and certification of aggregate material that is to be used at the site to the independent testing laboratory for review.

B. Submit certification that all material obtained from off-site sources complies with specification requirements.

C. Submit name of each material supplier and specific type and source of each material. Change in source throughout project requires approval of Owner.

D. If fabrics or geogrids are to be used, design shall be submitted for approval to Owner.

E. Submit Dewatering Plans upon request by Owner.

F. Shop drawings or details pertaining to excavating and filling are not required unless otherwise shown on the Drawings or if contrary procedures to Construction Documents are proposed.

G. Shop drawings or details pertaining to site utilities are not required unless required by regulatory authorities or unless uses of materials, methods, equipment, or procedures that are contrary to The Drawings or Specifications are proposed. Do not perform work until Owner has accepted required shop drawings.

H. Contact utility companies and determine if additional easements will be required to complete project. Provide written confirmation of the status of all easements to Owner at time of Preconstruction Conference or no later than 90 days prior to project possession date.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Fill and Backfill. Satisfactory soil materials excavated from the site.

B. Imported Fill Material: Satisfactory borrow material provided from offsite borrow areas when sufficient satisfactory soil materials are not available from required excavations.

C. Trench Backfill: ASTM D 2321 unless otherwise specified or shown on the drawings.

D. Building Subbase Material: Subbase for building and appurtenances slabs on ground is specified in Section 03300 or 03312 as applicable.

E. Bedding: Aggregate Type as indicated on the plans or naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.

F. Drainage Fill: Washed, narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

G. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and 0 to 5 percent passing a No. 4 sieve.

H. Topsoil: Topsoil shall consist of stripping material excavated from the site. Topsoil shall consist of organic surficial soil found in depth of not more than 12-inches. Topsoil shall be as further defined in Section 329300 – Planting.

I. Filter and drainage fabrics: As specified in Section 312800.

J. Steel Casing Pipe: Comply with AWWA C200 minimum grade B, size, and wall thickness as indicated on The Drawings.

K. Trench Utility Locator Tape: Heavy duty 6" wide underground warning tape. Tape shall be made from polyethylene material, 3.5 mils thick, with a minimum tensile strength of 1,750 psi. Place the tape at one-half the minimum depth of cover for the utility line or a maximum of 3 feet,

which ever is the less, but never above the top of subgrade. Color of tape shall be determined by as follows:

3. Natural Gas or Propane - Yellow
4. Electric - Red
5. Telephone – Orange
6. Water – Blue
7. Sanitary Sewer – Green

2.3 EQUIPMENT

A. Transport off-site materials to project using well-maintained and operating vehicles. Once on site, transporting vehicles shall stay on designated haul roads and shall at no time endanger improvements by rutting, overloading, or pumping.

2.4 SOURCE QUALITY CONTROL

A. Laboratory testing of materials proposed for use in the project shall be by the Independent Testing Laboratory at no cost to Owner. The Contractor shall provide samples of material obtained off-site.

B. In areas to receive pavement, California Bearing Ratio (CBR) or Limerock Bearing Ratio (LBR) tests shall be performed for each type of material that is imported from off-site. CBR or LBR value shall be equal to or above pavement design subgrade CBR or LBR value indicated on Construction Drawings

C. Following tests shall be performed on each type of on-site or imported soil material used as compacted fill:

1. Moisture and Density Relationship: ASTM D 698 or ASTM D 1557.
2. Mechanical Analysis: AASHTO T 88 or ASTM D422.
3. Plasticity Index: ASTM D 4318

PART 3 - EXECUTION

3.1 PREPARATION

A. Identify required lines, levels, contours, datum, elevations, and grades necessary for construction as shown on the drawings.

B. Notify utility companies to remove or relocate public utilities that are in conflict with proposed improvements.

C. Protect plant life, lawns, fences, existing structures, sidewalks, paving, and curbs, unless otherwise noted on the drawings from excavating equipment and vehicular traffic.

D. Protect benchmarks, property corners, and other survey monuments from damage or displacement. If marker needs to be removed it shall be referenced by licensed land surveyor and replaced, as necessary, by same.

E. Remove from site, material encountered in grading operations that, in opinion of Owner or the Contractor's Independent Testing Laboratory (ITL) is unsuitable or undesirable for backfilling,

subgrade, or foundation purposes. Dispose of in manner satisfactory to Owner. Backfill areas with layers of suitable material and compact as specified herein.

F. Prior to placing fill in low areas, such as previously existing creeks, ponds, or lakes, perform following procedures:

1. Drain water out by gravity with ditch having flow line lower than lowest elevation in low area. If drainage cannot be performed by gravity ditch, use adequate pump to obtain the same results.
2. After drainage of low area is complete, remove muck, mud, debris, and other unsuitable material by using acceptable equipment and methods that will keep natural soils underlying low area dry and undisturbed.
3. All muck, mud, and other materials removed from low areas shall be dried on-site by spreading in thin layers for observation by the ITL. Material shall be inspected and, if found to be suitable for use as fill material, shall be incorporated into lowest elevation of site filling operation, but not under building subgrade or within 8'-0" of perimeter of building subgrade or paving subgrade. If, after observation by the ITL, material is found to be unsuitable, unsuitable material shall be removed from site.

G. Locate and identify utilities that have previously been installed and protect from damage.

H. Locate and identify existing utilities that are to remain and protect from damage.

I. Maintain in operating condition existing utilities, previously installed utilities, and drainage systems encountered in utility installation. Repair surface or subsurface improvements shown on The Drawings.

J. Verify location, size, elevation, and other pertinent data required making connections to existing utilities and drainage systems as indicated on The Drawings.

K. Over excavate and properly prepare areas of subgrade that are not capable of supporting proposed systems. Stabilize these areas by using acceptable geotextile fabrics or aggregate material placed and compacted.

3.2 DEWATERING

A. General:

1. Provide dewatering systems as required for excavations.
2. Design and provide dewatering system using accepted and professional methods consistent with current industry practice to eliminate water entering the excavation under hydrostatic head from the bottom or sides. Design system to prevent differential hydrostatic head, which would result in floating out soil particles in a manner, termed as a “quick” or “boiling” condition. System shall not be dependent solely upon sumps or pumping water from within the excavation where differential head would result in a quick condition, which would continue to worsen the integrity of the excavation’s stability.
3. Provide dewatering system of sufficient size and capacity to prevent ground and surface water flow into the excavation and to allow Work to be installed in a dry condition.
4. Control, by acceptable means, all water regardless of source. Contractor shall be responsible for disposal of the water.

5. Confine discharge piping or ditches to available easement or to additional easement obtained by Contractor. Provide necessary permits or easement.
6. Control groundwater in a manner that preserves strength of foundation soils, does not cause instability or raveling of excavation slopes, and does not result in damage to existing structures. Where necessary, lower water level in advance of excavation utilizing wells, wellpoints, jet educators, or similar positive methods. The water level as measured by piezometers shall be maintained a minimum of 3 feet below prevailing excavation level.
7. Commence dewatering prior to any appearance of water in excavation and continue until Work is complete to the extent that no damage results from hydrostatic pressure, flotation, or other causes.
8. Open pumping with sumps and ditches will be allowed provided it does not result in boils, loss of fines, softening of the ground, or instability of slopes.
9. Install wells or wellpoints, if required, with suitable screens and filters so that continuous pumping of fines does not occur. Arrange discharge to facilitate collection of samples by the Owner. During normal pumping and upon development of wells, levels of fine sand or silt in the discharge water shall not exceed 5 ppm. Install sand tester on discharge of each pump during testing to verify that levels are not exceeded.
10. Control grading around excavations to prevent surface water from flowing into excavation areas.
11. No additional payment will be made for any supplemental measures to control seepage, groundwater, or artesian head.

B. Design:
1 Designate and obtain the services of a qualified dewatering specialist to provide dewatering plan as may be necessary to complete the Work.
2. Contractor shall be responsible for the accuracy of the drawings, design data, and operational records required.
3. Contractor shall be responsible for the design, installation, operation, maintenance, and any failure of any component of the system.

C. Damages:
1. Contractor shall be responsible for and shall repair any damage to work in place, other contractor's equipment, utilities, residences, highways, roads, railroads, private and municipal well systems, adjacent structures, natural resources, habitat, existing wells, and the excavation. Contractor responsibility shall also include, damage to the bottom due to heave and including but not limited to, removal and pumping out of the excavated area that may result from Contractor's negligence, inadequate or improper design and operation of the dewatering system, and any mechanical or electrical failure of the dewatering system.
2. Remove subgrade materials rendered unsuitable by excessive wetting and replace with approved backfill material at no additional cost to the Owner.

D. Maintaining Excavation in Dewatering Condition:
1. Dewatering shall be a continuous operation. Interruptions due to power outages, or any other reason will not be permitted.
2. Continuously maintain excavation in a dry condition with positive dewatering methods during preparation of subgrade, installation of pipe, and construction of structures until the critical period of construction or backfill is completed to prevent damage of subgrade

support, piping, structure, side slopes, or adjacent facilities from flotation or other hydrostatic pressure imbalance.

3. Provide standby equipment on site, installed, wired, and available for immediate operation if required to maintain dewatering on a continuous basis in the event any part of the system becomes inadequate or fails. If dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, perform such work as may be required to restore damaged structures and foundation soils at no additional cost to Owner.
4. System maintenance shall include but not be limited to 24-hour supervision by personnel skilled in the operation, maintenance, and replacement of system components, and any other work required to maintain excavation in dewatered condition.

E. System Removal: Upon completion of the work, remove dewatering equipment from the site, including related temporary electrical service.

F. Wells shall be removed or cut off a minimum of 3 feet below final ground surface, capped, and abandoned in accordance with regulations by agencies having jurisdiction.

3.3 TOPSOIL EXCAVATION

A. Cut heavy growths of grass from areas before stripping and remove cuttings with remainder of cleared vegetative material.

B. Strip topsoil to a depth of not less than 6 inches from areas that are to be filled, excavated, landscaped, or re-graded to such depth that it prevents intermingling with underlying subsoil or questionable material.

C. Stockpile topsoil in storage piles in areas shown on The Drawings or where directed by Owner. Construct storage piles to freely drain surface water. Cover storage piles as required to prevent windblown dust. Dispose of unsuitable topsoil as specified for waste material, unless otherwise specified by Owner. Remove excess topsoil from site unless specifically noted otherwise on The Drawings.

3.4 GENERAL EXCAVATION

A. Classification of Excavation: The Contractor shall assure himself by site investigation or other necessary means that he is familiar with the type, quantity, quality, and character of excavation work to be performed. Excavation shall be considered unclassified excavation, except as indicated in the Contract Documents.

B. When performing grading operations during periods of wet weather, provide adequate dewatering, drainage and ground water management to control moisture of soils.

C. Shore, brace, and drain excavations as necessary to maintain excavation as safe, secure, and free of water at all times.

D. Excavate building areas to line and grade as shown on the Drawings being careful not to over excavate beyond elevations needed for building subgrades.

E. Place suitable excavated material into project fill areas.

F. Include an Undercut Allowance in the project. Stipulated cubic yards (CY) quantity to be provided by the Geotechnical Engineer. The Undercut Allowance is to include provisions for the removal, replacement and compaction of unsuitable soil. Provide unit pricing for actual quantity adjustment. Refer to Bid Form Supplements, Appendix A – Unit Prices, for schedule.

G. Unsuitable excavated material shall be disposed of in manner and location that is acceptable to Owner and local governing agencies.

H. Perform excavation using capable, well-maintained equipment and methods acceptable to Owner and local governing agencies.

3.5 TRENCHING EXCAVATION FOR UTILITIES

A. Contact local utility companies before excavation begins. Dig trench at proper width and depth for laying pipe, conduit, or cable. Cut trench banks vertical, if possible, and remove stones from bottom of trench as necessary to avoid point-bearing. Over excavate wet or unstable soil, if encountered, from trench bottom as necessary to provide suitable base for continuous and uniform bedding. Replace overexcavation with suitable and dispose of unsuitable material.

B. Trench excavation sidewalls shall be sloped, shored, sheeted, braced, or otherwise supported by means of sufficient strength to protect workmen in accordance with applicable rules and regulations established for construction by the Department of Labor, Occupational Safety and Health Administration (OSHA), and by local ordinances. Lateral travel distance to exit ladder or steps shall not be greater than 25 feet in trenches 4 feet or deeper.

C. Perform trench excavation as indicated on the Drawings for specified depths. During excavation, stockpile materials suitable for backfilling in orderly manner far enough from bank of trench to avoid overloading, slides, or cave-ins.

D. Remove excavated materials not required or not suitable for backfill or embankments and waste off-site or at on-site locations approved by the Owner and in accordance with governing regulations. Dispose of structures discovered during excavation as specified in Section 02220.

E. Prevent surface water from flowing into trenches or other excavations by temporary grading or other methods, as required. Remove accumulated water in trenches and other excavations as specified.

F. Open cut excavation with trenching machine or backhoe. Where machines other than ladder or wheel-type trenching machines are used, do not use clods for backfill.

G. Accurately grade trench bottom to provide uniform bearing and support for each section of pipe on bedding material at every point along entire length except where necessary to excavate for bell holes, proper sealing of pipe joints, or other required connections. Dig bell holes and depressions for joints after trench bottom has been graded. Dig no deeper, longer, or wider than needed to make joint connection properly.

H. Trench width below top of pipe shall not be less than 12 inches nor more than 18 inches wider than outside surface of pipe or conduit that is to be installed to designated elevations and grades. Other

trench width for pipe, conduit, or cable shall be least practical width that will allow for proper compaction of trench backfill.

I. Trench depth requirements measured from finished grade or paved surface shall meet the following requirements or applicable codes and ordinances, whichever is more stringent:

1. Water Mains: 30 inches to top of pipe barrel or 6 inches below frost line, established by local building official, whichever is deeper.
2. Sanitary Sewer: Elevations and grades as indicated on the drawings and as specified in Section 02535.
3. Storm Sewer: Elevations and grades as indicated on the Drawings.
4. Electrical Conduits: 24 inches minimum to top of conduit or as required by NEC 300-5, NEC 710-36 codes, or local utility company requirements, whichever is deeper.
5. TV Conduits: 18 inches minimum to top of conduit or as required by local utility company, whichever is deeper.
6. Telephone Conduits: 18 inches minimum to top of conduit, or as required by local utility company, whichever is deeper.
7. Gas Mains and Service: 30 inches minimum to top of pipe, or as required by local utility company, whichever is deeper.

3.6 SUBGRADE PREPARATION

A. Scarification and Compaction: Areas exposed by excavation or stripping and on which subgrade preparations are to be performed shall be scarified to minimum depth of 8 inches and compacted as specified hereinafter.

B. Proofrolling: Subgrades shall be proofrolled to detect areas of insufficient compaction. Proofrolling shall be accomplished by making minimum of 2 complete passes with fully-loaded tandem-axle dump truck with a maximum weight of 20 tons, or approved equal, in each of 2 perpendicular directions while under the supervision and direction of the independent testing laboratory. Document and explain proofrolling inspection procedures and results in the laboratory inspection report. Areas of failure shall be excavated and recompacted as specified herein. Continual failure areas shall be stabilized in accordance with Section 02340 at no additional cost to Owner. Subgrade exposed longer than 48 hours or on which precipitation has occurred shall be re-proofrolled.

3.7 FILLING

A. Fill areas to contours and elevations shown on the Drawings with unfrozen materials.

B. Place fills in continuous lifts specified herein.

C. Fill within proposed building subgrade and paving subgrade shall not contain rock or stone greater than 6 inches in any dimension.

D. Unless otherwise specified for rock fill, rock or stone less than 6-inches in largest dimension may be used in fill below structures, paving, and graded areas, up to 24 inches below surface of proposed subgrade or finish grade of graded areas when mixed with suitable material. Rock or stone less than 2 inches in largest dimension may be used in fill within the upper 24 inches of proposed subgrade or finish grade of graded areas when mixed with suitable material.

E. Fill materials used in preparation of subgrade shall be placed in lifts or layers not to exceed 8 inches loose measure and compacted as specified hereinafter.

F. Material imported from off-site shall have CBR or LBR value equal to or above pavement design subgrade CBR or LBR value indicated on The Drawings.

G. Building area subgrade pad shall be that portion of site directly beneath and 10 feet beyond building and appurtenances, including limits of future building expansion areas as shown on the Drawings.

H. Prepare building area subgrade pad in strict accordance with the Geotechnical Engineering Report.

I. Unless specifically stated otherwise in foundation design and site grading recommendations, the following table stipulates maximum allowable values for plasticity index (PI) and liquid limit (LL) of suitable materials to be used as fill in specified areas:

Location	PI	LL
Building area 20	45	
Paving area	20	45

3.8 TRENCH BACKFILLING

A. Materials used for trench backfill shall comply with requirements as specified herein.

B. Backfill and compact in accordance with fill and compaction requirements in accordance with ASTM D 2321 unless otherwise shown on the drawings.

C. Do not backfill trenches until required tests are performed and utility systems comply with and are accepted by applicable governing authorities.

D. Backfill trenches to contours and elevations shown on the Drawings.

E. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.

3.9 BORINGS AND CASINGS UNDER ROADS, HIGHWAYS, AND RAILROAD CROSSINGS

A. When indicated by the Drawings, street, road, highway, or railroad crossings for utility mains installed by jacking and boring method shall be in accordance with area specifications and governing authorities.

B. Excavation of approach pits and trenches within right-of-way of street, road, highway, or railroad shall be of sufficient distance from paving or railroad tracks to permit traffic to pass without interference.Tamp backfill for approach pits and trenches within right-of-way in layers not greater than 6-inches thick for entire length and depth of trench or pit. Compact backfill to 98 percent of maximum density in accordance with ASTM D698, (or 95 percent of maximum density, in accordance with ASTM D1557) obtained at optimum moisture as determined by AASHTO T 180. Mechanical tampers may be used after cover of 6 inches has been obtained over top of barrel of pipe.

C. Accomplish boring operation using commercial type boring rig. Bore hole to proper alignment and grade. Bore hole shall be within 2 inches of same diameter as largest outside joint diameter of pipe installed. Install pipe in hole immediately after bore has been made and in no instance shall hole be left unattended while open.

D. In event subsurface operations result in failure or damage to pavement or railroad tracks within 1 year of construction, make necessary repairs to pavement or railroad tracks. If paving cracks on either side of pipe line or is otherwise disturbed or broken due to construction operations, repair or replace disturbed or broken area.

E. Clean, prime, and line interior and exterior of casing pipe with two coats of asphalt coating in accordance with and governing authorities.

F. Butt weld steel casing. Welds shall be full penetration single butt-welds in accordance with AWWA C206.

G. Install casing and utility pipe with end seals, vent pipe, and other special equipment in accordance with area specifications and governing authorities.

3.10 COMPACTION

A. Compact as follows:

	Percent of Maximum Laboratory Density	
Location	ASTM D698	ASTM D1557
Subgrade & Fill Below Structures	95	95
Subgrade & Fill Below Pavement	95	92

B. Maintain moisture content of not less than 1 percent below and not more than 3 percent above optimum moisture content of fill materials to attain required compaction density.

C. Exercise proper caution when compacting immediately over top of pipes or conduits. Water jetting or flooding is not permitted as method of compaction.

D. Corrective Measures for Non-Complying Compaction: Remove and recompact deficient areas until proper compaction is obtained. Continual failure areas shall be stabilized in accordance with Section 02340 at no additional cost to Owner.

3.11 MAINTENANCE OF SUBGRADE

A. Verify finished subgrades to ensure proper elevation and conditions for construction above subgrade.

B. Protect subgrade from excessive wheel loading during construction, including concrete trucks, dump trucks, and other construction equipment.

C. Remove areas of finished subgrade found to have insufficient compaction density to depth necessary and replace in manner that will comply with compaction requirements by use of material with CBR or LBR equal to or better than that specified on the drawings. Surface of

subgrade after compaction shall be firm, uniform, smooth, stable, and true to grade and cross-section.

D. Construct temporary ditches and perform such grading as necessary to maintain positive drainage away from subgrade at all times.

3.12 BORROW AND SPOIL SITES

A. Comply with NPDES and local erosion control permitting requirements for any and all on-site and off-site, disturbed spoil and borrow areas. Upon completion of spoil or borrow operations, clean up spoil or borrow areas in a neat and reasonable manner to the satisfaction of Owner or off-site property owner, if applicable.

3.13 FINISH GRADING

A. Check grading of building subgrades by string line from grade stakes (blue tops) set at not more than 50-foot centers. Allowable tolerance shall be plus or minus 0.10 feet from plan grade. Provide engineering and field staking as necessary for verification of lines, grades, and elevations.

B. Grade areas where finish grade elevations or contours are indicated on the Drawings, other than paved areas and buildings, including excavated areas, filled and transition areas, and landscaped areas. Graded areas shall be uniform and smooth, free from rock, debris, or irregular surface changes. Ground surfaces shall vary uniformly between indicated elevations. Grade finished ditches to allow for proper drainage without ponding and in manner that will minimize erosion potential. For topsoil, sodding, and seeding requirements refer to Section 329300.

C. Correct settled and eroded areas within 1 year after date of completion at no additional expense to Owner. Bring grades to proper elevation.

3.14 FIELD TESTING

A. Field density tests for in-place materials will be performed by the Contractor's Independent Testing Laboratory (ITL) as follows:

1. Building Subgrade Areas, Including 8'-0" Outside of Exterior Building Lines: In cut areas, not less than 1 compaction test for every 2,500 sq. ft. In fill areas, same rate of testing for each 8-inch lift, measured loose.
2. Areas of Construction Exclusive of Building Subgrade Areas: In cut areas, not less than 1 compaction test for every 10,000 sq. ft. In fill areas, same rate of testing for each 8-inch lift, measured loose.
3. Utility Trench Backfill: Intervals not exceeding 200-feet of trench for first and every other 8-inch lift of compacted trench backfill.
4. Test Method: In-place nuclear density, ASTM D 2922 (Method B-Direct Transmission).

B. Corrective Measures For Non-Complying Compaction: Remove and recompact deficient areas until proper compaction is obtained at no additional expense to Owner. Adjust moisture content as necessary to conform to the requirements of this section.

C. Field testing, frequency, and methods may vary as determined by and between the Contractor and the ITL.

END OF SECTION

SECTION 31 22 00

EXCAVATION, BACKFILL, AND COMPACTION FOR STRUCTURES

PART 1 - GENERAL

1. 1 SECTION INCLUDES

A. Excavation to line, grade, and configuration as shown on Construction Drawings for proposed structures and future expansion areas.

B. Fill to line, grade, and configuration as shown on Construction Drawings for proposed structures and future expansion areas.

C. Compacting for materials in acceptable manner as specified herein.

1. 2 RELATED SECTIONS

A. Section 312000 - Earthwork

B. Section 312600 - Aggregate Material

C. Construction drawings

1.3 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM) latest edition
1. D422 Standard Test Method For Particle – Size Analysis of Soil
2. D 698 Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN.m/m^3))
3. D 1557 Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 Kn.m/m^3))
4. D 2216 Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures
5. D 2487 Classification of Soils for Engineering Purposes
6. D 2922 Density of Soil and Soil-Aggregate In Place by Nuclear Methods (Shallow Depth)
7. D 3017 Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
8. D 4318 Liquid Limit, Plastic Limit, and Plasticity Index of Soils

B. American Association of State Highway and Transportation Officials (AASHTO) latest edition
1. T 88 Particle Size Analysis of Soils
2. State Department of Transportation (DOT): Standard Specifications for Construction and Materials, Latest Edition

1.4 QUALITY ASSURANCE

A. An independent testing laboratory, selected and paid by Contractor, will be retained to perform construction testing on filling operations and subgrade analysis as specified in Section 312000 and as specified herein.

B. Testing shall be in accordance with Part 3, “Field Quality Control”.

1. 5 SUBMITTALS

A. Shop drawings or details pertaining to excavating and filling for structures are not required unless otherwise shown on Construction Drawings or if contrary procedures to Contract Documents are proposed.

B. Submit 30-pound sample of each type of material from off-site borrow sources that is to be used in backfilling in air-tight container(s) to the independent testing laboratory or submit gradation and certification of aggregate material that is to be used at the site to the independent testing laboratory for review.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Fill material from on-site as specified in Section 312000 and approved by Owner.

B. Fill material from off-site as specified in Section 312000 and approved by Owner.

C. Aggregate material as specified in Section 312600.

2.2 EQUIPMENT

A. Transport off-site materials to the project using well-maintained and operating vehicles. Once on site, transporting vehicles shall stay on designated haul roads and shall at no time endanger improvements by rutting, overloading, or pumping.

PART 3 - EXECUTION

3.1 PREPARATION

A. Identify lines, elevations, and grades necessary to construct building subgrades as shown on Construction Drawings.

B. Protect benchmarks, property corners, and other survey monuments from damage or displacement. If marker needs to be removed it shall be referenced by licensed land surveyor and replaced, as necessary, by same.

C. Locate and identify utilities that have previously been installed and protect from damage.

D. Locate and identify existing utilities that are to remain and protect from damage.

E. Over excavate and properly prepare areas of subgrade that are not capable of supporting proposed structures. Stabilize these areas by using acceptable geotextile fabrics or aggregate materials placed and compacted as specified.

3.2 EXCAVATION

A. Excavate building areas to line and grade as shown on Construction Drawings being careful not to over excavate beyond elevations needed for building subgrades unless otherwise required by the Contract Documents.

B. Place suitable excavated material into project fill areas as specified in Section 312000.

C. Unsuitable excavated material is to be disposed of in manner and location that is acceptable to Owner and local governing agencies.

D. Perform excavation using capable, well-maintained equipment and methods acceptable to Owner and local governing agencies.

3.3 FILLING AND SUBGRADE PREPARATION

A. Building area subgrade pad shall be that portion of site directly beneath and 8-feet beyond building and appurtenances, including limits of future building expansion areas as shown on Construction Drawings.

B. Prepare building area subgrade pad in strict accordance with the Geotechnical Engineering Report. Rocks larger than 6-in. shall not be part of building subgrade fill.

C. Areas exposed by excavation or stripping and on which building subgrade preparations are to be performed shall be scarified to a minimum depth of 8-inches and compacted to minimum of 98 percent of maximum density, in accordance with ASTM D 698, (or 95 percent of maximum density, in accordance with ASTM D 1557) at moisture content of not less than 2 percent below and not more than 3 percent above optimum moisture content. Proofroll these areas to detect areas of insufficient compaction. Accomplish proofrolling by making a minimum of 2 complete passes with a fully-loaded tandem-axle dump truck with a maximum weight of 20 tons, or approved equal, in each of 2 perpendicular directions while under supervision and direction of the independent testing laboratory. Excavate and recompact areas of failure as specified herein. Continual failure areas shall be stabilized at no additional cost to Owner.

D. Place fill materials used in preparation of subgrade in lifts or layers not to exceed 8-inches loose measure and compacted to at least 95 percent Standard Proctor in accordance with ASTM D 698 at moisture content of not less than 2 percent below and not more than 3 percent above optimum moisture content. Unless specifically stated otherwise in The Geotechnical Engineering Report or Construction Drawings, following table stipulates maximum allowable values for plasticity index (PI) and liquid limit (LL) of suitable materials to be used as fill in specified areas:

Location	PI	LL

Building area	20	45

3.4 COMPACTION

A. Maintain optimum moisture content of fill materials as specified above to attain required compaction density.

B. Test materials in accordance with Section 312000.

C. Corrective measures for non-complying compaction: Remove and recompact deficient areas until proper compaction is obtained at no additional expense to Owner.

3.5 MAINTENANCE OF SUBGRADE

A. Verify finished subgrades to ensure proper elevation and conditions for construction above subgrade.

B. Protect subgrade from excessive wheel loading during construction, including concrete trucks, dump trucks, and other construction equipment.

C. Remove areas of finished subgrade found to have insufficient compaction density to depth necessary and replace in manner that will comply with compaction requirements by use of material equal to or better than that specified for fill herein. Surface of subgrade after compaction shall be firm, uniform, smooth, stable, and true to grade and cross-section.

D. Construct temporary ditches and/or perform such grading as necessary to maintain positive drainage away from subgrade at all times.

3.6 FINISH GRADING

A. Finish grading shall be in accordance with Section 312000 and as specified herein.

B. Check grading of building subgrades by string line from grade stakes (blue tops) set at not more than 50-foot centers. Tolerance of 0.10-foot will be permitted. Contractor to provide engineering and field staking necessary for verification of lines, grades, and elevations.

3.7 FIELD QUALITY CONTROL

A. See Section 312000, “Field Testing”.

END OF SECTION

SECTION 31 23 00

EXCAVATION, BACKFILL, AND COMPACTION FOR UTILITIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Excavation of trenches for installation of utilities.

B. Backfilling trenches with bedding material as specified and filling trenches with suitable material to proposed subgrade.

C. Compacting backfill materials in acceptable manner.

D. Borings and casings under roads.

1.2 RELATED SECTIONS

A. Section 310000 - Site Demolition

B. Section 312000 - Earthwork

C. Section 334100 - Storm Drainage

D. Section 312600 - Aggregate Materials

E. Construction Drawings

1.3 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM) latest edition

1. D422 Standard Test Method For Particle – Size Analysis of Soil
2. D 698 Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN.m/m^3))
3. D 1557 Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 Kn.m/m^3))
4. D 2216 Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures
5. D 2487 Classification of Soils for Engineering Purposes
6. D 2922 Density of Soil and Soil-Aggregate In Place by Nuclear Methods (Shallow Depth)
7. D 3017 Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
8. D 4318 Liquid Limit, Plastic Limit, and Plasticity Index of Soils

B. American Association of State Highway and Transportation Officials (AASHTO) latest edition
   1. T 88 Particle Size Analysis of Soils
   2. State Department of Transportation (DOT): Standard Specifications for Construction and Materials, Latest Edition

1.4 QUALITY ASSURANCE

A. An independent testing laboratory will perform testing at intervals not exceeding 200-feet of trench for first and every other 8-inch lift of compacted trench backfill and furnish copies of results as specified herein.

B. Testing shall be in accordance with Part 3, “Field Quality Control”.

1.5 SUBMITTALS

A. Shop drawings or details pertaining to site utilities are not required unless required by regulatory authorities or unless uses of materials, methods, equipment, or procedures that are contrary to Construction Drawings or Specifications are proposed. Do not perform work until Owner has accepted required shop drawings.

B. Contact utility companies and determine if additional easements will be required to complete project. Provide written confirmation of the status of all easements to Owner at time of Preconstruction Conference or no later than 90 days prior to project possession date.

C. Submit 30-pound sample of each type of fill material from off-site borrow sources that is to be used in backfilling, in air-tight container(s), to the independent testing laboratory or submit gradation and certification of aggregate material that is to be used at the site to the independent testing laboratory for review.

1.6 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations of subsurface utilities, structures, and obstructions installed or encountered.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Bedding Material: Aggregate Type as indicated on the plans and as specified in Section 312600.

B. Haunching Material: As specified in Section 312600. Aggregate Type as indicated on the plans and as specified in Section 312600.

C. Backfill material from the site as specified in Section 312000 and approved by Owner.

D. Backfill material from off-site as specified in Section 312000 and approved by Owner.

E. Steel Casing Pipe: Comply with AWWA C200 minimum grade B, size, and wall thickness as indicated on Construction Drawings.

F. Backfill material shall not contain rock or stone with a maximum size greater than 2 inches.

2.2 LOCATOR TAPE

A. Locator tape shall be heavy duty 6" wide underground warning tape. Tape shall be made from polyethylene material, 3.5 mils thick, with a minimum tensile strength of 1,750 psi. Place the tape at one-half the minimum depth of cover for the utility line or a maximum of 3', whichever is the lesser, but never above the top of subgrade. Color of tape shall be determined by APWA Color Standards: Natural Gas- Yellow, Electric - Red, Telephone – Orange, Water – Blue, Sanitary Sewer – Green.

2.3 EQUIPMENT

A. Transport off-site materials to project using well-maintained and operating vehicles. Once on site, transporting vehicles shall stay on designated haul roads and shall at no time endanger improvements by rutting, overloading, or pumping.

PART 3 - EXECUTION

3.1 PREPARATION

A. Set lines, elevations, and grades for proposed systems.

B. Protect benchmarks, property corners, and other survey monuments from damage or displacement. If marker needs to be removed it shall be referenced by licensed land surveyor and replaced, as necessary, by same.

C. Maintain in operating condition existing utilities, previously installed utilities, and drainage systems encountered in utility installation. Repair surface or subsurface improvements shown on Construction Drawings.

D. Verify location, size, elevation, and other pertinent data required making connections to existing utilities and drainage systems as indicated on Construction Drawings.

E. Over excavate and properly prepare areas of subgrade that are not capable of supporting proposed systems. Stabilize these areas by using acceptable geotextile fabrics or additional bedding material placed and compacted.

F. Provide dewatering systems as required for utility excavations. Dewatering systems shall comply with requirements of Section 312000.

3.2 EXCAVATION

A. Contact local utility companies before excavation begins. Dig trench at proper width and depth for laying pipe, conduit, or cable. Cut trench banks vertical, if possible, and remove stones from bottom of trench as necessary to avoid point-bearing. Over excavate wet or unstable soil, if encountered, from trench bottom as necessary to provide suitable base for continuous and uniform bedding.

B. Trench excavation sidewalls shall be sloped, shored, sheeted, braced, or otherwise supported by means of sufficient strength to protect workmen in accordance with applicable rules and regulations established for construction by the Department of Labor, Occupational Safety and Health Administration (OSHA), and by local ordinances. Lateral travel distance to exit ladder or steps shall not be greater than 25-feet in trenches 4-feet or deeper.

C. Perform excavation as indicated on Construction Drawings for specified depths. During excavation, stockpile materials suitable for backfilling in orderly manner far enough from bank of trench to avoid overloading, slides, or cave-ins.

D. Remove excavated materials not required or not suitable for backfill or embankments and waste off site or at on-site locations approved by the Owner and in accordance with governing regulations. Dispose of structures discovered during excavation as specified in Section 310000.

E. Prevent surface water from flowing into trenches or other excavations by temporary grading or other methods, as required. Remove accumulated water in trenches and other excavations as specified in Section 312000.

F. Open cut excavation with trenching machine or backhoe. Where machines other than ladder or wheel-type trenching machines are used, do not use clods for backfill. Dispose of unsuitable material and provide other suitable material at no additional cost to Owner.

G. Accurately grade trench bottom to provide uniform bearing and support for each section of pipe on bedding material at every point along entire length, except where necessary to excavate for bell holes, proper sealing of pipe joints, or other required connections. Dig bell holes and depressions for joints after trench bottom has been graded. Dig no deeper, longer, or wider than needed to make joint connection properly.

H. For pipes 12 inches in diameter or smaller, total trench width below top of pipe shall be the outside diameter plus not less than 12 inches nor more than 18 inches with the pipe or conduit that is to be installed to designated elevations and grades centered in the trench. For pipe diameters greater than 12 inches, trench width below the top of pipe shall be wide enough to accommodate workmen and equipment but not less than 18 inches. Other trench width for pipe, conduit, or cable shall be least practical width that will allow for proper compaction of trench backfill.

I. Trench depth requirements measured from finished grade or paved surface shall meet the following requirements or applicable codes and ordinances, whichever is more stringent:
   1. Water Mains: 30-inches to top of pipe barrel or 6-inches below frost line, established by local building official, whichever is deeper.
   2. Sanitary Sewer: Elevations and grades as indicated on Construction Drawings.

3. Storm Sewer: Elevations and grades as indicated on Construction Drawings.
4. Electrical Conduits: 24-inches minimum to top of conduit or as required by NEC 300-5, NEC 710-36 codes, or local utility company requirements, whichever is deeper.
5. TV Conduits: 18-inches minimum to top of conduit or as required by local utility company, whichever is deeper.
6. Telephone Conduits: 18-inches minimum to top of conduit, or as required by local utility company, whichever is deeper.
7. Gas Mains and Service: 30-inches minimum to top of pipe, or as required by local utility company, whichever is deeper.

3.3 PIPE BEDDING

A. Accurately cut trenches for pipe or conduit that is to be installed to designated elevations, 4 inches below bottom of pipe and to the width as specified herein. Place 4 inches of bedding material, compact in bottom of trench, and accurately shape to conform to lower portion of pipe barrel.

3.4 BACKFILLING

A. Criteria: Do not backfill trenches until required tests are performed and utility systems comply with and are accepted by applicable governing authorities. Backfill trenches as specified in Sections 312000 and one or more of the following sections, as applicable: 312200 for trenches below structures or 312400 for trenches below pavements. If improperly backfilled, reopen to depth required to obtain proper compaction. Backfill and compact, as specified herein, to properly correct the condition in an acceptable manner.

B. Backfilling: After pipe or conduit has been installed, bedded, and tested as required, backfill trench or structure excavation with specified material placed as given in the Construction Documents.

C. Backfill trenches to contours and elevations shown on Construction Drawings with unfrozen materials.

D. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.

3.5 COMPACTION

A. Exercise proper caution when compacting immediately over top of pipes or conduits. Water jetting or flooding is not permitted as method of compaction.

B. Maintain optimum moisture content of fill materials as specified in Section 312000 to attain required compaction density.

C. Materials used for backfill shall comply with requirements of Section 312600 and as specified herein.

3.6 BORINGS AND CASINGS UNDER ROADS, HIGHWAYS, AND RAILROAD CROSSINGS

A. When indicated by Construction Drawings, street, road, highway, or railroad crossings for utility mains installed by jacking and boring method shall be in accordance with area specifications and governing authorities.

B. Excavation of approach pits and trenches within right-of-way of street, road, highway, or railroad shall be of sufficient distance from paving or railroad tracks to permit traffic to pass without interference. Tamp backfill for approach pits and trenches within right-of-way in layers not greater than 6-inches thick for entire length and depth of trench or pit. Compact backfill to 95 percent of maximum density in accordance with ASTM D698, (or 95 percent of maximum density, in accordance with ASTM D1557) obtained at optimum moisture as determined by AASHTO T 180. Mechanical tampers may be used after cover of 6 inches has been obtained over top of barrel of pipe.

C. Accomplish boring operation using commercial type boring rig. Bore hole to proper alignment and grade. Bore hole shall be within 2 inches of same diameter as largest outside joint diameter of pipe installed. Install pipe in hole immediately after bore has been made and in no instance shall hole be left unattended while open.

D. In event subsurface operations result in failure or damage to pavement or railroad tracks within 1 year of construction, make necessary repairs to pavement or railroad tracks at no additional cost to Owner. If paving cracks on either side of pipe line or is otherwise disturbed or broken due to construction operations, repair or replace disturbed or broken area at no additional cost to Owner.

E. Clean, prime, and line interior and exterior of casing pipe with two coats of asphalt in accordance with area specifications and governing authorities.

F. Butt weld steel casing. Welds shall be full penetration single butt-welds in accordance with AWWA C206 and AWS D7-0-62.

G. Install casing and utility pipe with end seals, vent pipe, and other special equipment in accordance with area specifications and governing authorities.

3.7 FIELD QUALITY CONTROL

See Section 312000, “Field Quality Control”.

END OF SECTION

SECTION 31 24 00

EXCAVATION, BACKFILL, AND COMPACTION FOR PAVEMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Excavation to line, grade, and configuration as shown on Construction Drawings for proposed and future pavement areas.

B. Fill to line, grade, and configuration as shown on Construction Drawings for proposed and future pavement areas.

C. Compacting fill materials in acceptable manner as specified herein.

1.2 RELATED SECTIONS

A. Section 312000 - Earthwork

B. Section 321206 - Base Course

C. Section 312600 - Aggregate Materials

D. Section 321216 - Asphaltic Concrete Paving

E. Section 321333 - Curbs and Sidewalks

F. Construction Drawings

1.3 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM) latest edition
   1. D422 Standard Test Method For Particle – Size Analysis of Soil
   2. D 698 Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN.m/m^3))
   3. D 1557 Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 Kn.m/m^3))
   4. D 2216 Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures
   5. D 2487 Classification of Soils for Engineering Purposes
   6. D 2922 Density of Soil and Soil-Aggregate In Place by Nuclear Methods (Shallow Depth)
   7. D 3017 Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
   8. D 4318 Liquid Limit, Plastic Limit, and Plasticity Index of Soils

B. American Association of State Highway and Transportation Officials (AASHTO) latest edition

1. T 88 Particle Size Analysis of Soils
2. State Department of Transportation (DOT): Standard Specifications for Construction and Materials, Latest Edition

1.4 QUALITY ASSURANCE

A. Independent Testing Laboratory, selected and paid by Contractor, will be retained to perform construction testing on filling operations and subgrade analysis as specified in Section 02300 and as specified herein.

B. Testing shall be in accordance with Part 3, Section 3.07, “Field Quality Control”.

1.5 SUBMITTALS

A. Shop drawings or details pertaining to excavating and filling for pavement are not required unless otherwise required by the Construction Documents or if contrary procedures to Construction Documents are proposed.

B. Submit 30-pound sample of each type of off-site fill material that is to be used in backfilling in air-tight container to independent testing laboratory or submit gradation and certification of aggregate material that is to be used to independent testing laboratory for review.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Fill material from on-site as specified in Section 312000 and approved by Owner.

B. Fill material from off-site as specified in Section 312000 and approved by Owner.

C. Aggregate material as indicated on the plans and as specified in Section 312600.

2.2 EQUIPMENT

A. Transport off-site materials to project using well-maintained and operating vehicles. Once on site, transporting vehicles shall stay on designated haul roads and shall at no time endanger improvements by rutting, overloading, or pumping.

PART 3 - EXECUTION

3.1 PREPARATION

A. Identify lines, elevations, and grades necessary to construct pavements, curb, curb and gutter, bases, sidewalk, and roadways as shown on Construction Drawings.

B. Protect benchmarks, property corners, and other survey monuments from damage or displacement. If marker needs to be removed it shall be referenced by licensed land surveyor and replaced, as necessary, by same.

C. Locate and identify site utilities that have previously been installed and protect from damage.

D. Locate and identify existing utilities that are to remain and protect from damage.

E. Over-excavate and properly prepare areas of subgrade that are not capable of supporting proposed systems. Stabilize these areas by using acceptable geotextile fabrics or aggregate material placed and compacted.

3.2 EXCAVATION

A. Excavate roadway and pavement areas to line and grade as shown on Construction Drawings.

B. Place suitable material into project fill areas as specified in Section 02300.

C. Unsuitable excavated material is to be disposed of in manner and location that is acceptable to Owner and local governing agencies.

D. Perform excavation using capable, well-maintained equipment and methods acceptable to Owner and local governing agencies.

3.3 FILLING AND SUBGRADE PREPARATION

A. Areas exposed by excavation or stripping and on which subgrade preparations for paving are to be performed, including future pavement areas, shall be scarified to minimum depth of 8-inches and compacted to not less than 95 percent of maximum density, in accordance with ASTM D 698 (or 95 percent of maximum density, in accordance with ASTM D 1557) at moisture content of not less than 2 percent below and not more than 3 percent above optimum moisture content. Proofroll these areas to detect areas of insufficient compaction. Accomplish proofrolling by making minimum of 2 complete passes with fully-loaded tandem-axle dump truck with a maximum loaded weight of 20 tons, or approved equal, in each of 2 perpendicular directions until acceptable. Excavate and recompact areas of failure as specified herein. Continual failure areas shall be stabilized at no additional cost to Owner.

B. Place fill materials used in preparation of the subgrade in lifts or layers not to exceed 8-inches loose measure and compacted to minimum density of not less than 95 percent of maximum density, in accordance with ASTM D 698, (or 95 percent of maximum density, in accordance with ASTM D 1557) at moisture content of not less than 2 percent below and not more than 3 percent above optimum moisture content.

C. Following table stipulates maximum allowable values for plasticity index (PI) and liquid limit (LL) of suitable fill materials to be used in specified areas, unless specifically stated otherwise on Construction Drawings:

	PI	LL

Paving Area	20	45

D. Fill material imported from off-site or fill material removed from onsite cut areas shall have CBR or LBR value equal to or greater than pavement design subgrade CBR or LBR value indicated on Construction Drawings.

3.4 COMPACTION

A. Maintain optimum moisture content of fill materials as specified herein to attain required compaction density.

B. Test materials in accordance with Section 312000.

C. Corrective measures for non-complying compaction: Remove and recompact deficient areas until proper compaction is obtained at no additional expense to Owner.

D. Construct temporary ditches and/or perform such grading as necessary to maintain positive drainage away from subgrade at all times.

3.5 MAINTENANCE OF SUBGRADE

A. Verify finished subgrades to ensure proper elevation and conditions for construction above subgrade.

B. Protect subgrade from excessive wheel loading during construction including concrete trucks, dump trucks, and other construction equipment.

C. Remove areas of finished subgrade found to have insufficient compaction density to depth necessary and replace in manner that will comply with compaction requirements by use of material equal to or better than best subgrade material on site. Surface of subgrade after compaction shall be hard, uniform, smooth, stable, and true to grade and cross-section.

3.6 FINISH GRADING

A. Finish grading shall be in accordance with Section 312000 and as specified herein.

B. Check grading of paving areas by string line from grade stakes (blue tops) set at not more than 50-foot centers. Tolerances of 0.10-foot, more or less, will be permitted. Contractor is to provide engineering and field staking necessary for verification of lines, grades, and elevations.

3.7 FIELD QUALITY CONTROL

A. See Section 312000, “Field Quality Control”.

END OF SECTION

SECTION 31 26 00

AGGREGATE MATERIALS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Aggregate materials for use as specified in other Sections.

1.2 RELATED SECTIONS

A. Section 310000 – Site Demolition

B. Section 311000 – Site Clearing

C. Section 312000 – Earthwork

D. Section 312200 – Excavation, Backfill, and Compaction for Structures

E. Section 312300 – Excavation, Backfill, and Compaction for Utilities

F. Section 312400 – Excavation, Backfill, and Compaction for Pavement

G. Section 312800 – Erosion Control and Sedimentation

H. Construction Drawings

1.3 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM) latest edition

1. C136 Method for Sieve Analysis of Fine and Coarse Aggregates
2. D698 Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN.m/m^3))
3. D1557 Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 Kn.m/m^3))
4. D2216 Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures
5. D2487 Classification of Soils for Engineering Purposes
6. D2922 Density of Soil and Soil-Aggregate In Place by Nuclear Methods (Shallow Depth)
7. D3017 Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
8. D4318 Liquid Limit, Plastic Limit, and Plasticity Index of Soils

B. American Association of State Highway and Transportation Officials (AASHTO) latest edition

1. T 88 Particle Size Analysis of Soils

C. State Department of Transportation (DOT): Standard Specifications for Construction and Materials, Latest Edition.

1.4 QUALITY ASSURANCE

A. Tests and analysis of aggregate materials will be performed in accordance with ASTM and AASHTO procedures specified herein.

1.5 SUBMITTALS

A. Submit 30-pound sample of each aggregate or mixture that is to be incorporated into project in air-tight containers to the independent testing laboratory or submit gradation and certification of aggregate material that is to be incorporated into project to the independent testing laboratory for review.

B. Submit name of each material supplier and specific type and source of each material. Any change in source requires approval of Owner.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Construction and materials shall meet or exceed requirements of this Section and applicable state highway department specifications section(s) referred to or noted on the Construction Drawings which pertain to paving base course design, materials, preparation, and execution. Materials shall be as indicated in the Construction Documents and shall comply with state highway department specifications regarding source, quality, gradation, soundness, absorption, liquid limit, plasticity index, and mix proportioning.

B. Soil Materials

1. Class II: Coarse-Grained Soils; conforming to ASTM D2487 Group Symbol, GW, GP, SW and SP.
2. Class III: Coarse-Grained Soils with Fines; conforming to ASTM D2487 Symbol GM, GC, SM and SC.
3. Class IV-A: Fine-Grained Soils (inorganic); conforming to ASTM D2487 Group Symbol ML and CL.
4. Class IV-B: Fine Grained Soils (inorganic); conforming to ASTM D2487 Group Symbol MH and CH.
5. Class V: Organic Soils; conforming to ASTM D2487 Group Symbol OL, OH, and PT.

C. Aggregate Material

1. Coarse Aggregate Type A1: Material shall be sound crushed limestone, crushed slag, granulated slag, crushed gravel, or other types of suitable material meeting the requirements of this section. Crushed limestone, crushed slag and crushed gravel shall meet the following grading requirements:

Sieve Size	Percent Passing
1 1/2 inches	100
1 inch	75-100

3/4 inch	60-100
3/8 inch	35-75
No. 4	30-60
No. 30	7-30
No. 200	0-5

2. Coarse Aggregate Type A2: Material shall be crushed carbonate, crushed gravel, crushed air-cooled slag, granulated slag, a mixture of crushed and granulated slag, or other types of suitable material meeting the requirements of this item. Crushed carbonate stone or mixtures of crushed and granulated slags shall meet the following gradation requirements:

Sieve Size	Percent Passing
2 inches	100
1 inch	70-100
3/4 inch	50-90
No. 4	30-60
No. 30	7-30
No. 200	0-5

3. Aggregate Type A3: Pea Gravel – Natural stone; washed, free of clay, shale, organic matter; graded in accordance with ASTM C136 and D2487; to the following limits:

    a. Minimum size: 1/4 inch
    b. Maximum Size: 5/8 inch

4. Fine Aggregate Type A4: Sand – Natural river or bank sand; washed; free of silt, clay, loam, friable or soluble materials, and organic matter; graded in accordance with ASTM C136 and D2487; within the following limits:

Sieve Size	Percent Passing
No. 4	90-100
No. 50	7-40
No. 200	0-5

5. Class I-A: Material shall be sound crushed limestone, crushed slag, granulated slag, crushed gravel, or other types of suitable material meeting the requirements of this item. Crushed limestone, crushed slag and crushed gravel shall meet the following grading requirements:

Sieve Size	Percent Passing
1-1/2 inches	100
No. 4	$\leq$ 10
No. 200	< 5

6. Class I-B: Material shall be crushed carbonate, crushed gravel, crushed air-cooled slag, granulated slag, a mixture of crushed and granulated slag, or other types of suitable material meeting the requirements of this item. Crushed carbonate stone or mixtures of crushed and granulated slags shall meet the following gradation requirements:

Sieve Size	Percent Passing
1-1/2 inches	100

No. 4	≤50
No. 200	< 5

2.2 EQUIPMENT

A. Transport off-site materials to project using well-maintained and operating vehicles. Once on site, transporting vehicles shall stay on designated haul roads and shall at no time endanger any improvements by rutting, overloading, or pumping.

PART 3 - EXECUTION

3.1 STOCKPILING

A. Stockpile on-site at locations indicated by Owner in such manner that there will be no standing water or mixing with other materials.

3.2 BORROW AND SPOIL SITES

A. Upon completion of borrow and/or spoil operations, clean up borrow and/or spoil areas as indicated on Construction Drawings in neat and reasonable manner to satisfaction of property owner and Owner.

END OF SECTION

SECTION 31 28 00

EROSION AND SEDIMENTATION CONTROL

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes
   1. Installation of temporary and permanent erosion and sedimentation control systems.
   2. Installation of temporary and permanent slope protection systems.

B. Related Sections
   1. Section 311000 - Site Clearing
   2. Section 312000 - Earthwork
   3. Storm Water Pollution Prevention Plan
   4. Construction Drawings (“Site Maps”)

1.2 ENVIRONMENTAL REQUIREMENTS

A. Protect adjacent properties, any identified endangered or threatened species or critical habitat, any identified cultural or historic resources, and receiving water resources from erosion and sediment damage until final stabilization.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Seed, sod, and ground covers for the establishment of vegetation.

B. Sediment control devices as specified on the Construction Drawings.

C. Rolled erosion control products according to Erosion Control Technology Council (ECTC) standard specifications.

D. Temporary mulches such as loose, straw, wood cellulose, or agricultural silage.

E. Temporary and permanent outfall structures as specified on the drawings.

PART 3 – EXECUTION

3.1 PREPARATION

A. Review the drawings and Storm Water Pollution Prevention Plan.

B. Revise SWPPP as necessary to address potential pollution from site identified after issuance of the SWPPP at no additional cost to owner.

C. Conduct storm water pre-construction meeting with Site Contractor, all ground-disturbing Sub-contractors, site engineer of record or someone from their office familiar with the site and SWPPP, and state or local agency personnel in accordance with requirements of the special conditions.

3.2 EROSION AND SEDIMENTATION CONTROL AND SLOPE PROTECTION IMPLEMENTATION

A. Place erosion and sediment control systems in accordance with the drawings and Storm Water pollution Prevention Plan or as may be dictated by site conditions in order to maintain the intent of the specifications and permits.

B. Deficiencies or changes on the drawings or Storm Water Pollution Prevention Plan shall be corrected or implemented as site conditions change. Changes during construction shall be noted in the Storm Water Pollution Prevention Plan and posted on the drawings (Site Maps).

C. Owner has authority to limit surface area of erodible earth material exposed by clearing and grubbing, excavation, borrow and embankment operations and to direct Contractor to provide immediate permanent or temporary pollution control measures.

D. Maintain temporary erosion and sedimentation control systems as dictated by site conditions, indicated in the construction documents, or as directed by governing authorities or Owner to control sediment until final stabilization. Contractor shall respond to maintenance or additional work ordered by Owner or governing authorities immediately, but in no case, within not more than 48 hours if required at no additional cost to the Owner.

E. Contractor shall incorporate permanent erosion control features, paving, permanent slope stabilization, and vegetation into project at earliest practical time to minimize need for temporary controls.

F. Permanently seed and mulch cut slopes as excavation proceeds to extent considered desirable and practical.

G. Unless required within a shorter timeframe by the applicable General Permit for Storm Water Discharges Associated with Construction Activity, slopes that erode easily or that will not be graded for a period of 14 days or more, shall be temporarily stabilized as work progresses with vegetation or other acceptable means unless otherwise specified in the Contract Documents. In the event it is not practical to seed areas, slopes must be stabilized with mulch and tackifier, bonded fiber matrix, netting, blankets or other means to reduce the erosive potential of the area.

END OF SECTION

SECTION 31 31 00 – SOIL TREATMENT

PART 1 - GENERAL

1.01 SCOPE: Provide soil treatment for termite control, complete.

1.02 SUBMITTALS: In compliance with Section 01 33 00, submit manufacturer's technical data, name of chemical, rates of application, and application instructions.

1.03 QUALITY ASSURANCE:

A. Comply with requirements of Arkansas State Plant Board, or other governing authority.

B. Engage a professional pest control operator, licensed in accordance with regulations of governing authorities for application of soil treatment solution.

1.04 PROJECT CONDITIONS: Do not apply soil treatment solution until excavating, filling and grading operations are completed. Do not apply soil treatment to frozen or excessively wet soils or during inclement weather. Comply with handling and application instructions of the soil toxicant manufacturer.

1.05 WARRANTY: Furnish 5-year warranty certifying that applied soil termiticide treatment will prevent infestation of subterranean termites and, that if subterranean termite activity is discovered during the warranty period, Contractor will re-treat the soil and repair or replace damage caused by termite infestation.

PART 2 - PRODUCTS

2.01 MATERIALS: Use termiticide carrying an EPA registration number and approved by Arkansas State Plant Board or other governing authority.

PART 3 - EXECUTION

3.01 APPLICATION:

A. Surface Preparation: Remove foreign matter which could decrease effectiveness of treatment on areas to be treated. Loosen, rake and level soil to be treated, except previously compacted areas under slabs and foundations.

B. Concentrations and Application Rates: Comply with label directions of termiticide, and with Arkansas State Plant Board or other governing authority specifications and recommendations for the following areas:

1. Under slab-on-grade, sidewalks, platforms, ramps, and paving within the border of roof line.

2. Floor drains and traps.

3. Below expansion joints, control joints, and to all electrical and plumbing conduits and pipes that penetrate concrete slab.

4. Along both sides of foundation walls, around perimeter of concrete footings, beams, and piers that extend below grade.

C. Allow not less than 12 hours for drying after application before beginning construction activities.

D. Post signs in the areas of application warning workers that soil termiticide treatment has been applied. Remove signs when areas are covered by other construction.

E. Reapply soil treatment solution to areas disturbed by subsequent excavation, landscape grading, or other construction activities following application.

END OF SECTION

SECTION 32 12 06

BASE COURSE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes
   1. Aggregate base for asphaltic concrete and Portland cement concrete paving including sand/shell base and hot-mix sand asphalt base.

B. Related Sections
   1. Section 312000 – Earthwork

1.2 REFERENCES

A. Asphalt Institute

B. State Highway Department Standard Specifications

1.3 QUALITY ASSURANCE

A. An independent testing laboratory, selected and paid by Contractor, will be retained to perform construction testing of in-place base course for compliance with requirements for thickness, compaction, density, and tolerances. Paving base course tolerances shall be verified by rod and level readings on not more than 50-foot centers to be not more than 0.05-feet above design elevation which will allow for paving thickness as shown on Construction Drawings. Contractor shall provide instruments and suitable benchmark.

1.4 SUBMITTALS

A. Submit materials certificate to the independent testing laboratory that is signed by materials producer and Contractor, certifying that materials comply with, or exceed, requirements specified herein or on the Construction Drawings.

B. Submit certification of base course materials and placement as specified in Parts 2 and 3 hereinafter.

1.5 WEATHER LIMITATIONS

A. Do not place aggregate when base surface temperature is less than 40 degrees F, nor when air temperature is below 45 degrees F. Do not place aggregate when surface is wet or frozen. Do not place aggregate when weather conditions are unfavorable otherwise.

PART 2 - PRODUCTS

2.1 BASE COURSE MATERIAL

A. Aggregate Base Course: Aggregate base course shall consist of a well graded, durable aggregate uniformly moistened and mechanically stabilized by compaction. Base course may consist of a granular base (crushed slag, stone, or gravel, etc), sand/shell base material, or a hot-mix sand asphalt base.

B. Base course shall be as shown on the drawings, or when not shown, shall be as specified herein.

C. Aggregate base material requirements from State or other local highway agency specifications may be use for aggregate base course for roads, streets, or similar use pavements if the following conditions are met:
   1. Percentage of material by weight passing the No. 200 sieve will not exceed 10.
   2. Portion of the material passing the No. 40 sieve must have a liquid limit not greater than 25 and a plasticity index not greater than 5.

D. Aggregate shall consist of clean, sound, durable particles of crushed stone, crushed slag, crushed gravel, angular sand, or other approved material. Aggregate shall be free of lumps of clay, organic matter, and other objectionable materials or coatings. The portion retained on the No. 4 sieve shall be known as coarse aggregate; that portion passing the No. 4 sieve shall be known as fine aggregate.
   1. Coarse aggregates shall be angular particles of uniform density.
   2. Fine aggregates shall be angular particles of uniform density. Fine aggregate shall consist of screenings, angular sand, crushed recycled concrete fines, or other finely divided mineral matter processed or naturally combined with the coarse aggregate.

E. Gradation: The specified gradation requirements shall apply to the completed base course. The aggregates shall have a maximum size of 2 inches and shall be continuously well graded within the following limits:

GRADATION OF AGGREGATES
Percentage by Weight Passing Square-Mesh Sieve

Sieve Designation	No. 1	No. 2	No. 3
2 inch	100	----	----
1-1/2 inch	70-100	100	----
1 inch	45-80	60-100	100
1/2 inch	30-60	30-65	40-70
No. 4	20-50	20-50	20-50
No. 10	15-40	15-40	15-40
No. 40	5-25	5-25	5-25
No. 200	0-10	0-10	0-10

NOTE: Particles having diameters less than 0.0008 inch shall not be in excess of 3 percent by weight of the total sample tested.

F. Hot-mix Sand Asphalt Bases: Asphalt Institute Type VI, VII, or VIII Mixes for Hot-mix Sand Asphalt Bases. Hot-Mix base shall be used only under asphaltic concrete surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Contractor shall verify to the Owner in writing that the subgrade has been inspected, tested, and gradients and elevations are correct, dry, and properly prepared in accordance with Section 02300.

3.2 CONSTRUCTION

A. Perform base course construction in accordance with the applicable State standard specifications or as shown or specified.

B. Perform base course construction in a manner that will drain the surface properly and prevent runoff from adjacent areas from draining onto base course construction.

C. Compact base material to not less than 95 percent of optimum density, as determined by ASTM D 698 unless otherwise indicated on the Drawings.

D. Construct to thickness indicated on Construction Drawings.
   1. Granular Base: Apply in lifts or layers not exceeding 8-inches, measured loose.
   2. Sand/Shell Base: Apply in lifts or layers not exceeding 4-inches, measured loose.
   3. Hot-mix Sand Asphalt Bases: Apply in lifts or layers not exceeding 3-inches, measured loose.

3.3 FIELD QUALITY CONTROL

A. Field testing specified below will be performed by the Contractor's Independent Testing Laboratory at no cost to the Owner.

B. Field testing, frequency, and methods may vary as determined by and between the Contractor and the Contractor's Testing Laboratory.

C. Field density tests for in-place materials will be performed in accordance with the following:
   1. Nuclear Method: ASTM D 2922 (Method B-Direct Transmission)
   2. Base material thickness: One test for each 20,000 sq. ft. of in-place base material area.
   3. Base material compaction: One test in each lift for each 20,000 sq. ft. of in-place base material area.

D. The independent testing laboratory will prepare reports that indicate test location, elevation data, and test results. Owner and Contractor shall be provided with copies of the reports within 96 hours of the time the test was performed. In the event that the test results show failure to meet any of the Specifications; Owner and Contractor will be notified immediately by the independent testing laboratory.

E. The Contractor shall certify in writing to the Owner that base course placement is in accordance with specification requirements prior to subsequent work thereon.

F. The Contractor shall pay for retesting due to failures at no additional expense to Owner. Contractor shall provide free access to the site for testing activities.

END OF SECTION

SECTION 32 12 16

ASPHALTIC CONCRETE PAVING

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 WORK INCLUDED

A. Prepare subgrade to receive base course.

B. Provide compacted base course.

C. Place base course and place asphaltic concrete hot mix (ACHM) binder course.

D. Tack base course and place ACHM surface course.

1.3 RELATED WORK

A. Section 312000 - Earthwork

B. Section 334100 - Storm Drainage

C. Section 321333 - Concrete Curb and Gutters

D. Section 033000 - Cast in Place Concrete

1.4 REFERENCES

A. Arkansas State Highway and Transportation Dept. (AHTD):

1. Standard Specifications for Highway Construction, Edition of 2003, hereafter referred to as "AHTD Standard Specifications".

PART 2 - PRODUCTS

2.1 BASE COURSE MATERIALS

A. Crushed Stone: Class 7, meeting the requirements of section 303 of the AHTD Standard Specifications, or approved equal.

B. Tack Coat: Shall be applied as specified and meeting the requirements of section 401 of the AHTD Standard Specifications.

2.2 ASPHALT PAVEMENT MATERIALS

A. ACHM Surface Course:

1. Type 2 mix as described in Sections 407 and 409 of the AHTD Standard Specifications.
2. The surface course shall be composed of a mixture of mineral aggregate and asphalt cement in the proportions by weight for the type mixture designated.

B. ACHM Binder Course:

1. Type 2 mix as described in Sections 405 and 409 of the AHTD Standard Specifications.
2. The base course shall be composed of a mixture of mineral aggregate and asphalt cement in the proportions by weight for the type mixture designated.

PART 3 - EXECUTION

3.1 SUBGRADE PREPARATION

A. Ensure grading of the subgrade to the required elevation.

B. Scarify to a depth of six inches the subgrade where the base course is to be placed.

C. Water and thoroughly mix subgrade until optimum moisture content is obtained when deficiency of moisture content exists. When excess of moisture exists, rework and aerate subgrade until optimum moisture content is obtained.

D. Re-compact the subgrade to not less than 98 percent of optimum density as determined by ASTM D 698 or 95 percent of optimum density, as determined by ASTM D 1557 unless otherwise indicated on the Drawings.

E. Before final rolling, shape the entire area to the required cross section, adding additional subsoil as required and compact the subgrade surface to the required density.

3.2 PLACEMENT OF BASE COURSE

A. Place the crushed stone base material over the prepared subgrade in accordance with the construction methods described in section 303 of the AHTD Standard Specifications.

B. Place the crushed stone base material over the prepared building pad at 4 inches in depth. The building slab will be placed over the compacted base material.

C. Add water during compaction to bring the base course materials to optimum moisture content. When an excess moisture exists, rework the base course materials until optimum moisture content is obtained.

D. Compact the base course to not less than 95 percent of optimum density, as determined by ASTM D 1557 unless otherwise indicated on the Drawings.

3.3 PLACING TACK COATS

A. Apply the bituminous tack coat to the prepared base at the rate of 0.03 gallon to 0.10 gallon per square yard as designated by the Architect/ Engineer.

B. Clean the base course surface and place the tack coats in accordance with the requirements of section 401 of the AHTD Standard Specifications.

3.4 PLACING ACHM SURFACE COURSE

A. Construction Methods: Section 410, AHTD Standard Specifications.

B. Temperature range of mix:

1. When discharged from mixer: 285 degrees F. to 325 degrees F.
2. When placed on base course: 275 degrees F. 325 degrees F.

C. Temperature of air: Do not place ACHM when air temperature in the shade is below 40 degrees F.

D. Place asphalt pavement to compacted depth shown on Drawing.

E. Compact to required density, with approved rolling equipment. Start compaction as soon as pavement will bear equipment without checking or undue displacement.

F. Required density: 92 percent of maximum theoretical density.

G. Carry out compaction in three operations in pass sequence. Ensure each pass of roller overlaps previous passes to ensure smooth surface free of roller marks. Keep roller wheels sufficiently moist so as not to pick up material.

H. Perform hand tamping in areas not accessible to rolling equipment.

I. Ensure joints made during paving operations and at connection to existing pavement are straight, clean vertical and free of broken or loose material.

J. Ensure surface of completed asphalt pavement is true to lines, profiles and elevations indicated, and is free from depressions exceeding 1/4 inch when measured with a 10 foot straight-edge.

K. Do not allow vehicular traffic on newly paved areas until surface has cooled to atmospheric temperature.

3.5 FIELD QUALITY CONTROL

A. Testing laboratory will make in-place tests of density and moisture content of the subgrade and the base course in accordance with ASTM D 2922-78.

B. Testing laboratory will make density tests of compacted asphalt paving in accordance with ASTM D 107-76.

END OF SECTION

SECTION 32 13 13

PORTLAND CEMENT CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

1.2 Section Includes

1. Preparation and placement of Portland cement concrete parking areas.
2. Preparation and placement of Portland cement concrete roads and entrances.

1.3 Related Sections

1. Section 312000 - Earthwork
2. Section 321206 - Base Course
3. Section 321313 - Pavement Markings

1.4 REFERENCS

A. American Concrete Institute (ACI)

1. ACI 301 -Structural Concrete for Buildings.
2. ACI 305R - Hot Weather Concreting
3. ACI 306R - Standard Specification for Cold Weather Concreting
4. ACI 308 - Standard Practice for Curing Concrete

B. American Society for Testing and Materials (ASTM)

1. ASTM A185 - Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
2. ASTM A615 - Deformed and Plain Billet-Steel for Concrete Reinforcement
3. ASTM C 31 - Test Methods of Making and Curing Concrete Test Specimens in the Field.
4. ASTM C33 - Concrete Aggregates
5. ASTM C 39 - Test Method for Comprehensive Strength of Cylindrical Concrete Specimens.
6. ASTM C42 - Obtaining And Testing Drilled Cores And Sawed Beams Of Concrete
7. ASTM C94 - Ready-Mixed Concrete
8. ASTM C 138 - Test Method for Unit Weight, Yield, and Air Content (Gravemetric) of Concrete.
9. ASTM C143 - Method for Slump of Hydraulic Cement Concrete
10. ASTM C150 - Portland Cement
11. ASTM C 172 - Method of Sampling Freshly Mixed Concrete.
12. ASTM C231 - Air-Content of Freshly Mixed Concrete by the Pressure Method
13. ASTM C260 - Air-Entraining Admixtures for Concrete
14. ASTM C309 - Liquid Membrane-Forming Compounds for Curing Concrete
15. ASTM C920 - Standard Specification for Elastomeric Joint Sealants
16. ASTM C1064 - Temperature Of Freshly Mixed Portland Concrete Cement
17. ASTM D994 - Preformed Expansion Joint Filler for Concrete (Bituminous)
18. ASTM D1751 - Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
19. ASTM D2628 - Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements

C. Federal Specifications (FS)
   1. FS HH-F-341 - Fillers, Expansion Joint: Bituminous (Asphalt & Tar)

D. State Highway Department Standard Specifications

1.5 QUALITY ASSURANCE

A. Establish and maintain required lines and elevations.

B. Check surface areas at intervals necessary to eliminate ponding areas. Remove and replace unacceptable paving as directed by Owner.

1.6 SUBMITTALS

A. Submit certified laboratory test data or manufacturer's certificates and data for the items listed below certifying that materials are in conformance requirements specified herein. Submit to the Engineering Consultant of Record and the Independent Testing Laboratory for review and approval and within 7 calendar days after receipt of Notice-to-Proceed.
   1. Portland cement concrete mix
   2. Aggregate gradations
   3. Preformed expansion joint filler
   4. Field molded/poured sealant
   5. Dowel bars
   6. Expansion sleeves
   7. Tie bars
   8. Reinforcing steel bars
   9. Welded wire fabric
   10. Air entraining admixtures
   11. Water-reducing and set-retarding admixtures (if used)

B. Submit certification that joint sealant has been installed in accordance with the manufacturer's instructions. Include copy of written instructions.

1.7 PROJECT CONDITIONS

A. Maintain access for vehicular and pedestrian traffic as required for other construction activities. Utilize temporary striping, flagmen, barricades, warning signs, and warning lights as required.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Concrete: Mix concrete and deliver in accordance with ASTM C94.
   1. Design mix shall produce normal weight concrete consisting of Portland cement, aggregate, water-reducing admixture, air-entraining admixture, and water to produce following:
      a. Compressive Strength: 4,000 psi, minimum at 28 days, unless otherwise indicated on Construction Drawings.

b. Slump Range: 1”-3” for hand placed concrete, 1-1/4” to 3” for machine placed (slipform) concrete
c. Air Entrainment: 5 to 7 percent

B. Forms: Steel, wood, or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects. Use flexible spring steel forms or laminated boards to form radius bends as required. Coat forms with nonstaining type of coating that will not discolor or deface surface of concrete.

C. Welded Wire Mesh: Welded plain cold-drawn steel wire fabric, ASTM A185. Furnish in flat sheets.

D. Reinforcing Bars: Deformed steel bars, ASTM A615, Grade 60.

E. Portland Cement: ASTM C150, Type I

F. Joint Fillers: Resilient premolded bituminous impregnated fiberboard units complying with ASTM D994, D1751, D2628; FS HH-F-341, Type II, Class A.

G. Joint Sealants: ASTM C920, non-priming, pourable, self-leveling polyurethane.
1. Acceptable sealants include Sonneborn “SL1”, Sonneborn "SL2", Sonneborn “Sonomeric 1”, Sonneborn “Sonomeric 2”, Mameco "Vulkem 245", or Woodmont Products "Chem-Caulk".

H. Aggregate: ASTM C33.

I. Water: Clean and potable

J. Dowel Bars: ASTM A615, grade 60, and plain steel bars.

K. Air Entraining Mixture: ASTM C260, Sika AER by Sika Corporation or Air Mix by the Euclid Chemical Corporation.

L. Curing Compound: ASTM C309, Hydrocide by Sonneborn of Rexnord Chemical Products, Inc. or Polyseal 4 in 1 by Chem Masters Corporation.

M. Joint Backup Rods: CCEVA Rod 100 by E-Poxy Industrials, Inc., or Sealtight BACKER ROPE by W.R. Meadows, Inc.

PART 3 - EXECUTION

3.1 PREPARATION

A. Proofroll prepared base material surface to check for unstable areas in accordance with Section 312000 including documentation and re-proof rolling as required. Paving work shall begin only after unsuitable areas have been corrected and are ready to receive paving.

B. Remove loose material from compacted base material surface to produce firm, smooth surface immediately before placing concrete.

3.2 INSTALLATION

A. Form Construction
   1. Set forms to required grades and lines, rigidly braced and secured.
   2. Install sufficient quantity of forms to allow continuance of work and so that forms remain in place minimum of 24 hours after concrete placement.
   3. Check completed formwork for grade and alignment to following tolerances:
      a. Top of forms not more than 1/8-inch in 10'-0".
      b. Vertical face on longitudinal axis, not more than1/4-inch in 10'-0".
   4. Clean forms after each use and coat with form release agent as often as required to ensure separation from concrete without damage.

B. Reinforcement: Fasten reinforcing bars or welded wire fabric (if required) accurately and securely in place with suitable supports and ties. Remove from reinforcement all dirt, oil, loose mill scale, rust, and other substances that will prevent proper bonding of the concrete to the reinforcement.

C. Concrete Placement
   1. Concrete may be mixed and placed when the air temperature in the shade and away from artificial heat is a minimum of 35 degrees F and rising. Hot and cold weather concreting shall be in accordance with ACI 305R and 306R, respectively.
   2. Do not place concrete until base material and forms have been checked for line and grade. Moisten base material if required to provide uniform dampened condition at time concrete is placed. Concrete shall not be placed around manholes or other structures until they are at required finish elevation and alignment.
   3. Place concrete using methods that prevent segregation of mix. Consolidate concrete along face of forms and adjacent to transverse joints with internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Consolidate with care to prevent dislocation of reinforcing, dowels, and joint devices.
   4. Deposit and spread concrete in continuous operation between transverse joints, as far as possible. If interrupted for more than 1/2 hour, place construction joint.

D. Joint Construction: Construct expansion, weakened-plane control (contraction), and construction joints straight with face perpendicular to concrete surface. Construct transverse joints perpendicular to centerline, unless otherwise detailed.
   1. Weakened-Plane Control or Contraction Joints: Provide joints at spacing of 15'-0" on centers, maximum each way. Construct control joints for depth equal to at least 1/4 of the concrete thickness, as follows:
      a. Form tooled joints in fresh concrete by grooving top with recommended tool and finishing edge with jointer.
      b. Form sawed joints using powered saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut joints into hardened concrete as soon as surface will not be torn, abraded, or otherwise damaged by cutting action.
   2. Construction Joints: Place construction joints at end of placements and at locations where placement operations are stopped for period of more than 1/2 hour, except where such placements terminate at expansion joints. Construct joints in accordance with standard details.
   3. Transverse Expansion Joints: Locate expansion joints at maximum of 180'-0" on centers, maximum each way unless otherwise shown on the Construction Drawings. Provide premolded joint

filler for expansion joints abutting concrete curbs, catch basins, manholes, inlets, structures, sidewalks, and other fixed objects.

4. Butt Joints: For joints against existing pavement, place 16” long dowels eight inches into holes drilled into center of existing slab. Epoxy dowels into holes with approved epoxy compound. Place dowels prior to concrete placement for new concrete. Dowel spacing to be 24” on center unless otherwise shown on Construction Drawings. Saw joint and fill with joint sealer.

E. Joint Fillers: Extend joint fillers full-width and depth of joint, and not less than 1/2-inch or more than 1-inch below finished surface where joint sealer is indicated. Furnish joint fillers in 1-piece lengths for full width being placed, wherever possible. Where more than 1 length is required, lace or clip joint filler sections together.

F. Joint Sealants: Joints shall be sealed with approved exterior pavement joint sealants and shall be installed in accordance with manufacturer's recommendations.

3.3 CONCRETE FINISHING

A. After striking off and consolidating concrete, smooth surface by screeding and floating. Adjust floating to compact surface and produce uniform texture. After floating, test surface for trueness with 10'-0" straightedge. Distribute concrete as required to remove surface irregularities and refloat repaired areas to provide continuous smooth finish.

B. Work edges of slabs and formed joints with edging tool, rounding edge to 1/2-inch radius. Eliminate tool marks on concrete surface. After completion of floating and troweling, when excess moisture or surface sheen has disappeared, complete surface finishing, as follows:

1. Inclined Slab Surfaces: Provide coarse, nonslip finish by scoring surface with stiff-bristled broom perpendicular to flow of traffic so as to produce regular corrugations not over 1/16 of an inch deep.
2. Paving: Provide coarse, nonslip finish by scoring surface with stiff-bristled broom perpendicular to flow of traffic so as to produce regular corrugations not over 1/16 of an inch deep.

C. Do not remove forms for 24 hours after concrete has been placed. After form removal, clean ends of joints and point up minor honeycombed areas. Remove and replace areas or sections with major defects, as directed by Owner.

D. Protect and cure finished concrete paving using either membrane curing compound or moist-curing methods described in "water-curing" section of ACI 308.

3.4 CLEANING AND ADJUSTING

A. The Contractor shall certify in writing that placement is in accordance with specification requirements.

B. Sweep concrete pavement and wash free of stains, discolorations, dirt, and other foreign material just prior to final inspection.

C. Protect concrete from damage until acceptance of work. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials.

3.5 FIELD QUALITY CONTROL

A. Field quality control tests specified herein will be conducted by the Contractor's Independent Testing Laboratory at no cost to the Owner in accordance with Section 01458. The Contractor shall perform additional testing as considered necessary by the Contractor for assurance of quality control. Retesting required as a result of failed initial tests shall be at the Contractor's expense.

B. Field testing, frequency, and methods may vary as determined by and between the Contractor and the Contractor's Testing Laboratory.

C. Review the Contractor's proposed materials and mix design for conformance with specifications.

D. Perform testing in accordance with ACI 301 and testing standards listed herein.

E. Strength Tests:
   1. Secure composite samples in accordance with ASTM C 172. Sample at regularly spaced intervals from middle portion of the batch. Sampling time shall not exceed 15 minutes.
   2. Mold and cure specimens in accordance with ASTM C 31.
      a. A minimum of four concrete test cylinders shall be taken for every 100 cubic yards or less of each class of concrete placed each day and not less than once for each 5000 square feet of paved area.
      b. During the initial 24 hours (plus or minus 8 hours) after molding, the temperature immediately adjacent to the specimens shall be maintained in the range of 60 to 80 degrees F. Control loss of moisture from the specimens by shielding from the direct rays of the sun and from radiant heating devices.
      c. Specimens transported prior to 48 hours after molding shall not be demolded, but shall continue initial curing at 60 to 80 degrees F until time for transporting.
      d. Specimens transported after 48 hours age shall be demolded in 24 hours (plus or minus 8 hours). Curing shall then be continued but in saturated limewater at 73.4 degrees (plus or minus 3 degrees F) until the time of transporting.
      e. Wet cure cylinders under controlled temperature until testing.
   3. Test cylinders in accordance with ASTM C 39.
      a. Date test cylinders and number consecutively. Give each cylinder of each set an identifying letter (i.e. A, B, C, D). Prepare a sketch of the building plan for each test set identifying location of placed concrete.
      b. Test one cylinder (A) at 7 days for information. If the compressive strength of the concrete sample is equal to or above the 28 day specified strength, test another cylinder (B) at 7 days. The average of the breaks shall constitute the compressive strength of the concrete sample.
      c. Test two cylinders (B and C) at 28 days and the average of the breaks shall constitute the compressive strength of the concrete sample.
      d. Retain fourth cylinder (D) for further testing if needed, but do not retain cylinder more than 60 days.
   4. Evaluation and Acceptance:
      a. Strength level of concrete will be considered satisfactory if the average of all sets of three consecutive strength tests equal or exceed specified strength and no individual strength

test (average of two cylinders) results are below specified compressive strength by more than 500 psi.

b. Complete concrete work will not be accepted unless requirements of ACI 301, have been met, including dimensional tolerances, appearance, and strength of structure.

c. Where average strength of cylinders, as shown by tests is not satisfactory, Owner reserves the right to require Contractor to provide improved curing conditions of temperature and moisture to secure required strength. If average strength of laboratory control cylinders should fall so low as to cause portions of structure to be in question by Owner, follow core procedure set forth in ASTM C42. If results of core test indicate, in opinion of Owner, that strength of structure is inadequate, provide without additional cost to Owner, replacement, load testing, or strengthening as may be ordered by Owner. If core tests are so ordered and results of such tests disclose that strength of structure is as required, cost of test will be paid by Owner.

F. Slump Test: Conduct slump test for each cylinder set taken in accordance with ASTM C 143. Make additional slump tests for every other load from a stationary mixer or truck to test consistency. Sampling shall be in accordance with ASTM C 172.

G. Air Content: Conduct air content test for each cylinder set for concrete exposed to freeze-thaw in accordance with ASTM C 231, ASTM C 173, or ASTM C 138. Indicate test method on report. Make test at same time as slump test.

H. Unit Weight: ASTM C 138.

I. Temperature Test: Conduct temperature test for each cylinder set taken in accordance with ASTM C 1064. Test hourly when air temperature is 40 F and below or 80 F and above. Determine temperature of concrete sample and ambient air for each strength test.

J. In addition to required information noted previously in this Section, record the following information on concrete compression reports:

1. Test cylinder number and letter.
2. Specific foundations or structures covered by this test.
3. Proportions of concrete mix or mix identification.
4. Maximum size coarse aggregate.
5. Specified compressive strength.
6. Tested compressive strength.
7. Slump, air-content (when applicable) and concrete temperature.
8. Concrete plastic unit weight.
9. Concrete Temperature.
10. Elapsed time from batching at plant to discharge from delivery truck at project.
11. Date and time concrete was placed.
12. Ambient temperature, wind speed, and relative humidity during concrete placement.
13. Name of technician securing samples.
14. Curing conditions for concrete strength test specimens (field and laboratory).
15. Date strength specimens transported to laboratory.
16. Age of strength specimens when tested.
17. Type of fracture during test.

K. At the start of each day's mixing, report any significant deviations from approved mix design including temperature, moisture and condition of aggregate.

L. Certify each delivery ticket of concrete. Report type of concrete delivered, amount of water added and time at which cement and aggregate were loaded into truck, and time at which concrete was discharged from truck

M. In Place Pavement Testing: The Contractor's Independent Testing Laboratory will randomly core pavement at minimum rate of 1 core per 20,000 sq. ft of pavement, with minimum of 3 cores from heavy-duty areas and 3 cores from light duty areas. Cores will be sampled and tested in accordance with ASTM C 42. Core will be tested for thickness and quality of aggregate distribution. Core holes shall be patched by the Contractor immediately with Portland cement concrete and shall be finished to provide level surface as specified herein.

N. Additional Tests: Additional in-place tests shall be conducted as directed by the Owner when specified concrete strengths and other characteristics have not been attained in the structures.

END OF SECTION

SECTION 32 13 23

PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 SUMMARY

1.2 Section Includes

1. Painting and marking of pavements, curbs, guard posts, and light pole bases.

1.3 REFERENCE STANDARDS

A. American Association of State Highway and Transportation (AASHTO)
   1. AASHTO M248 - Ready-Mixed White and Yellow Traffic Paints

B. American Society for Testing and Materials (ASTM)
   1. ASTM D4414 - Standard Practice for Measurement of Wet Film Thickness by Notched Gauges.

C. Federal Specifications (FS)

   1. FS A-A-2886 - Paint, Traffic, Solvent Based (supersedes FS TT-P-85 and FS TT-P-115, Type I)
   2. FS TT-P-1952 - Paint, Traffic And Airfield Marking, Waterborne

1.4 PROJECT CONDITIONS

A. Maintain access for vehicular and pedestrian traffic as required for other construction activities. Utilize flagmen, barricades, warning signs, and warning lights as required.

1.4 QUALITY ASSURANCE

B. Use trained and experienced personnel in applying the products and operating the equipment required for properly performed work.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Paint shall be waterborne or solvent borne, colors as shown or specified herein. Pavement marking paints shall comply with applicable state and local laws enacted to ensure compliance with Federal Clean Air Standards. Paint materials shall conform to the restrictions of the local Air Pollution Control District.

B. Waterborne Paint: Paints shall conform to FS TT-P-1952.

C. Solvent Borne Paint: Paint shall conform to FS A-A-2883 or AASHTO M248. Paint shall be non-bleeding, quick-drying, and alkyd petroleum base paint suitable for traffic-bearing surface and be

mixed in accordance with manufacture's instructions before application for colors White, Yellow, Blue, and Red.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the work area and correct conditions detrimental to timely and proper completion of the work. Do not proceed until unsatisfactory conditions are corrected.

3.2 PREPARATION

A. Sweep and clean surface to eliminate loose material and dust.

B. Where existing pavement markings are indicated on Construction Drawings to be removed or would interfere with adhesion of new paint, a motorized abrasive device shall be used to remove the markings. Equipment employed shall not damage existing paving or create surfaces hazardous to vehicle or pedestrian traffic. Within public rights-of-way, appropriate governing authority shall approve method of marking removal.

C. New pavement surfaces shall be allowed to cure for not less than 30 days before application of marking materials.

3.3 CLEANING EXISTING PAVEMENT MARKINGS

A. In general, markings shall not be placed over existing pavement marking patterns. Existing pavement markings, which are in good condition but interfere or conflict with the newly applied marking patterns, shall be removed. Deteriorated or obscured markings that are not misleading or confusing or do not interfere with the adhesion of the new marking material do not require removal. Whenever grinding, scraping, sandblasting or other operations are performed, the work shall be conducted in such a manner that the finished pavement surface is not damaged or left in a pattern that is misleading or confusing. When these operations are completed the pavement surface shall be blown off with compressed air to remove residue and debris resulting from the cleaning work.

3.4 APPLICATION

A. Apply two coats of paint at manufacturer's recommended rate, without addition of thinner, with maximum of 100 square feet per gallon or as required to provide a minimum wet film thickness of 15 mils and dry film thickness of 7 ½ mils per coat. Paint shall be applied for a total dry film thickness of 15 mils. Apply with mechanical equipment to produce uniform straight edges. At sidewalk curbs and crosswalks, use straightedge to ensure uniform, clean, and straight stripe.

B. Install pavement markings according to manufacturer's recommended procedures for the specified material.

C. Following items shall be painted with colors noted below:

1. Pedestrian Crosswalks: White
2. Exterior Sidewalk Curbs, Light Pole Bases, and Guard posts: Yellow
3. Fire Lanes: Red or per local code
4. Lane Striping where separating traffic moving in opposite directions: Yellow
5. Lane Striping where separating traffic moving in the same direction: White
6. ADA Symbols: Blue or per local code
7. ADA parking space markings as shown on the drawings.
8. Parking Stall Striping: Yellow, unless otherwise noted on Construction Drawings

3.5 FIELD QUALITY CONTROL

A. Inspection: After the paint has thoroughly dried, visually inspect the entire application and touch up as required to provide clean, straight lines and surfaces throughout.

B. Testing: Testing of wet film thickness shall be performed a minimum of two times on each parking row (including striped islands) and pedestrian cross walks, and a minimum of one test on each lane/alignment striping. At least one test shall be performed after refilling paint striping machine, changing operators of striping machine, and changing paint types, brands, etc. This shall be performed in addition to the testing stated above. These tests shall be performed on each coat applied. Testing shall be performed in accordance with ASTM D4414.

3.6 CLEANING

A. Waste materials shall be removed at the end of each workday. Upon completion of the work, all containers and debris shall be removed from the site. Paint spots upon adjacent surfaces shall be carefully removed by approved procedures that will not damage the surfaces and the entire job left clean and acceptable.

END OF SECTION

SECTION 32 13 33

CURBS AND SIDEWALKS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes
   1. Portland cement concrete curb, gutter, and sidewalk.

B. Related Sections
   1. Section 312000 - Earthwork

1.2 REFERENCS

A. American Concrete Institute (ACI)
   1. ACI 305R - Hot Weather Concreting
   2. ACI 306R - Standard Specification for Cold Weather Concreting
   3. ACI 308 - Standard Practice for Curing Concrete

B. American Standards for Testing and Materials (ASTM) latest edition
   1. ASTM A185 - Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
   2. ASTM A615 - Deformed and Plain Billet-Steel for Concrete Reinforcement
   3. ASTM C94 - Ready-Mixed Concrete
   4. ASTM C260 - Air-Entraining Admixtures for Concrete
   5. ASTM C309 - Liquid Membrane-Forming Compounds for Curing Concrete
   6. ASTM D994 - Preformed Expansion Joint Filler for Concrete (Bituminous)
   7. ASTM D1190 - Concrete Joint Sealer, Hot Poured, Elastic Type
   8. ASTM D1751 - Performed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
   9. ASTM D2628 - Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements

C. Federal Specifications (FS)
   1. FS HH-F-341 - Fillers, Expansion Joint: Bituminous (Asphalt & Tar)

D. State Highway Department Standard Specifications

1.3 SUBMITTALS

A. Submit materials certificate from materials producer and Contractor, certifying that materials comply with, or exceed requirements specified herein to the Engineering Consultant of Record and the Independent Testing Laboratory for review and approval and within 7 calendar days after receipt of Notice-to-Proceed, submit for approval, certified laboratory test data or manufacturers certificates and data for the following items:
   1. Portland cement concrete mix
   2. Aggregate gradations
   3. Preformed expansion joint filler
   4. Field molded/poured sealant

5. Dowel bars
6. Expansion sleeves
7. Tie bars
8. Reinforcing steel bars
9. Welded wire fabric
10. Air entraining admixtures
11. Water-reducing and set-retarding admixtures (if used)

1.4 QUALITY ASSURANCE

A. Establish and maintain required lines and elevations.

B. Check surface areas at intervals necessary to eliminate ponding areas. Remove and replace unacceptable work as directed by Owner.

1.5 PROJECT CONDITIONS

A. Maintain access for vehicular and pedestrian traffic as required for other construction activities. Utilize temporary striping, flagmen, barricades, warning signs, and warning lights as required.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Concrete: Mix concrete and deliver in accordance with ASTM C94.
   1. Design mix shall produce normal weight concrete consisting of Portland cement, aggregate, water-reducing admixture, air-entraining admixture, and water to produce following:
      a. Compressive Strength: 4,000 psi, minimum at 28 days, unless otherwise indicated on Construction Drawings.
      b. Slump Range: 1”-3” for hand placed concrete, 1-1/4” to 3” for machine placed (slipform) concrete
      c. Air Entrainment: 5 to 7 percent

B. Forms: Steel, wood, or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects. Use flexible spring steel forms or laminated boards to form radius bends as required. Forms shall be of depth equal to depth of curbing or sidewalk, and so designed as to permit secure fastening together at tops. Coat forms with nonstaining type of coating that will not discolor or deface surface of concrete.

C. Welded Wire Mesh: Welded plain cold-drawn steel wire fabric, ASTM A 185. Furnish in flat sheets.

D. Reinforcing Steel: Deformed steel bars, ASTM A 615, Grade 60.

E. Portland Cement: Shall conform to ASTM C150, Type I

F. Joint Fillers: Resilient premolded bituminous impregnated fiberboard units complying with ASTM D994, D1751, D2628; FS HH-F-341, Type II, Class A or approved equal.

G. Joint Sealants: Conforming to ASTM D1190, non-priming, pourable, self-leveling polyurethane. Acceptable sealants are Sonneborn "Sonolastic Paving Joint Sealant", Sonneborn "Sonomeric CT 1 Sealant", Sonneborn "Sonomeric CT 2 Sealant", Mameco "Vulken 245", or Woodmont Products "Chem-Caulk".

H. Aggregate: ASTM C33.

I. Water: Clean and potable

J. Dowel Bars: ASTM A615, grade 60, and plain steel bars.

K. Air Entraining Mixture: ASTM C260; Sika AER by Sika Corporation or Air Mix by the Euclid Chemical Corporation.

L. Curing Compound: ASTM C309; Hydrocide by Sonneborn of Rexnord Chemical Products, Inc. or and Polyseal 4 in 1 by Chem Masters Corporation.

M. Joint Backup Rods: CCEVA Rod 100 by E-Poxy Industrials, Inc., Sealtight BACKER ROPE by W.R. Meadows, Inc. or approved equal.

PART 3 - EXECUTION

3.1 PREPARATION

A. Begin paving work only after unsuitable areas have been corrected and are ready to receive paving.

B. Remove loose material from compacted base material surface to produce firm, smooth surface immediately before placing concrete.

3.2 INSTALLATION

A. Form Construction
   1. Set forms to required grades and lines, rigidly braced and secured.
   2. Install sufficient quantity of forms to allow continuance of work and so that forms remain in place minimum of 24 hours after concrete placement.
   3. Check completed formwork for grade and alignment to following tolerances:
      a. Top of forms not more than 1/8-inch in 10'-0".
      b. Vertical face on longitudinal axis, not more than 1/4-inch in 10'-0".
   4. Clean forms after each use and coat with form release agent as often as required to ensure separation from concrete without damage.

B. Reinforcement: Fasten reinforcing bars or welded wire fabric (if required) accurately and securely in place with suitable supports and ties. Remove from reinforcement all dirt, oil, loose mill scale, rust, and other substances that will prevent proper bonding of the concrete to the reinforcement.

C. Concrete Placement
   1. Concrete shall be mixed and placed when the air temperature in the shade and away from artificial heat is a minimum of 35 degrees F and rising. Hot and cold weather concreting shall be in accordance with ACI 305R and 306R, respectively.

2. Do not place concrete until base material and forms have been checked for line and grade. Moisten base material if required to provide uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until set at required finish elevation and alignment.
3. Place concrete using methods that prevent segregation of mix. Consolidate concrete along face of forms and adjacent to transverse joints with internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Consolidate with care to prevent dislocation of reinforcing, dowels, and joint devices.
4. Deposit and spread concrete in continuous operation between transverse joints, as far as possible. If interrupted for more than 1/2 hour, place construction joint. Automatic machine may be used for curb and gutter placement. Machine placement shall be at required cross section, line, grade, finish, and jointing as specified for formed concrete. If results are not acceptable, remove and replace with formed concrete as specified herein.

D. Joint Construction
1. Contraction Joints: Construct concrete curb or combination concrete curb and gutter, where specified on Construction Drawings, in uniform sections of length specified on Construction Drawings. Form joints between sections either by steel templates, 1/8-inch in thickness, of length equal to width of curb and gutter, and with depth which will penetrate at least 2-inches below surface of curb and gutter; or with 3/4-inch thick performed expansion joint filler cut to exact cross section of curb and gutter; or by sawing to depth of at least 2-inches while concrete is between 4 and 24 hours old. If steel templates are used, they shall be left in place until concrete has set enough to hold it's shape, but shall be removed while forms are still in place.
2. Longitudinal Construction Joints: Tie concrete curb or combination concrete curb and gutter, where specified on Construction Drawings, to concrete pavement with 1/2-inch round deformed reinforcement bars of length and spacing shown on Construction Drawings.
3. Transverse Expansion Joints: Concrete curb, combination concrete curb and gutter, or concrete sidewalk shall have filler cut to exact cross section of curb, gutter, or sidewalk. Joints shall be similar to type of expansion joint used in adjacent pavement.

E. Joint Fillers: Extend joint fillers full-width and depth of joint, and not less than 1/2-inch or more than 1-inch below finished surface where joint sealer is indicated. Furnish joint fillers in 1-piece lengths for full width being placed, wherever possible. Where more than 1 length is required, lace or clip joint filler sections together.

F. Joint Sealants: Install in accordance with manufacturer's recommendations.

3.3 CONCRETE FINISHING

A. After striking off and consolidating concrete, smooth surface by screeding and floating. Adjust floating to compact surface and produce uniform texture. After floating, test surface for trueness with 10'-0" straightedge. Distribute concrete as required to remove surface irregularities, and refloat repaired areas to provide continuous smooth finish.

B. Work edges of sidewalks, gutters, back top edge of curb, and formed joints with edging tool, rounding edge to 1/2-inch radius. Eliminate tool marks on concrete surface. After completion of floating and trowelling, when excess moisture or surface sheen has disappeared, complete surface finishing, as follows:

1. Curbs, gutters, and sidewalks: Broom finish by drawing fine-hair broom across surface perpendicular to flow of traffic. Repeat operation as necessary to produce fine line texture.

C. Do not remove forms for 24 hours after concrete has been placed. After form removal, clean ends of joints and point up minor honeycombed areas. Remove and replace areas or sections with major defects as directed Owner.

D. Protect and cure finished concrete paving using acceptable moist-curing methods in accordance with "water-curing" section of ACI 308.

3.4 BACKFILL

A. After concrete has set sufficiently, spaces on either side of concrete curb, combination concrete curb and gutter, or concrete sidewalk shall be refilled to required elevation with suitable material compacted in accordance with Section 312000.

3.5 CLEANING AND PROTECTION

A. Sweep concrete pavement and wash free of stains, discolorations, dirt, and other foreign material just prior to final inspection.

B. Protect concrete from damage until acceptance of work. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials.

END OF SECTION

SECTION 321373 - PAVEMENT JOINT SEALANTS

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 the following:

1. Expansion and contraction joints within cement concrete pavement.
2. Joints between cement concrete and asphalt pavement.

1. 3 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples: For each type and color of joint sealant required.

C. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.

1. 4 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

B. Use manufacturer's standard test methods to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.

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 date, pot life, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials to comply with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1. 6 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
2. When joint substrates are wet or covered with frost.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2. 1 MANUFACTURERS

A. Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to one of the products listed in other Part 2 articles.

2. 2 MATERIALS

A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer based on testing and field experience.

B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2. 3 COLD-APPLIED JOINT SEALANTS

A. Multicomponent Jet-Fuel-Resistant Sealant for Concrete: Pourable, chemically curing elastomeric formulation complying with the following requirements for formulation and with ASTM C 920 for type, grade, class, and uses indicated:

1. Urethane Formulation: Type M; Grade P; Class 12-1/2; Uses T, M, and, as applicable to joint substrates indicated, O.

a. Products:

1) Pecora Corporation; Urexpan NR-300.

2. Coal-Tar-Modified Polymer Formulation: Type M; Grade P; Class 25; Uses T and, as applicable to joint substrates indicated, O.

a. Products:

1) Meadows, W. R., Inc.; Sealtight Gardox.

3. Bitumen-Modified Urethane Formulation: Type M; Grade P; Class 25; Uses T, M, and, as applicable to joint substrates indicated, O.

a. Products:

1) Tremco Sealant/Waterproofing Division; Vulkem 202.

B. Single-Component Jet-Fuel-Resistant Urethane Sealant for Concrete: Single-component, pourable, coal-tar-modified, urethane formulation complying with ASTM C 920 for Type S; Grade P; Class 25; Uses T, M, and, as applicable to joint substrates indicated, O.

1. Products:

a. Sonneborn, Div. of ChemRex, Inc.; Sonomeric 1.

C. Type NS Silicone Sealant for Concrete: Single-component, low-modulus, neutral-curing, nonsag silicone sealant complying with ASTM D 5893 for Type NS.

1. Products:

a. Crafco Inc.; RoadSaver Silicone.
b. Dow Corning Corporation; 888.

D. Type SL Silicone Sealant for Concrete and Asphalt: Single-component, low-modulus, neutral-curing, self-leveling silicone sealant complying with ASTM D 5893 for Type SL.

1. Products:

a. Crafco Inc.; RoadSaver Silicone SL.
b. Dow Corning Corporation; 890-SL.

E. Multicomponent Low-Modulus Sealant for Concrete and Asphalt: Proprietary formulation consisting of reactive petropolymer and activator components producing a pourable, self-leveling sealant.

1. Products:

a. Meadows, W. R., Inc.; Sof-Seal.

2. 4 HOT-APPLIED JOINT SEALANTS

A. Jet-Fuel-Resistant Elastomeric Sealant for Concrete: Single-component formulation complying with ASTM D 3569.

1. Products:

a. Crafco Inc.; Superseal 444/777.
b. Meadows, W. R., Inc.; Poly-Jet 3569.

B. Jet-Fuel-Resistant Sealant for Concrete and Tar Concrete: Single-component formulation complying with ASTM D 3581.

1. Products:

a. Crafco Inc.; Superseal 1614A.

b. Meadows, W. R., Inc.; Poly-Jet 1614.

C. Elastomeric Sealant for Concrete: Single-component formulation complying with ASTM D 3406.

1. Products:

a. Crafco Inc.; Superseal 444/777.
b. Meadows, W. R., Inc.; Poly-Jet 3406.

D. Sealant for Concrete and Asphalt: Single-component formulation complying with ASTM D 3405.

1. Products:

a. Koch Materials Company; Product No. 9005.
b. Meadows, W. R., Inc.; Sealtight Hi-Spec.

2. 5 JOINT-SEALANT BACKER MATERIALS

A. Provide joint-sealant backer materials that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint-sealant manufacturer based on field experience and laboratory testing.

B. Round Backer Rods for Cold- and Hot-Applied Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

C. Backer Strips for Cold- and Hot-Applied Sealants: ASTM D 5249; Type 2; of thickness and width required to control sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.

D. Round Backer Rods for Cold-Applied Sealants: ASTM D 5249, Type 3, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

2. 6 PRIMERS

A. Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

PART 3 - EXECUTION

3. 1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3. 2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.

B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3. 3 INSTALLATION OF JOINT SEALANTS

A. Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install backer materials of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of backer materials.
2. Do not stretch, twist, puncture, or tear backer materials.
3. Remove absorbent backer materials that have become wet before sealant application and replace them with dry materials.

D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses provided for each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealants from surfaces adjacent to joint.
2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.

F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions, unless otherwise indicated.

G. Provide recessed joint configuration for silicone sealants of recess depth and at locations indicated.

3. 4 CLEANING

A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

3. 5 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations with repaired areas are indistinguishable from the original work.

END OF SECTION 02764

SECTION 32 31 13

PVC COATED CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes
   1. Polyvinyl chloride (PVC) coated chain link fence – see plans for fence height.

B. Related Sections
   1. Section 311000 - Site Clearing
   2. Section 312000 - Earthwork

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM)
   1. ASTM A 392 - Zinc-Coated Steel Chain-Link Fence Fabric
   2. ASTM C 94 - Ready-Mixed Concrete
   3. ASTM F668 - Polyvinyl Chloride (PVC) Finish

B. Chain Link Fence Manufacturers Institute (CLFMI) latest edition Product Manual

1.3 SUBMITTALS

A. Manufacture’s technical literature with fence and gate installation instructions.

B. Shop drawings showing fence and gate designs.

C. Submit full color palette sample of actual PVC coated steel wire for Architect’s selection.

D. Project Record Documents: Accurately record actual locations of property perimeter posts relative to property lines and easements. This shall be certified by a registered Land Surveyor.

1.4 QUALITY ASSURANCE

A. Chain link fabric, posts, and components, and installation shall conform to the requirements of the CLFMI Product Manual unless otherwise shown or specified.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this Section with minimum 3 years documented experience.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Polyvinyl Chloride (PVC) Finish: Where indicated on the plans, provide framework, fittings, and accessories coated with the manufacturer’s standard polyvinyl chloride plastic resin finish thermally bonded and adhered to a cured primer applied over zinc-coated steel not less than 10-mills think.

B. Steel Posts: Type I or II or roll formed "C" Section steel conforming to CLFMI and as specified hereinafter.

C. Fabric:

1. PVC Chain Link Fence: Comply with ASTM F 668, with core wire diameter (gage) measured prior to application of PVC coating with not less than 0.030 oz. zinc per sq. ft. of uncoated surface on 9 gage wire. Polymer coating shall be Class 2b, 0.006" to 0.010" thick PVC coating fused and adhered to a cured primer over zinc-coated steel core wire.

D. End, Corner, and Pull Posts: Minimum sizes and weights as follows.
   1. Fabric Height: Type I or II in accordance with CLFMI Product Manual.

E. Line (Intermediate) Posts: Minimum sizes and weights as follows.
   1. Fabric Height: Type I, II, or "C" Section in accordance with CLFMI Product Manual.

F. Top & Bottom Rails: Type I or II in accordance with CLFMI Product Manual.
   1. Manufacturer's longest lengths.
   2. Couplings: Expansion type, approximately 6 inches long.
   3. Attaching Devices: Means of attaching top rail securely to each gate, corner, pull, and end post.

G. Sleeves: Galvanized steel pipe not less than 6-inches long with inside diameter not less than ½ inch greater than outside diameter of pipe. Provide steel plate closure welded to bottom of sleeve of width and length not less than 1 inch greater than outside diameter of sleeve.

H. Wire Ties: Class 1 galvanized steel, no less than 9 gage.

I. Post Brace Assembly: Manufacturer's standard adjustable brace at end of gate posts and at both sides of corner and pull posts, with horizontal brace located at mid-height of fabric. Use same material as top rail for brace, and truss to line posts with 0.375-inch diameter rod and adjustable tightener.

J. Post Tops: Galvanized steel, weather tight closure cap for each tubular post. Furnish caps with openings to permit passage of top rail.

K. Stretcher Bars: Galvanized steel, 1 piece lengths equal to full height of fabric, with minimum cross-section of 3/16-inch x 3/4-inch. Provide one stretch bar for each gate and end post, and two for each corner and pull post.

L. Stretch Bar Bands: Manufacturer's standard

M. Gates: Gates shall be fabricated from welded metal and finished to match fence fabric and framework. Provide horizontal and vertical members to ensure proper gate operation and attachment of fabric, hardware, and accessories.

N. Ready Mix Concrete: ASTM C94, mix design as follows:
   1. Design mix to produce normal weight concrete consisting of Portland cement, aggregate, water-reducing admixture, air-entraining admixture, and water to produce following:
      a. Compressive Strength: 3,500 psi, minimum at 28 days, unless otherwise indicated on Construction Drawings.
      b. Slump Range: 1 to 3 inches at time of placement
      c. Air Entrainment: 5 to 8 percent

O. Water: Clean

2.2 FINISH

A. PVC Coated Chain Link Fence:
   1. Fabric, Framing, and Other Iron Parts: Class 2b, PVC coating not less than 0.010" thick

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with recommended procedures and instructions of fencing manufacturer. Provide secure, aligned installation with line posts spaced at 10'-0" o.c. maximum, or as recommended by fencing manufacturer.

B. Methods for Setting Posts:
   1. Grade-Set Posts:
      a. Drill or hand excavate to a depth approximately 3 inches lower than post bottom. Set post bottom not less than 36 inches below finish grade.
      b. Excavate each post hole to 12 inch diameter, or not less than four times diameter of post.
      c. Place concrete around posts and vibrate or tamp for consolidation. Check each post for vertical and top alignment, and hold in position during placement and finishing operations. Extend concrete footing 2-inches above grade and trowel crown to shed water.
      d. Post shall be set plumb within 1/4" in 10 feet.

   2. Sleeve Set Posts: Anchor posts by means of pipe sleeves preset and anchored into concrete. After posts have been inserted into sleeves, fill annular space between post and sleeve solid with non-shrink, non-metallic grout, mixed and placed to comply with grout manufacturer's directions.

C. Install chain link fence in accordance with CLFMI Product Manual unless otherwise specified herein.

D. Top & Bottom Rails: Run rails continuously, bending to form radius for curved runs. Provide expansion couplings as recommended by manufacturer.

E. Brace Assemblies: Install braces so posts are plumb when diagonal rod are under proper tension.

F. Fabric: Leave approximately 2 inches between finish grade and bottom selvage. Pull fabric taut and tie to posts, rails, and tension wires. Install fabric on security side of fence, and anchor to framework so that fabric remains in tension after pulling force is released.

G. Stretcher Bars: Secure at end, corner, pull, and gate posts by threading through or clamping to fabric at 4 inches o.c. and secure to posts with metal bands spaced at 15 inches o.c.

H. Tie Wires:
   1. Use U-shaped wire, conforming to diameter of pipe to which attached, clasping pipe and fabric firmly when ends twisted at least 2 full turns. Bend ends of wire to minimize hazard to persons or clothing.
   2. Tie fabric to line posts with wire ties spaced 12 inches o.c. Tie fabric to rails and braces with wire ties spaced 24 inches o.c. Tie fabric to tension wires with hog rings spaced 24-inches o.c.
   3. Manufacturer's standard procedure will be accepted if of equal strength and durability.

I. Fasteners: Install nuts for tension bands and hardware bolts on side of fence opposite fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

J. Gates: Install gates according to the manufacturer’s written instructions, plum, level, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tampered-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricated where necessary.

3.2 ADDITIONAL INSTALLATION PROVISIONS

A. Use U-shape tie wires, conforming to the diameters of pipe, that clasp the pipe and fabric firmly with ends twisted at least 2 full turns.

B. Bend ends of exposed wires to minimize hazards to persons or clothing.

C. Install nuts for fasteners on tension bands and hardware bolts on the side of the fence opposite the fabric. The ends of bolts, once secure and checked for smooth operation, shall be peened to prevent removal of nuts.

D. Repair PVC coating damaged in the field with methods and techniques as recommended by the manufacturer.

END OF SECTION

SECTION 32 31 13.13 – POLYVINYL CHLORIDE (PVC)-COATED CHAIN LINK FENCE

PART 1 - GENERAL

1.01 SCOPE: Provide PVC-coated, galvanized steel chain link fences and gates, complete.

1.02 RELATED WORK SPECIFIED IN OTHER SECTIONS:

A. Excavation, filling and grading; Section 31 20 00.

B. Concrete for post footings; Section 03 30 00.

1.03 SUBMITTALS: Comply with Section 01 33 00.

A. Product Data: Provide manufacturer's technical data, specifications, and installation instructions for fence and gate posts, fabric, gates, gate operators, and accessories.

B. Shop Drawings: Show location of fence, gates, and details of post installation, gate swing, hardware, and accessories.

1.04 QUALITY ASSURANCE: Obtain chain link fence as complete unit, including necessary erection accessories, fittings, and fastenings from a single source or manufacturer.

PART 2 - PRODUCTS

2.01 MANUFACTURERS: Anchor Fence, Cyclone Fence Products, Allied Tube and Conduit, American Chain Link Fence Co., or approved equal.

2.02 PVC COATING: Provide PVC coating for all components and accessories. Comply with ASTM F668 and ASTM F934; color as selected by Architect from manufacturer’s standard color palette.

2.03 FABRIC:

A. Steel Fabric: Comply with Chain Link Fence Manufacturers Institute Product Manual. Furnish one-piece fabric widths.

1. Size: 2" mesh, 9 gage (0.148" diameter) wire, 6 gage at backstop.

2. Selvage: Knuckle at selvage and twist at other.

B. Galvanized Steel Finish: ASTM A 392, Class 1, with not less than 1.2 oz. zinc per sq. ft. of uncoated wire surface.

2.04 FRAMING:

A. Strength requirements for posts and rails conforming to ASTM F 669.

1. Pipe shall be straight, true to section, material, and sizes specified, and shall conform to the following weights per foot:

NPS In Inches	Outside Diameter in Inches	Type I Steel
1-1/4	1.660	2.27
1-1/2	1.990	2.72
2	2.375	3.65
2-1/2	2.875	5.79

B. Steel Framework, General: Posts, Rails, And Braces.

1. Type I Pipe: Hot-dipped galvanized steel pipe conforming to ASTM F 1083, plain ends, standard weight (Schedule 40) with not less than 1.8 oz. zinc per sq. ft. of surface area coated.

2. H Section: Hot-rolled steel H shape with minimum yield strength of 45,000 psi conforming to ASTM F 669, group III and hot-dip galvanized with minimum 2.0 oz. zinc per sq. ft. of surface area conforming to ASTM A 123.

3. Square Tubing: Fabricated from steel conforming to ASTM A 500, grade B and hot-dip galvanized with minimum 2.0 oz. zinc per sq. ft. of surface area conforming to ASTM A 123.

C. Round Line of Intermediate Posts: 2.375" OD Type I steel pipe.

D. Round End, Corner, Pull Posts; 2.875" OD Type I steel pipe.

E. Top And Intermediate Rails: Manufacturer's longest length, with expansion-type couplings, approximately 6" long, for each joint. Provide means for attaching top rail securely to each pull and end post.

1. Galvanized Steel 1-1/4" NPS (1.66 OD) Type I steel pipe.

F. Horizontal Slide Gate Posts: Provide steel pipe gate posts, complying with ASTM F 1184, Type I overhead slide; 2.875" OD Type I steel pipe.

G. Swing Gate Posts: Furnish posts to support single gate leaf, according to ASTM F 900; 2.875 OD Type I steel pipe.

2.05 FITTINGS AND ACCESSORIES:

A. Material: Comply with ASTM F 626; galvanized steel in compliance with ASTM A 153, with zinc weights per Table 1.

B. Tension Wire: 0.177" diameter metallic coated steel marcelled tension wire conforming to ASTM 824 with finish to match fabric.

1. Type II Zinc Coated, Class 2

C. Tie Wires: 12 gage (0.106" diameter) galvanize steel with a minimum of 0.080 oz. per square foot of zinc coating of surface area in accordance with ASTM A 641, Class 3.

D. Center Rail: Same material as top rail. Provide manufacturer's standard galvanized steel cap for each end.

E. Post and Line Caps: Provide weathertight cap for each post. Provide line post caps with loop to receive tension wire or top rail.

F. Tension or Stretcher Bars: Hot-dip galvanized steel with minimum length 2" less than full height of fabric, minimum cross-section of 3/16" by 3/4" and minimum 1.20 oz. zinc, coating per square foot of surface area. Provide one bar for each end post, and two for each corner and pull post, except where fabric is integrally woven into post.

G. Tension or Steel Stretcher Bands: Minimum 3/4" wide hot-dip galvanized steel with minimum 1.20 oz. zinc per sq. ft. of surface.

1. Tension Bands: Minimum 14 gage.

2. Tension and Brace Bands: Minimum 12 gage.

2.06 CONCRETE: Specified in Section 03 30 00

2.07 GATES:

A. Fabrication: Fabricate perimeter frames of gates from metal and finish to match fence framework. Assemble gate frames by welding. Provide horizontal and vertical members to ensure proper gate operation and attachment of fabric, hardware, and accessories. Space frame members maximum of 8 feet apart unless otherwise indicated.

1. Provide same fabric as for fence. Install fabric with tension bars and bands at vertical edges and at top and bottom edges.

2. Install diagonal cross-bracing consisting of 3/8" diameter adjustable-length truss rods on gates to ensure frame rigidity without sag or twist.

B. Swing Gates: Comply with ASTM F 900.

1. Fabricate perimeter frames of minimum 1.90-inch OD Type I steel pipe or 2.00" square galvanized steel tubing.

2. Hardware: Provide hardware and accessories per ASTM A 153, and in accordance with the following:

a. Hinge: Size and material to suit gate size, non-lift-off type, offset to permit 180 degree gate opening. Provide 1-1/2" pair of hinges for each leaf.

b. Latch: Forked type plunger-bar type to permit operation from either side of gate, with padlock eye as integral part of latch.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. General: Install in compliance with ASTM F 567.

1. Do not begin installation and erection before final grading is completed; coordinate with concrete work.

B. Excavation: Drill or hand-excavate (using post-hole digger) holes for posts to diameters and spacings indicated, in firm, undisturbed or compacted soil.

1. Excavate holes for each post to minimum diameter recommended by fence manufacture, but not less than 4 times larger cross-section of post.

2. Excavate hole depths approximately 3" lower than post bottom, with bottom of posts set not less than 36" below finish grade surface.

C. Setting Posts: Center and align posts in holes 3" above bottom of excavation. Space maximum 10' o.c.

1. Protect portion of posts above ground from concrete splatter. Place concrete around posts and vibrate or tamp for consolidation. Check each post for vertical and top alignment, and hold in position during placement and finishing operations.

2. Unless otherwise indicated, extend concrete footings 2" above grade and trowel to crown to shed water.

D. Top Rails: Run rails continuously through line post caps, bending to radius for curved runs and at other posts terminating into rail end attached to posts or post caps fabricated to receive rail. Provide expansion couplings as recommended by fencing manufacturer.

E. Center Rails: Provide center rails as indicated. Install in one piece between posts and flush with post on fabric side, using rail ends and special offset fittings when necessary.

F. Brace Assemblies: Install braces so posts are plumb when diagonal rod is under proper tension.

G. Bottom Tension Wire: Install tension wire within 6" of bottom of fabric before stretching fabric and tie to each post with not less than same gage and type of wire. Pull wire taut, without sags. Fasten fabric to tension wire with 11 gage hog rings of same material and finish as fabric wire, spaced maximum 24" o.c.

H. Fabric: Leave approximately 2" between finish grade and bottom selvage. Pull fabric taut and tie to posts, rails, and tension of wires. Install fabric on court side

of fence, and anchor to framework so that fabric remains in tension after pulling force is released.

I. Tension or Stretcher Bars: Thread through or clamp to fabric 4" o.c., and secure to end, corner, pull, and gate posts with tension bands spaced not over 15" o.c.

J. Tie Wires: Us U-shaped wire or proper length to secure fabric firmly to posts and rails with ends twisted as least 2 full turns. Bend ends of wire to minimize hazard to persons or clothing.

1. Tie fabric to line posts 12" o.c. and to rails and braces 24" o.c.

K. Fasteners: Install nuts for tension bands and hardware bolts on side of fence opposite fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

L. Gates: Install gates plumb, level and secure for full opening without interference. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

END OF SECTION

BLANK

SECTION 32 32 23

CONCRETE SEGMENTAL RETAINING WALL SYSTEM

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Concrete segmental retaining wall units
B. Geosynthetic reinforcement
C. Leveling pad base
D. Drainage aggregate
E. Reinforced backfill
F. Drainage pipe
G. Prefabricated drainage composite
H. Geotextile filter
I. Impervious materials
J. Construction adhesive

1.2 RELATED SECTIONS

A. Section 312000 – Earthwork

1.3 REFERENCES

A. American Association of State Highway Transportation Officials (AASHTO)
    1. AASHTO M288 Geotextile Specification for Highway Applications
    2. AASHTO Standard Specifications for Highway Bridges

B. American Society for Testing and Materials (ASTM)
    1. ASTM C140 Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units
    2. ASTM C1262 Standard Test Method for Evaluating the Freeze-Thaw Durability of Manufactured Concrete Masonry Units and Related Concrete Units
    3. ASTM C1372 Standard Specification for Segmental Retaining Wall Units
    4. ASTM D448 Standard Classification for Sizes of Aggregate for Road and Bridge Construction
    5. ASTM D698 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/f3)(600 kN-m/m3)
    6. ASTM D1556 Standard Test Method for Density and Unit Weight of Soil in Place by the Sand Cone Method
    7. ASTM D1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/f3)(2700 kN-m/m3)
    8. ASTM D2487 Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System)

9. ASTM D2922 Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
10. ASTM D3034 Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
11. ASTM D4318 Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
12. ASTM D4491 Standard Test Method for Water Permeability of Geotextiles by the Permittivity Method
13. ASTM D4595 Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method
14. ASTM D4873 Standard Guide for Identification, Storage and Handling of Geosynthetics
15. ASTM D5084 Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter
16. ASTM D5262 Standard Test Method for Evaluating the Unconfined Tension Creep Behavior of Geosynthetics
17. ASTM D5321 Standard Test Method for Determining the Coefficient of Soil and Geosynthetic or Geosynthetic and Geosynthetic Friction by the Direct Shear Method
18. ASTM D5818 Standard Practice for Obtaining Samples of Geosynthetics from a Test Section for Assessment of Installation Damage
19. ASTM D6637 Standard Test Method for Determining Tensile Properties of Geogrids by the Single- or Multi-Rib Tensile Method
20. ASTM D6638 Standard Test Method for Determining Connection Strength Between Geosynthetic Reinforcement and Segmental Concrete Units
21. ASTM D6916 Standard Test Method for Determining the Shear Strength Between Segmental Concrete Units
22. ASTM D6706 Standard Test Method for Measuring Geosynthetic Pullout Resistance in Soil
23. ASTM F405 Standard Specification for Corrugated Polyethylene (PE) Tubings and Fittings
24. ASTM G51 Standard Test Method for Measuring pH of Soil for Use in Corrosion Testing

C. Federal Highway Administration
1. Elias, V., Christopher, B., and Berg, R., “Mechanically Stabilized Earth Walls and Reinforced Soil Slopes Design and Construction Guidelines,” Federal Highway Administration Report No. FHWA-NHI-00-043, March 2001.
2. Elias, V., Christopher, B., and Berg, R., “Corrosion/Degradation of Soil Reinforcements for Mechanically Stabilized Earth Walls and Reinforced Soil Slopes,” Federal Highway Administration Report No. FHWA-NHI-00-044, March 2001.

D. National Concrete Masonry Association (NCMA)
1. NCMA Design Manual for Segmental Retaining Walls, Second Edition, Second Printing (1997) or Design Manual for Segmental Retaining Walls, Third Edition (2010).

1.4 DEFINITIONS

A. Concrete Segmental Retaining Wall (SRW) Units: Dry-stacked masonry units used as the retaining wall fascia.
B. Reinforced Backfill: Soil which is used as fill behind the SRW unit, and within the reinforced soil mass (if applicable).

C. Drainage Aggregate: Material used (if applicable) within, between, and directly behind the concrete retaining wall units.
D. Geotextile Filter: Material used for separation and filtration of dissimilar soil types.
E. Foundation Soil: Soil mass supporting the leveling pad and reinforced soil zone of the retaining wall system.
F. Geosynthetic Reinforcement: Polymeric material designed specifically to reinforce the soil mass.
G. Prefabricated Drainage Composite: three-dimensional geosynthetic drainage medium encapsulated in a geotextile filter, used to transport water.
H. Impervious Materials: Clay soil or low permeability geosynthetic used to prevent water percolation into the drainage zone and reinforced backfill behind the wall.
I. Global Stability: The general mass movement of a soil reinforced segmental retaining wall structure and adjacent soil mass.
J. Project Geotechnical Engineer: A registered engineer who provides site observations, recommendations for foundation support, and verifies soil shear strength parameters.

1. 5 SUBMITTALS

A. Submit the following in accordance with Section 013300:
1. Product Data: Material description and installation instructions for each manufactured product specified.
2. Shop Drawings: Retaining wall system design, including wall elevation views, geosynthetic reinforcement layout, pertinent details, and drainage provisions. The shop drawings shall be signed by a registered professional engineer licensed in the state of wall installation.
3. Design Calculations: Engineering design calculations prepared in accordance with the NCMA Design Manual for Segmental Retaining Walls, or the AASHTO Standard Specifications for Highway Bridges, Section 5.8 (whichever is applicable). Analysis of global stability must be addressed and incorporated into the shop drawings.
4. Samples
    a. Furnish one unit in the color and face pattern specified, if requested.
    b. Furnish 12-inch square or larger piece of the geosynthetic reinforcement specified.
5. Test Reports: Independent laboratory reports stating moisture absorption and compressive strength properties of the concrete retaining wall units meet the Project Specifications when tested in accordance with ASTM C140, Sections 6, 8 and 9.

1. 6 DELIVERY, STORAGE AND HANDLING

A. Concrete Retaining Wall Units and Accessories: Deliver, store, and handle materials in accordance with manufacturer's recommendations, in such a manner as to prevent damage. Check the materials upon delivery to assure that proper material has been received. Store above ground on wood pallets or blocking. Remove damaged or otherwise unsuitable material, when so determined, from the site.

1. Exposed faces of concrete wall units shall be free of chips, cracks, stains, and other imperfections detracting from their appearance, when viewed from a distance of 10 feet.
2. Prevent mud, wet cement, adhesives and similar materials that may harm appearance of units, from coming in contact with system components.

B. Geosynthetics (including geosynthetic reinforcement, geotextile filter, prefabricated drainage composite) shall be delivered, stored, and handled in accordance with ASTM D4873.

1.7 EXTRA MATERIALS

A. Furnish Owner with 3 replacement units identical to those installed on the Project.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Concrete Retaining Wall Units: "Anchor™ Highland Stone 6"/3" Retaining Wall" as manufactured under license from Anchor Wall Systems.
   1. Physical Requirements
      a. Meet requirements of ASTM C1372, except the maximum water absorption shall be limited to 7 percent, and unit height dimensions shall not vary more than plus or minus 1/16 inch from that specified in the ASTM reference, not including textured face.
      b. Unit Face Area: Not less than 0.67 square feet.
      c. Color: Selected by the Owner from manufacturer's full range of standard colors.
      d. Face Pattern Geometry: Straight Face
      e. Texture: Split-Rock Face.
      f. Include an integral concrete shear connection flange/locator.

B. Geosynthetic Reinforcement: Polyester fiber geogrid or geotextile, or polypropylene woven geotextile

C. Leveling Pad Base
   1. Aggregate Base: Crushed stone or granular fill meeting the following gradation as determined in accordance with ASTM D448:

Sieve Size	Percent Passing
1 inch	100
No. 4	35 to 70
No. 40	10 to 35
No. 200	3 to 10

      a. Base Thickness: 6 inches (minimum compacted thickness).
   2. Concrete Base: Nonreinforced lean concrete base.
      a. Compressive Strength: 3,000 psi (minimum).
      b. Base Thickness: At least 2 inches

D. Drainage Aggregate: Clean crushed stone or granular fill meeting the following gradation as determined in accordance with ASTM D448:

Sieve Size	Percent Passing
1 inch	100
3/4 inch	75 to 100
No. 4	0 to 60
No. 40	0 to 50
No. 200	0 to 5

E. Backfill: Soil free of organics and debris and consisting of either GP, GW, SP, SW, or SM type, classified in accordance with ASTM D2487 and the USCS classification system.
   1. Soils classified as SC, ML and CL are considered suitable soils for segmental retaining walls with a total height of less than 10 feet unless the Plasticity Index (PI) is 20 or more.
   2. Maximum particle size for backfill is 4 inches.
   3. Unsuitable soils are organic soils and those soils classified as CH, OH, MH, OL, or PT.

F. Impervious Material: Clayey soil or other similar material which will prevent percolation into the drainage zone behind the wall.

G. Drainage Pipe: Perforated or slotted PVC or corrugated HDPE pipe manufactured in accordance with D3034 and/or ASTM F405. The pipe may be covered with a geotextile filter fabric to function as a filter.

H. Construction Adhesive: Exterior grade adhesive as recommended by the retaining wall unit manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the areas and conditions under which the retaining wall system is to be erected, and notify the Architect in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.

B. Promptly notify the wall design engineer of site conditions which may affect wall performance, soil conditions observed other than those assumed, or other conditions that may require a reevaluation of the wall design.

C. Verify the location of existing structures and utilities prior to excavation.

3.2 PREPARATION

A. Ensure surrounding structures are protected from the effects of wall excavation.

B. Excavation support, if required, is the responsibility of the Contractor, including the stability of the excavation and its influence on adjacent properties and structures.

3.3 EXCAVATION

A. Excavate to the lines and grades shown on the Drawings. Over-excavation not approved by the Architect will not be paid for by the Owner. Replacement of these soils with compacted fill and/or wall system components will be required at the Contractor's expense. Use care in excavating to prevent disturbance of the base beyond the lines shown.

3.4 FOUNDATION PREPARATION

A. Excavate foundation soil as required for footing or base dimension shown on the Drawings, or as directed by the Project geotechnical engineer.
B. The Project geotechnical engineer will examine foundation soil to ensure that the actual foundation soil strength meets or exceeds that indicated on the Drawings. Remove soil not meeting the required strength. Oversize resulting space sufficiently from the front of the block to the back of the reinforcement, and backfill with suitable compacted backfill soils.
C. The Project geotechnical engineer will determine if the foundation soils will require special treatment or correction to control total and differential settlement.
D. Fill over-excavated areas with suitable compacted backfill, as recommended by the Project geotechnical engineer.

3.5 BASE COURSE PREPARATION

A. Place base materials to the depths and widths shown on the Drawings, upon undisturbed soils, or foundation soils prepared in accordance with Article 3.04.
    1. Extend the leveling pad laterally at least 6 inches in front and behind the lowermost concrete retaining wall unit.
    2. Provide aggregate base compacted to 6 inches thick (minimum).
    3. The Contractor may at their option, provide a concrete leveling pad as specified in Subparagraph 2.01.C.2, in lieu of the aggregate base.
    4. Where a reinforced footing is required by local code official, place footing below frost depth.
B. Compact aggregate base material to provide a level, hard surface on which to place the first course of units.
C. Prepare base materials to ensure complete contact with retaining wall units. Gaps are not allowed.

3.6 ERECTION

A. General: Erect units in accordance with manufacturer's instructions and recommendations, and as specified herein.
B. Place first course of concrete wall units on the prepared base material. Check units for level and alignment. Maintain the same elevation at the top of each unit within each section of the base course.
C. Ensure that foundation units are in full contact with natural or compacted soil base.
D. Place concrete wall units side-by-side for full length of wall alignment. Alignment may be done by using a string line measured from the back of the block. Gaps are not allowed between the foundation concrete wall units.
E. Place 12 inches (minimum) of drainage aggregate between, and directly behind, the concrete wall units. Fill voids in retaining wall units with drainage aggregate. Provide a drainage zone behind the wall units to within 9 inches of the final grade. Cap the backfill and drainage aggregate zone with 9 inches of impervious material.
F. Install drainage pipe at the lowest elevation possible, to maintain gravity flow of water to outside of the reinforced zone. Slope the main collection drainage pipe, located just behind the concrete

retaining wall units, 2 percent (minimum) to provide gravity flow to the daylighted areas. Daylight the main collection drainage pipe through the face of the wall, and/or to an appropriate location away from the wall system at each low point or at 50-foot (maximum) intervals along the wall. Alternately, the drainage pipe can be connected to a storm sewer system at 50-foot (maximum) intervals.

G. Remove excess fill from top of units and install next course. Ensure drainage aggregate and backfill are compacted before installation of next course.

H. Check each course for level and alignment. Adjust units as necessary to maintain level and alignment prior to proceeding with each additional course.

I. Install each succeeding course. Backfill as each course is completed. Pull the units forward until the locating surface of the unit contacts the locating surface of the units in the preceding course. Interlock wall segments that meet at corners by overlapping successive courses. Attach concrete retaining wall units at exterior corners with adhesive specified.

J. Install geosynthetic reinforcement in accordance with geosynthetic manufacturer's recommendations and the shop drawings.
   1. Orient geosynthetic reinforcement with the highest-strength axis perpendicular to the wall face.
   2. Prior to geosynthetic reinforcement placement, place the backfill and compact to the elevation of the top of the wall units at the elevation of the geosynthetic reinforcement.
   3. Place geosynthetic reinforcement at the elevations and to the lengths shown on the Drawings.
   4. Lay geosynthetic reinforcement horizontally on top of the concrete retaining wall units and the compacted backfill soils. Place the geosynthetic reinforcement within one inch of the face of the concrete retaining wall units. Place the next course of concrete retaining wall units on top of the geosynthetic reinforcement.
   5. The geosynthetic reinforcement shall be in tension and free from wrinkles prior to placement of the backfill soils. Pull geosynthetic reinforcement hand-taut and secure in place with staples, stakes, or by hand-tensioning until the geosynthetic reinforcement is covered by 6 inches of loose fill.
   6. The geosynthetic reinforcements shall be continuous throughout their embedment lengths. Splices in the geosynthetic reinforcement strength direction are not allowed.
   7. Do not operate tracked construction equipment directly on the geosynthetic reinforcement. At least 6 inches of compacted backfill soil is required prior to operation of tracked vehicles over the geosynthetic reinforcement. Keep turning of tracked construction equipment to a minimum.
   8. Rubber-tired equipment may pass over the geosynthetic reinforcement at speeds of less than 5 miles per hour. Turning of rubber-tired equipment is not allowed on the geosynthetic reinforcement.

3.7 BACKFILL PLACEMENT

A. Place reinforced backfill, spread and compact in a manner that will minimize slack in the reinforcement.

B. Place fill within the reinforced zone and compact in lifts not exceeding 6 to 8 inches (loose thickness) where hand-operated compaction equipment is used, and not exceeding 12 inches (loose thickness) where heavy, self-propelled compaction equipment is used.

1. Only lightweight hand-operated compaction equipment is allowed within 4 feet of the back of the retaining wall units. If the specified compaction cannot be achieved within 4 feet of the back of the retaining wall units, replace the reinforced soil in this zone with drainage aggregate material.

C. Compaction testing shall be done in accordance with ASTM D1556 or ASTM D6938

D. Minimum Compaction Requirements for Fill Placed in the Reinforced Zone
   1. The minimum compaction requirement shall be determined by the project geotechnical engineer testing the compaction. At no time shall the soil compaction requirements be less than 95 percent of the soil's modified Proctor maximum dry density (ASTM D1557) for the entire wall height
   2. Utility Trench Backfill: Compact utility trench backfill in or below the reinforced soil zone to 98 percent of the soil's modified Proctor maximum dry density (ASTM D1557), or as recommended by the Project geotechnical engineer. If the height from the utility to finish grade is higher than 30 feet, increase compaction to 100 percent of the modified Proctor density.
      a. Utilities must be properly designed (by others) to withstand all forces from the retaining wall units, reinforced soil mass, and surcharge loads, if any.
   3. Moisture Content: Within 2 percentage points of the optimum moisture content for all wall heights.
   4. These specifications may be changed based on recommendations by the Project geotechnical engineer.
      a. If changes are required, the Contract Sum will be adjusted by written Change Order.

E. At the end of each day's operation, slope the last level of compacted backfill away from the interior (concealed) face of the wall to direct surface water runoff away from the wall face.
   1. The General Contractor is responsible for ensuring that the finished site drainage is directed away from the retaining wall system.
   2. In addition, the General Contractor is responsible for ensuring that surface water runoff from adjacent construction areas is not allowed to enter the retaining wall area of the construction site.

F. Refer to Article 3.10 for compaction testing.

3.8 CAP UNIT INSTALLATION

A. Apply adhesive to the top surface of the unit below and place the cap unit into desired position.

B. Cut cap units as necessary to obtain the proper fit.

C. Backfill and compact to top of cap unit.

3.9 SITE CONSTRUCTION TOLERANCES

A. Site Construction Tolerances
   1. Vertical Alignment: Plus or minus 1-1/2 inches over any 10-foot distance, with a maximum differential of 3 inches over the length of the wall.
   2. Horizontal Location Control from Grading Plan
      a. Straight Lines: Plus or minus 1-1/2 inches over any 10-foot distance.
      b. Corner and Radius Locations: Plus or minus 12 inches.

c. Curves and Serpentine Radii: Plus or minus 2 feet.

3. Immediate Post Construction Wall Batter: Within 2 degrees of the design batter of the concrete retaining wall units.
4. Bulging: Plus or minus 1-1/4 inches over any 10-foot distance.

3.10 FIELD QUALITY CONTROL

A. Installer is responsible for quality control of installation of system components.
B. The General Contractor, at their expense, will retain a qualified professional to perform quality assurance checks of the installer's work.
C. Correct work which does not meet these specifications or the requirements shown on the Drawings at the installer's expense.
D. Perform compaction testing of the reinforced backfill placed and compacted in the reinforced backfill zone.
    1. Testing Frequency
        a. One test for every 2 feet (vertical) of fill placed and compacted, for every 50 lineal feet of retaining wall.
        b. Vary compaction test locations to cover the entire area of the reinforced soil zone, including the area compacted by the hand-operated compaction equipment.

3.11 ADJUSTING AND CLEANING

A. Replace damaged units with new units as the work progresses.
B. Remove debris caused by wall construction and leave adjacent paved areas broom clean.

END OF SECTION

SECTION 32 83 00

SITE SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes
   1. Traffic control signs.
   2. Site signs.

1.2 REFERENCES

A. American Standard for Testing Materials (ASTM)
   1. ASTM C94 - Ready Mix Concrete

B. US Department of Transportation, Federal Highway Administration
   1. Manual on Uniform Traffic Control Devices (MUTCD).

PART 2 - PRODUCTS

2.1 SIGNS: All signs will be furnished and installed by the Contractor. Conform to the following and MUTCD classification is shown in parentheses:

A. "STOP" Signs: 30-inches x 30-inches, Octagon, white legend and border on red background (R1-1)

B. "YIELD" Signs: 36-inches x 36-inches x 36-inches, Triangle, red legend and border band with white interior (R1-2)

C. "SPEED LIMIT 10MPH" Signs: 12-inches x 18-inches, black legend and border on white background (R2-1)

D. "NO RIGHT TURN" (or "NO LEFT TURN") Signs: 24-inches x 24-inches, black legend and border, red circle and bar, and white background (R3-1 and R3-2)

E. "RIGHT TURN ONLY" (or "LEFT TURN ONLY") Signs: 30-inches x 36-inches, black legend and border on white background (R3-5)

F. "DO NOT ENTER" Signs: 30-inches x 30-inches, white legend, bar, and background and red circle (R5-1)

G. "NO TRUCKS" Signs: 24-inches x 24-inches, black truck symbol, red circle and bar, on white background (R5-2)

H. "ACCESSIBLE PARKING SYMBOL" Signs: 18-inches x 24-inches, green legend and border, white symbol on blue box, and white background (R7-8)

I. "PED XING" Signs: 30-inches x 30-inches, black legend and border on yellow background (W11-2)

J. Miscellaneous Signs: See Construction Drawings

2.2 POSTS

A. 2” diameter galvanized steel pipe with galvanized sign-mounting hardware for each sign.

2.3 CONCRETE

A. Mix concrete and deliver in accordance with ASTM C94.

B. Design mix to produce normal weight concrete consisting of Portland cement, aggregate, water-reducing admixture, air-entraining admixture, and water to produce following:
   1. Compressive Strength: 3,500 psi, minimum at 28 days, unless otherwise indicated on Construction Drawings.
   2. Slump Range: 1 to 3-inches at time of placement
   3. Air Entrainment: 5 to 8 percent

PART 3 - EXECUTION

3.1 PREPARATION

A. Contractor shall field verify underground utilities prior to sign installation. Primary utilities of concern of shallow depths are lawn sprinkler systems, electric, telephone, fiber optic, cable and gas.

B. Cost related to repair of damaged surface and subsurface facilities shall be paid for by the Contractor at no additional expense to the Owner.

3.2 INSTALLATION

A. Install posts in 12 inch diameter x 24 inch deep concrete foundations. Set posts vertical and plumb with bottom of sign at minimum 7'-0" above finish grade unless otherwise indicated on the Construction Drawings. Mount signs in accordance with manufacturer's instructions. Existing concrete shall be core-drilled as necessary.

END OF SECTION

SECTION 32 92 00

TURF AND GRASSES

PART 1- GENERAL

1.01 DESCRIPTION

A. Provide sodded lawns as shown and specified. The work includes:
   1. Soil preparation.
   2. Sodding lawns and other indicated areas.
   3. Maintenance.

B. Related Work:

   1. Section 328400: Landscape Irrigation System
   2. Section 329300: Planting

1.02 QUALITY ASSURANCE

A. Sod: Comply with American Sod Producers Association (ASPA) classes of sod materials.

B. Provide and pay for materials testing. Testing agency shall be acceptable to the Landscape Architect. Provide the following data:

   1. Topsoil:

      a. pH factor.
      b. Mechanical analysis.
      c. Percentage of organic content.
      d. Recommendations on type and quantity of additives required to establish satisfactory pH factor and supply of nutrients to bring nutrients to satisfactory level for planting.

C. Installer's qualifications: Minimum of 5 years experience installing sod. The Contractor shall purchase from and maintain liability insurance and a performance bond in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located. See Section 00100 for specifics.

1.03 SUBMITTALS

A. Submit sod grower's certification of grass species. Identify source location.

B. Submit soil test report(s).

C. Upon sodded lawn acceptance, submit written maintenance instructions recommending procedures for maintenance of sodded lawns.

1.04 DELIVERY, STORAGE AND HANDLING

A. Cut, deliver, and install sod within 24-hour period.

1. Do not harvest or transport sod when moisture content may adversely affect sod survival.
2. Protect sod from sun, wind and dehydration prior to installation.
3. Do not tear, stretch or drop sod during handling and installation.

1.05 PROJECT CONDITIONS

A. Work notification: Notify Landscape Architect at least 3 working days prior to start of sodding operations.

B. Protect existing utilities, paving, and other facilities from damage caused by sodding operations.

C. Perform sodding work only after planting and other work affecting ground surface has been completed.

D. Restrict traffic from lawn areas until grass is established. Erect signs and barriers as required.

E. Provide hose and lawn-watering equipment as required.

1.06 WARRANTY

A. Warrant all sodding for a period of one year after the date of acceptance against defects including death and unsatisfactory growth in the opinion of the Landscape Architect.

B. Replace in accordance with the drawings and specifications, all sod that is dead or, as determined by the Landscape Architect, in an unhealthy or unsightly condition. The cost of such replacement (s) is at Contractor's expense. Warrant all replacement sod for 1 year after installation.

C. Warranty shall not include damage or loss of sodding caused by fires, floods, freezing rains, lightning storms, or winds over *75* miles per hour, winter kill caused by extreme, cold and sever winter conditions not typical of planting area; acts of vandalism or negligence on the part of the Owner.

D. Replacements; Replacements are subject to all requirements stated in this specification and subject to inspection by the Landscape Architect.

E. Repair grades, lawn areas, paving and any other damage resulting from replacement sodding operations, at no additional cost to the Owner.

F. Inspect job site monthly during warranty period to determine what changes, if any, should be made in the maintenance program. Submit all recommended changes in writing to the Landscape Architect and the Owner.

PART 2- PRODUCTS

A. Sod: Tiffway Bermuda. Provide sod free of grassy or broadleaf weeds.

B. Provide well-rooted, healthy sod, free of diseases, nematodes and soil borne insects. Provide sod uniform in color, leaf texture, density, and free of weeds, undesirable grasses, stones, roots, thatch, and extraneous material; viable and capable of growth and

development when planted.

1. Furnish sod machine stripped in roles not more than 42” wide and; uniformly 1” to 1-1/2” thick with clean-cut edges. Mow sod before stripping.

C. Topsoil for Sod Areas: Fertile, friable, natural topsoil of loamy character, without admixture of subsoil material, obtained from a well-drained arable site, reasonably free from clay, lumps coarse sands, stones, plants, roots, sticks, and other foreign materials, with acidity range of between pH 6.0 and 6.8.

1. Identify source location of topsoil proposed for use on the project.
2. Topsoil which exists on the project site, including that which has been stripped and stockpiled during construction, will be acceptable if it meets the requirements of this specification, and if approved in writing by Landscape Architect.
3. Provide topsoil free of substances harmful to the plants that will be grown in the soil.

D. Fertilizer:

1. Granular, non-burning product composed of not less than *50%* organic slow acting, guaranteed analysis professional fertilizer.

a. Type A: Starter Fertilizer, formula in accordance with approved laboratory soil test report(s) and time of application.
b. Type B: Top Dressing Fertilizer, formula in accordance with approved laboratory soil test report(s) and time of application.

E. Ground Limestone : Limestone shall contain no less than 85 percent calcium carbonate by weight. It shall be crushed so that at least *50%* will pass a 10-mesh sieve and 90% will pass through a 20-mesh sieve. The application of limestone shall be in accordance with approved laboratory soil test report(s).

F. Stakes : Use where sod slopes greater than 3:1 or in drainage swales.

1. Softwood, 3/4” dia. x 8” long or,
2. Steel, tee shaped pins, 4” head x 8” leg.

G. Water: Free of substance harmful to sod growth. Hoses or other methods of transportation furnished by Contractor.

PART 3- EXECUTION

3.01 INSPECTION

A. Examine finish surfaces, grades, topsoil quality and depth. Do not start sodding work until unsatisfactory conditions are corrected.

3.02 PREPARATION

A. Limit preparation to areas that will be immediately sodded.

B. Loosen topsoil of lawn areas to minimum depth of 4”. Remove stones over 1” in any dimension and sticks, roots, rubbish and extraneous matter.

C. Grade lawn areas to smooth, free draining and even surface with a loose, and uniformly fine texture. Roll and rake; remove ridges and fill depressions as required to drain.

D. Apply limestone at rate determined by the soil test, to adjust pH of topsoil. Distribute evenly by machine and incorporate thoroughly into topsoil.

E. Apply fertilizer at the approved rates. Apply fertilizer by mechanical rotary or drop type distributor, thoroughly and evenly incorporated with the soil to a depth of 3” by disking or other approved methods. Fertilize areas inaccessible to power equipment with hand tools and incorporate it into soil.

F. Dampen dry soil prior to sodding.

G. Restore prepared areas to specified condition if eroded, settled, or otherwise disturbed after fine grading and prior to sodding.

3.03 INSTALLATION

A. Sodding:

1. Time of Sodding:

a. Tiffway Bermuda: anytime except when soil is wet, muddy, or frozen.

2. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod strips. Do not overlay edges. Stagger strips to offset joints in adjacent courses. Remove excess sod to avoid smothering of adjacent grass. Provide sod pad top 1” below adjacent curbs, sidewalks, and flush with drains and seeded areas.

3. Where sod is installed adjacent to existing lawn areas, new sod shall be recessed so that a level and flush condition exists between existing and new lawn areas.

4. Install initial row off sod in a straight line, beginning at bottom of slopes, perpendicular to direction of the sloped area. Place subsequent rows parallel to and lightly against previously installed row.

5. Peg/pin sod on slopes greater than 3 to 1 to prevent slippage at a ratio of 2 stakes per yd. of sod.

6. Water sod thoroughly with a fine spray immediately after laying.

7. Roll with light lawn roller to ensure contact with sub-grade.

3.04 MAINTENANCE

A. Maintain sodded lawns until completion and acceptance of the entire project or not less than 30 days after completion and acceptance of sodding operations.

B. Maintain sodded lawn areas, including water, spot weeding, mowing, application of herbicides, fungicides, insecticides and resodding until a full, uniform stand of grass free

of weed, undesirable grass species, disease, and insects is achieved and accepted by the Landscape Architect.

1. Water sod thoroughly every 2 to 3 days, as required to establish proper rooting.

2. Repair, rework and resod all areas that have washed out or are eroded. Replace undesirable or dead areas with new sod.

3. Mow lawn areas as soon as lawn top growth reaches a 4” height. Cut back to 3” height. Repeat mowing as required to maintain specified height. Not more than 40% of grass leaf shall be removed at any single mowing.

4. Apply Type B fertilizer to lawns approximately 30 days after sodding at recommended rate in soil test report(s). Apply evenly with a mechanical rotary of drop type distributor. Thoroughly water into soil.

5. Apply herbicides as required to control weed growth or undesirable grass species.

6. Apply fungicides and insecticides as required to control diseases and insects.

7. Remove sod pegs (if used).

3.05 CLEAN UP AND PROTECTION

A. During sodding work, keep pavements clean and work area in an orderly condition.

B. Upon completion of work, clear grounds of debris, superfluous materials and all equipment. Remove from site to satisfaction of Landscape Architect.

C. Protect sodding work and materials from damage due to landscape operations, operations by other contractors and trades and trespassers. Maintain protection during installation and maintenance periods. Treat, repair or replace damaged sodding work as directed, at no additional cost to the Owner.

3.06 INSPECTION AND ACCEPTANCE

A. Inspection to determine acceptance of sodded lawn will be made by the Landscape Architect, at the time of Substantial Completion for the entire project. The Contractor shall provide notification at least five *(5)* working days before requested inspection date.

1. Sodded areas will be acceptable provided all requirements, including maintenance, have been complied with, and a healthy, even-colored viable lawn is established, free of weeds, undesirable grass species, disease, and insects.

2. If the date of Substantial Completion occurs in the dormant season, lawn areas will be reviewed at the beginning of the next growing season for compliance with this specification.

B. Upon Substantial Completion and acceptance of lawn areas, and at the end of the Contractor’s maintenance period, the Owner will assume lawn maintenance.

END OF SECTION

SECTION 33 05 00

WATER DISTRIBUTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes
1. Site water piping and fittings including domestic potable waterline and fire protection system supply waterline, valves, and fire hydrants.

B. Related Sections
1. Section 312000 - Earthwork

1.2 REFERENCES

A. American Society of Mechanical Engineers (ASME)
1. ASME B 16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings

B. American Society for Testing and Materials (ASTM)
1. ASTM B 88—Seamless Copper Water Tube
2. ASTM D 1784—Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds
3. ASTM D 2241—Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR-Series)
4. ASTM D 2564—Poly (Vinyl Chloride) (PVC) Solvent Cement
5. ASTM D 2672—Poly (Vinyl Chloride) (PVC) Integrally Molded Bell Ends For Solvent - Cemented Pipe Joints.
6. ASTM D 3139—Joints for Plastic Pressure Pipes using Flexible Elastomeric Seals
7. ASTM F 477—Elastomeric Gaskets And Lubricant
8. ASTM F 656—Poly (Vinyl Chloride) (PVC) Cement Primer

C. American Water Works Association (AWWA)
1. AWWA C105—Polyethylene Encasement for Ductile Iron Piping for Water and other Liquids
2. AWWA C110—Ductile-Iron and Gray-Iron Fittings, 3 Inches Through 48 Inches, for Water and Other Liquids
3. AWWA C111—Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings
4. AWWA C151—Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids
5. AWWA C500—Gate Valves for Water and Sewage Systems
6. AWWA C504—Rubber-Seated Butterfly Valves
7. AWWA C600—Installation of Ductile-Iron Water Mains and Appurtenances
8. AWWA C605—Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings
9. AWWA C651—Disinfecting Water Mains
10. AWWA C900—Polyvinyl Chloride (PVC) Pressure Pipe, 4 Inches Through 12 Inches, for Water Distribution

D. National Fire Protection Associations (NFPA)
1. NFPA 24 - Installation of Private Fire Service Mains and Their Appurtenances

1.3 QUALITY ASSURANCE

A. Products, where marked for compliance with code or test standards, shall also mark specific standard as required in the Contract Documents.

B. Perform installation in accordance with utility company or municipality requirements.

C. Valves: Mark manufacturer's name and pressure rating on valve body.

D. Perform disinfection of potable lines in accordance with AWWA C651.

1.4 SUBMITTALS

A. Product Data: Provide Project Engineer with data on pipe materials, pipe fittings, hydrants, valves, and accessories.

B. Manufacturer's Certificate: Certify that products meet or exceed state or local requirements.

C. Furnish 1 copy of results of meter test and hydrostatic pressure test to Owner and utility company upon completion of water distribution backfilling operations.

D. Project Record Documents:

1. Disinfection report: Record the following:
   a. Type and form of disinfectant used.
   b. Date and time disinfectant injection start and time of completion.
   c. Test locations.
   d. Initial and 24 hour disinfectant residuals (quantity in treated water) in ppm for each outlet tested.
   e. Date and time of flushing start and completion.
   f. Disinfectant residual after flushing in ppm for each outlet tested.
2. Bacteriological report: Record the following:
   a. Date issued, project name, testing laboratory name, address, and telephone number.
   b. Time and date of water sample collection.
   c. Name of person collecting samples.
   d. Test locations
   e. Initial and 24 hour disinfectant residuals in ppm for each outlet tested.
   f. Coliform bacteria test results for each outlet tested.
   g. Certification that water conforms, or fails to conform, to bacterial standards.
   h. Bacteriologist’s signature and authority.
3. Accurately record actual locations of piping mains, valves, connections, and top of pipe elevations.
4. Identify and describe unexpected variations to subsoil conditions and location of uncharted utilities.
5. Two consecutive series of samples that are not collected on the same day must show that the water is bacteriologically safe for drinking purposes in accordance with state health department rules.

PART 2 – PRODUCTS

2.1 PIPE

A. Pipe sizes less than 3-inches that are installed below grade and outside building shall comply with one or combination of following:
   1. Seamless Copper Tubing: Type "K" soft copper, ASTM B88.
   2. Fittings: Wrought copper (95-5 Tin Antimony solder joint), ASME B 16.22.
   3. Polyvinyl Chloride (PVC) Water Pipe: Pipe, ASTM D 2241, with SDR 21 rating, continually marked with manufacturer's name, pipe size, cell classification, SDR rating, and ASTM D1784 material classification.
      a. Pipe joints: Integrally molded bell ends, ASTM D2672.
      b. Cement primer: ASTM F656.
      c. Solvent cement: ASTM D2564.
      d. Trace wire: Magnetic detectable conductor, (#12 Copper) brightly colored plastic covering imprinted with “Water Service” in large letters.

B. Pipe sizes 3-inches and larger that are installed below grade and outside building shall comply with one or combination of following:
   1. Gray Cast Iron Water Pipe: ANSI A21.6, thickness class 52.
      a. Fittings: Either mechanical joint or push-on joint, AWWA C110 or AWWA C111.
      b. Elastomeric gaskets and lubricant: ASTM F477.
   2. Ductile Iron Water Pipe: AWWA C151, thickness class 50.
      a. Fittings: Either mechanical joint or push-on joint, AWWA C110 or AWWA C111.
      b. Elastomeric gaskets and lubricant: ASTM F477.
   3. Polyvinyl Chloride (PVC) Water Pipe: Pipe, Class 250 PVC ASTM 2241, continually marked as required.
      a. Elastomeric gaskets and lubricant: ASTM F477 for smaller pipes.
      b. Pipe joints: Integrally molded bell ends, ASTM D3139.
      c. Trace wire: Magnetic detectable conductor, (#12 Copper) brightly colored plastic covering imprint with “Water Service” in large letters.

2.2 VALVES

A. Gate Valves, 2-Inches and Larger:
   1. Manufacturer and Model: Mueller Resilient Wedge Gate Valves or approved equal.
   2. AWWA C500, Iron body, non-rising stem with square nut, single wedge, resilient seat, flanged or mechanical joint ends, control rod, post indicator where indicated on Construction Drawings, extension box and valve key.

B. Ball Valves, 2-Inches and Smaller:
   1. Manufacturer and Model: Mueller Oriseal or approved equal.
   2. Brass body, teflon coated brass ball, rubber seats and stem seals, Tee stem pre-drilled for control rod, AWWA compression inlet end, compression outlet with electrical ground connector, with control rod, extension box and valve key.

C. Butterfly Valves, From 2-Inch to 24-Inch: AWWA C504, Iron body, bronze disc, resilient replaceable seat, water or lug ends, infinite position lever handle.

D. Check Valves, Post Indicator Valves, And Backflow Preventors
   1. Refer to Section 13900 - Fire Suppression in Architectural/Building Specifications

2.3 FIRE HYDRANTS

A. Fire Hydrants: Type as required by utility company/Local Fire Department and as shown on Construction Drawings.

B. Hydrant Extensions: Fabricate in multiples of 6-inches with rod and coupling to increase barrel length.

C. Hose and Steamer Connections: Match sizes with utility company, with two hose nozzles, one pumper nozzle.

D. Finish: Apply primer and 2 coats of enamel or special coating to color as required by utility company.

2.4 ACCESSORIES

A. Thrust Blocking: Place 3000 psi concrete to provide sufficient bearing area to transmit unbalanced thrust from bends, tees, caps, or plugs to undisturbed soil without loading undisturbed soil in excess of 2,500 pounds per square foot when water main pressure is 100 psi.

MINIMUM THRUST BLOCKING BEARING AREAS

Pipe Diameter	Tees Sq. Ft	90° Bend Sq. Ft	45° Bend Sq. Ft	22½° Bend Sq. Ft.	11¼° Bend Sq. Ft.	5 5/8 Bend Sq. Ft.	Cap/Plug Sq. Ft.
3"	1.0	1.0	1.0	1.0	1.0	1.0	1.5
4"	1.0	1.0	1.0	1.0	1.0	1.0	2.0
6"	1.5	2.0	1.0	1.0	1.0	1.0	3.0
8"	2.5	3.5	1.8	1.0	1.0	1.0	4.0
10"	4.0	5.5	2.8	1.5	1.0	1.0	6.0
12"	6.0	8.0	4.0	2.0	1.5	1.0	8.5
14"	8.0	11.0	5.5	3.0	2.0	1.5	12.0
16"	10.0	14.2	7.0	4.0	3.0	2.5	15.0
18"	21.0	21.0	12.0	6.0	4.0	3.5	24.0

B. Locked mechanical joint fittings shall be installed where vertical changes in direction are required and, if approved by Owner and governing authority, can be installed in lieu of above thrust blocking requirements.

C. Polyethylene Encasement: Single layer of two ply cross-laminated high density polyethylene encasement per AWWA C105, meeting the following nominal specifications; AWWA C105-93, Section 4.1.2, High Density Cross-Laminated Polyethylene Film, Type III, Class C (Black), Grade 33, tensile strength 5,000 psi minimum, elongation 100 percent, thickness nominal 0.004 inch (4 mil).

D. Trace Wire: 12-gauge coated wire

EXECUTION

3.1 EXAMINATION

A. Verify that building service connection and municipal utility water main size, location, and depth are as indicated on Construction Drawings.

3.2 PREPARATION

A. Ream pipe and tube ends and remove burrs.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare pipe for connections to equipment with flanges or unions.

D. Protect benchmarks, property corners, and other survey monuments from damage or displacement. If marker needs to be removed it shall be referenced by licensed land surveyor and replaced, as necessary, by same.

3.3 TRENCHING AND BEDDING

A. Excavate pipe trench and place bedding material in accordance with Section 312000.

B. Pipe bedding in accordance with AWWA C605.

3.4 INSTALLATION - PIPE AND FITTINGS

A. Maintain separation of water main from sanitary and storm sewer piping in accordance with state or local codes.

B. Install pipe and fittings in accordance with AWWA C600 and AWWA C605.

C. Ductile iron pipe and fittings shall be installed with polyethylene tubing around the pipe for the entire length of the project except where water main is within steel casing or is concrete encased. Install polyethylene tubing in accordance with AWWA C105, Method A.

D. Install pipe to allow for expansion and contraction without stressing pipe or joints or as specified by pipe manufacturer.

E. Install access fittings in accordance with local codes to permit disinfection of water system performed under this Section.

F. Connections with Existing Pipelines: Where connections are made between new work and existing piping, make connection using suitable fittings for conditions encountered. Make each connection with existing pipe at time and under conditions with least interference with operation of existing pipeline and in compliance with local utility company.

G. Form and place concrete for thrust blocks or other specified methods of retainage at each change of direction or end of pipe main.

H. Place pipe to depth in accordance with Section 312000.

I. Backfill trench in accordance with Section 312000.

J. Install trace wire continuous over top of non-metal pipe. Bury a minimum of 6 inches below finish grade, and above pipeline.

3.5 INSTALLATION - VALVES AND HYDRANTS

A. Install gate valves as indicated on Construction Drawings. Support valve on concrete pads with valve stem vertical and plumb. Install valve boxes in manner that will not transmit loads, stress, or shock to valve body. Center valve box over operating nut of valve vertical and plumb. Securely fit valve box together leaving cover flush with finished surface.

B. Install fire hydrant assemblies as indicated on Construction Drawings in vertical and plumb position with steamer/pumper nozzle pointed perpendicular to traffic where hydrant is adjacent to street, roadway, or parking lot drive or toward protected building unless otherwise directed by local authorities. Support hydrant assembly on concrete pad and firmly brace on side opposite inlet pipe against undisturbed soil and concrete blocking. Place minimum of 6-cubic feet of crushed stone or gravel around hydrant base and barrel after thrust blocking has cured at least 24 hours. Maintain vertical position of hydrant backfilling and compacting.

3.6 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Disinfect distribution system with chlorine before acceptance for domestic operation. Chlorine dosage shall be not less than 50 parts per million. Flush lines before introduction of chlorinating materials and after contact period of not less than 24 hours. Flush with clean water after contact period until residual chlorine content is not greater than 1.0 part per million. Flush water discharged from water supply lines or hydrants shall not be allowed to discharge directly onto exposed soil or turf which could result in erosion of soil. If potential for erosion exists at discharge point, measures shall be taken to prevent

erosion. Open and close valves in lines being disinfected several times during contact period. After disinfection, take water sample and bacteriological test in accordance with AWWA C651. Do not place distribution system in service until approval is obtained from local governing authorities.

B. Contractor shall provide a means of neutralizing the super-chlorinated water before releasing into the environment. This may be accomplished by either a method of dechlorinization, direct release into a detention area approved by Engineer, or any method acceptable to federal, state, and local codes. Direct release to open ground shall not be allowed, unless contained within an on site detention facility with 6" permanent storage. In this case, the Contractor shall time the release to assure that no rainstorms are imminent. The intent of this condition is to allow the majority of the chlorine to evaporate into the atmosphere before a rainstorm has the opportunity to wash the residual downstream. Contractor shall not release super-chlorinated water directly into the sanitary sewer system, private or public, nor any storm drain system not directly discharging into the detention facility.

3.7 SERVICE CONNECTIONS

A. Provide water service connection in compliance with utility company requirements including reduced pressure backflow preventor (if required) and water meter with by-pass valves and sand strainer.

3.8 FIELD QUALITY CONTROL

A. Test water distribution system pipe installed below grade and outside building in accordance with the following procedures:
   1. Perform testing of pipe materials, joints, and other materials incorporated into construction of water mains and force mains to determine leakage and water tightness. Test pressure pipeline in accordance with Section 4 of AWWA C600, Section 7 of AWWA C605 and NFPA 24. In the event state or local code requires more stringent test, more stringent test shall take precedence.
   2. Pressure Test: After pipe has been laid, subject newly laid pipe or valved section to hydrostatic pressure of at least 1.5 times working pressure at point of testing and not less than 1.25 times working pressure at highest point along test section.
   3. Leakage Test: Conduct leakage test concurrently with pressure test. Leakage is defined as quantity of water that must be supplied into newly laid pipeline or valved section thereof to maintain pressure within 5 psi of specified test pressure after air in pipeline has been expelled and pipeline has been filled with water. Leakage shall not be measured by drop in pressure in test section over period of time.
      a. Leakage shall not be greater than that determined by the following formula:

$$Q = \frac{LD\sqrt{P}}{148{,}000}$$

Where: Q = allowable make up water, (gallons per hour)
L = length of pipe tested, (feet)
D = nominal diameter of pipe, (inches)
P = average test pressure during test, (psig)

   4. Visible Leakage: Repair visible leaks regardless of amount of leakage measured.
   5. Acceptance of Installation: If test of pipe laid in place discloses leakage greater than that specified, Contractor shall, at his own expense, locate leak and make repairs as necessary until leakage is within specified allowance. Supply water for testing at no expense to Owner.

END SECTION

SECTION 33 07 00

SANITARY SEWAGE SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes
1. Sanitary sewer drainage piping, fittings, accessories, cleanouts, and bedding.
2. Connection of site sanitary sewer system to municipal sanitary sewer systems.

B. Related Sections
1. Section 312000 - Earthwork
2. Section 03300 - Cast-in-place Concrete

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM)
1. ASTM A74 - Cast Iron Soil Pipe and Fittings
2. ASTM A746 - Ductile Iron Gravity Sewer Pipe
3. ASTM C425 - Compression Joints for Vitrified Clay Pipe and Fittings
4. ASTM C564 - Rubber Gaskets for Cast Iron Soil Pipe and Fittings
5. ASTM C700 - Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated
6. ASTM D2241 - Poly (vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
7. ASTM D2657 - Heat-Joining Polyolefin pipe and Fittings
8. ASTM D3034 - Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
9. ASTM D3035 - Polyethylene (PE) Plastic Pipe Using Flexible Elastomeric Seals
10. ASTM D3139 - Joints for Plastic Pressure Pipe Using Flexible Elastomeric Seals
11. ASTM D3261 - Butt Heat Fussion Polyethylene (PE) Plastic Fittings For Polyethylene Plastic Pipe And Tubing
12. ASTM F477 - Elastomeric Seals (Gaskets) for Joining Plastic Pipe
13. ASTM F1417 - Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air.

B. American Water Works Association (AWWA)
1. AWWA C111 - Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings
2. AWWA C600 - Ductile-Iron Water Mains And Their Appurtenances
3. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In, For Water Distribution
4. AWWA C901 - Polyethylene (PE) Pressure Pipe, Tubing And Fittings 1/2 Inch Through 3 Inches, For Water Distribution
5. AWWA C906 - Polyethylene (PE) Pressure Pipe And Fittings, 4 Inch Through 63 Inch, For Water Distribution

1.3 SUBMITTALS

A. Product Data: Provide data of pipe materials, pipe fittings, and accessories.

B. Manufacturer's Certificate: Certify that products meet or exceed specified or local requirements.

C. Project Record Documents:
1. Accurately record actual locations of pipe runs, connections, cleanouts, and invert elevations.

2. Identify and describe unexpected variations to subsoil conditions and location of uncharted utilities.

1.4 PROJECT CONDITIONS

A. Coordinate work with termination of sanitary sewer connection outside building and connection to municipal sewer utility service.

PART 2 - PRODUCTS

2.1 SEWER PIPE, FITTINGS, AND JOINTS

A. Polyvinyl Chloride Pipe (PVC): ASTM D 3034, rated SDR 35 unless otherwise specified by the utility company. Pipe shall be continually marked with manufacturer's name, pipe size, cell classification, SDR rating, and ASTM D 3034 classification.
   1. Pipe joints: Integrally molded bell ends, ASTM D 3034, Table 2, with factory supplied elastomeric gaskets and lubricant.

B. Vitrified Clay Pipe (VCP): ASTM C700: Use only if required by local jurisdiction.
   1. Fittings: ASTM C700
   2. Joints: ASTM C425
   3. Gaskets: ASTM C425. Gaskets shall be manufactured from high grade, properly vulcanized elastomeric compound consisting of either basic natural or synthetic rubber. Gasket manufacturing tolerances shall comply with Rubber Manufacturer's Association tolerances for gaskets.
   4. Lubricant: Suitable for lubricating joint components; no deteriorating effects on gasket or pipe material, will not support growth of fungi or bacteria, and shall be of type recommended by gasket manufacturer.

C. Force Main:

   1. High-Density Polyethylene Pipe (HDPE): AWWA C901 and C906, ASTM D3035, SDR 11 for 150 psi pressure rating and SDR 13.5 for 125 psi pressure rating.
      a. Fittings: Molded, AWWA C901 or C906.
      b. Joints: Butt fusion, ASTM D2657, flanged gasket joints at interface
   2. Polyvinyl Chloride Pipe (PVC): For less than 4 inches in diameter, ASTM D2241 for push-on or solvent weld joints, and for pipe 4 inches in diameter and larger, AWWA C900, Class 150 with push-on joints.
      a. Joints/Fittings: Push-on, ASTM D3139 with ASTM F477 gaskets.
      b. Solvent Cement: ASTM D2564.
   3. Ductile Iron Pipe (DIP): ASTM A746, Class 50, inside nominal diameter as shown on the drawings, bell and spigot end.
      a. Ductile Iron Pipe Joint Device: AWWA C111, rubber gasket joint devices.

2.2 PIPE ACCESSORIES

A. Pipe Joints: Mechanical clamp ring type, stainless steel expanding and contracting sleeve, neoprene-ribbed gasket for positive seal.

B. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps, etc.

2.3 APPURTENANCES

A. Trace Wire: Magnetic detectable conductor (#12 copper), brightly colored plastic covering, imprinted with “Sanitary Sewer Service” in large letters.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that trench cut and excavation is ready to receive work and excavations, dimensions, and elevations are as indicated on Construction Drawings.

3.2 PREPARATION

A. Hand trim excavations to required elevations. Correct over excavation with bedding material.

B. Remove large stones or other hard matter that could damage pipe or impede consistent backfilling or compaction.

3.3 BEDDING

A. Excavate trench and place bedding material in accordance with Section 312000.

3.4 INSTALLATION - PIPE

A. Install type and class of pipe as shown on the drawings. Pipes shall be laid and maintained to the required line and grade with necessary fittings, bends, manhole risers, cleanouts and other appurtenances placed at the required locations. The pipe shall be installed with uniform bearing under the full length of the barrel of the pipe. The pipe shall be inspected for defects and cracks before being lowered into the trench. Defective, damaged or unsound pipe, or pipe that has had its grade disturbed after laying shall be taken up and replaced. Commence installation at lowest point with the bell end upgrade.

B. No pipe shall be laid in water or when trench conditions are unsuitable for work.

C. Pipe connecting to manholes or other structures shall terminate flush inside of the structure wall.

D. Joints for PVC and CISP shall be thoroughly lubricated with an approved lubricant before pipe sections are slipped together. Open ends shall be fully protected with a stopper to prevent earth or other material from entering the pipe during construction. Carefully free interior of the pipe from dirt, cement and other deleterious material as the work progresses.

E. Maintain separation of potable water main from sewer piping at crossings a minimum of 10 feet horizontal and 18 inches vertical.

F. Install HDPE piping and fittings to AWWA C901 and C906. Butt fusion welded per ASTM D3261.

G. Route pipe in straight line parallel to roads, buildings and adjacent utilities and as shown on the drawings.

H. Establish elevations of buried piping with sufficient cover as recommended by pipe manufacturer to ensure not less than 3 feet of cover, except as noted on drawings.

I. Form and place concrete for thrust blocks at each elbow of pipe force main. See construction drawing for details of construction.

J. Backfill trench in accordance with Section 312000.

K. Install trace wire continuous over top of non-metal pipe. Bury 6 inches minimum below finish grade, above pipeline.

3.5 INSTALLATION – CLEANOUTS

A. Form bottom of excavation clean and smooth to correct elevation.

B. For cleanouts, form and place cast-in-place concrete base pad with provision for sanitary sewer pipe to be installed to proper elevations.

3.6 FIELD QUALITY CONTROL

A. Pipes and joints shall not be completely backfilled until after inspection, testing, and approval by the Owner and local jurisdiction.

B. Prior to testing for leakage, the pipe trench shall be backfilled to at least the spring line of the pipe. If required to prevent pipe movement during testing, additional backfill shall be added leaving the pipe joints uncovered to permit inspection.

C. Exfiltration Test
1. Sanitary sewer manholes and each section of sewer line between successive manholes shall be tested by closing the lower end of the sewer to be tested and the inlet sewer of the upper manhole, using stoppers.
2. Fill the manhole and pipe with water to a point which produces a maximum of 3 feet of head above the invert of the sewer at the center of the upper manhole; or if groundwater is present, 3 feet of head above the average adjacent groundwater level.
3. The allowable leakage shall be 200 gal/inch of pipe diameter/mile/day

D. Infiltration Test
1. If excessive ground water is encountered in the construction of a section of the sewer, the exfiltration test shall not be used.
2. The upper and lower ends of the sewer to be tested shall be closed sufficiently to prevent the entrance of water.
3. Pumping of ground water shall be discontinued for at least 3 days; then infiltration shall be tested.
4. Infiltration into each section of sewer between adjoining manholes shall not exceed that allowed for the exfiltration test, except that head conditions shall be a maximum of 6 feet.

E. The Exfiltration Test may be limited to the manholes only when the authority having jurisdiction does not require the test and the construction manager waives the test. The Infiltration Test will always be required when excessive ground water is encountered in addition to the air test.

F. Air Test: Gravity systems shall be air tested between manholes at 3.5 psi for 5 minutes per ASTM F1417 for plastic pipes.

G. Deflection Test:
1. Deflection tests shall be conducted on all plastic pipe using a mandrel with a diameter equal to 95 percent of the inside diameter of the pipe. The test shall be performed without mechanical pulling devices.
2. Allowable Deflection: Maximum allowable pipe deflection shall not exceed 5 percent of nominal inside diameter.
3. Mandrel: Mandrel, go/no-go, device shall be cylindrical in shape and constructed with either 9 or 16 evenly spaced arms or prongs. Mandrels with fewer arms will be rejected as not sufficiently accurate. Contact length of mandrel's arms shall equal or exceed nominal inside diameter of

sewer to be inspected. Critical mandrel dimensions shall carry tolerance of 0.01-inch maximum. Contractor shall provide mandrel and necessary equipment for mandrel test.

4. Procedure: Mandrel shall be hand-pulled through flexible pipe sewer lines no earlier than 30 days after trench has been completely backfilled. Sections of sewer not passing mandrel shall be uncovered and rebedded, rerounded, or replaced to satisfaction of Owner or governing agency. Repaired section shall be retested.

H. Hydrostatic Test: Force main piping shall be hydrostatically tested at 150 psi in accordance with AWWA C 600.

I. Provide measuring devices, meters, water, materials, and labor for making the required tests.

J. Tests shall be conducted in the presence of the Construction Manager or his designee. Test data shall be submitted to the Engineer for review and approval.

END OF SECTION

SECTION 330800

SEWER MANHOLES, FRAMES, AND COVERS

GENERAL

1.1 SUMMARY

1.2 Section Includes

1. Monolithic concrete, modular precast concrete, masonry, and precast polyethylene manhole assemblies.

1.3 Related Sections

1. Section 031200 - Earthwork. Excavation, backfill, and compaction
2. Section 334100 - Storm Drainage

1.4 REFERENCE STANDARDS

A.

1. ASTM A 48 - Gray Iron Castings
2. ASTM C 55 - Concrete Building Brick
3. ASTM C 478 - Precast Reinforced Concrete Manhole Sections
4. ASTM C 923 - Resilient Connectors Between Reinforced Concrete Manhole Structures and Pipes
5. ASTM D 1248 - Polyethylene Plastics Molding and Extrusion Materials

B. International Masonry Industry All-Weather Council (IMIAC)

1. Recommended Practices and Guide Specification for Cold Weather Masonry Construction

C. State Department of Transportation (DOT), Construction and Material Specifications

1.5 SUBMITTALS

A. Shop Drawings: Indicate reference to Construction Drawings of manhole locations, elevations, piping with sizes, locations, and elevations of penetrations.

B. Product Data: Provide data for manhole covers, component construction, features, configuration, and dimensions.

PART 2 - PRODUCTS

2.1 MANHOLES

A. Cast-In-Place Concrete: Nonreinforced cast in place concrete barrel.

1. Concrete: 3500 psi concrete
2. Forms: Steel sheet accurately shaped and fabricated of sufficient strength to form dense watertight walls to true dimensions.

B. Precast Concrete: Reinforced precast concrete barrel.

1. Manhole sections conforming to ASTM C 478 with gaskets in accordance with ASTM C 923.
2. Construct manholes of precast concrete sections as required by Construction Drawings to size, shape, and depth indicated.

C. Concrete Brick: ASTM C 55, Grade N Type I-moisture controlled, normal weight, of same grade, type and weight as block units, nominal modular size of 3 5/8-inches x 7 5/8-inches x 2 1/4-inches

D. Precast Polyethylene:
1. Manufacturer: Advanced Drainage Systems (ADS) or approved equal.
2. Precast polyethylene in accordance with ASTM D 1248. Nominal cylinder internal diameter shall be 48-inches and shall be designed to accept concrete filled polyethylene manhole lids and standard cast iron frames with lid or grate.
3. Manholes shall have compressive strength that meets ASTM D 2412 standards.

E. Mortar and Grout: Mortar for finishing and sealing shall be Class "C". Honeycombing less than 2-inches deep shall be repaired using Class "D" mortar.

F. Brick Transition Reinforcement: Formed steel 8-gauge wire with galvanized finish.

G. Configuration:
1. Barrel Construction: Concentric with eccentric cone top section.
2. Shape: Cylindrical
3. Clear Inside Dimensions: 48-inches diameter minimum or as indicated on Construction Drawings.
4. Design Depth: As indicated on Construction Drawings.
5. Clear Lid Opening: 22-inches minimum
6. Pipe Entry: Provide openings as indicated on Construction Drawings
7. Main and Lateral Pipes: Neatly cut off main and lateral pipes flush with inside of manhole or inlet where they enter structure walls. Point up irregularities and rough edges with nonshrinking grout.

H. Inverts: Shape inverts for smooth flow across structure floor as indicated on Construction Drawings. Use concrete and mortar to obtain proper grade and contour. Finish surface with fine textured wood float.

2.2 COMPONENTS

A. Lid and Frame:
1. Manufacturer: Neenah Foundry Company, East Jordan Iron Works, or approved equal.
2. ASTM A 48, Class 30B heavy duty cast iron construction, machined flat bearing surface.
3. Removable lid, closed or open as indicated on Construction Drawings, sealing gasket.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify items specified by other Sections are properly sized and located.

B. Verify that built-in items are in proper location and ready for roughing into work.

C. Verify that the excavation for manholes is correct.

3.2 PREPARATION

A. Coordinate placement of inlet and outlet pipe or duct sleeves as indicated on Construction Drawings.

3.3 PRECAST MANHOLE CONSTRUCTION

A. Place base pad to proper elevation and location and trowel top surface level for placement of manhole barrel.

B. Place manhole barrel plumb and level to correct elevations and anchor to base pad.
   1. After completion of slab foundation, lower first joint of manhole barrel into position, grooved end first, and set level and plumb on concrete base. Align and adjust to proper grade prior to placing and forming invert. Pour invert immediately after setting of first section of manhole barrel.
   2. Prior to setting subsequent manhole barrel sections, apply primer to tongue and groove ends and allow to set in accordance with manufacturer's recommendations. Place "Ram-nek", or equivalent, plastic rope on tongue end. Lower next section into position, and remove excess material from interior of structure. Add additional material on exterior of joint, if necessary, for completely watertight joint.

C. Set cover frames and lids level without tipping, to correct elevations. Utilize pre-cast rings or brick and mortar to achieve final rim elevation. Maximum limit, 4 courses.

3.4 CAST-IN-PLACE MANHOLE CONSTRUCTION

A. Cast-in-place shall conform to the applicable requirements. Utilize steel forms.

B. Place base pad to proper elevation and location and pour monolithically with invert. Base shall support pipe to first joint.

C. Deposit concrete in evenly distributed layers of about 18 inches, with each layer vibrated to bond to preceding layer.

D. Place gasket between all joints and paint exterior of manhole within 5’ of the joint with mastic waterproofing.

E. Place precast concrete cone.

F. Set section cover frames and lids level without tipping, to correct elevations. Utilize pre-cast rings or brick and mortar to achieve final rim elevation. Maximum limit, 4 courses.

3.5 MASONRY MANHOLE CONSTRUCTION

A. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

B. Lay masonry units in running bond. Course 3 brick units and 3 mortar joints to equal 8 inches.

C. Form flush mortar joints

D. Lay masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.

E. Install joint reinforcement 16 inches on center

F. Place joint reinforcement in first and second horizontal joints above base pad and below lid frame opening

G. As work progresses, build in fabricated metal items

H. Cut and fit masonry for pipes as specified herein

I. Set cover frames and covers level to correct elevations without tipping.

3.6 TESTING

A. General:

1. All sanitary sewer manholes shall be inspected and tested tested for water tightness or damage prior to acceptance by the owner and engineer. If a manhole fails the test, the Contractor shall locate the leak and make proper repairs and re-test. The owner or engineer reserves the right to refuse leaking manholes, in which case the Contractor will replace the manhole at his expense.

END OF SECTION

SECTION 33 41 00

STORM DRAINAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes
1. Storm sewer drainage piping, fittings, and accessories.
2. Storm drainage structures.

1.2 Related Requirements
1. Section 312000 - Earthwork
2. Section 312800 - Erosion and Sedimentation Control
3. Section 033000 - Cast-In-Place Concrete

1.3 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials (AASHTO)
1. AASHTO M36 - Zinc Coated (Galvanized) Corrugated Iron or Steel Culverts and Under Drains
2. AASHTO M190 - Bituminous Coated Corrugated Metal Culvert Pipe and Arches
3. AASHTO M252 - Corrugated Polyethylene Drainage Tubing, 3 to 10 Inch Diameter
4. AASHTO M294 - Corrugated Polyethylene Drainage Tubing, 12 to 48 Inch Diameter
5. AASHTO MP7-97 - Corrugated Polyethylene Drainage Tubing, 54 to 60 Inch Diameter
6. AASHTO M198 - Joints for Circular Sewer and Culvert Pipe Using Flexible Watertight Gaskets
7. AASHTO H170 – Reinforced Concrete Culvert, Storm Drain and Sewer Pipe

B. American Society for Testing and Materials (ASTM)
1. ASTM A74 - Cast Iron Soil Pipe and Fittings
2. ASTM A185 - Steel welded Wire Fabric, Plain, for Concrete Reinforcement
3. ASTM A615 - Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
4. ASTM A746 - Ductile Iron Gravity Sewer Pipe
5. ASTM C76 - Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
6. ASTM C150 - Portland Cement
7. ASTM C206 - Finished Hydrated Lime
8. ASTM C443 - Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets
9. ASTM C564 - Rubber Gasket for Cast Iron Soil Pipe and Fittings
10. ASTM C969 - Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines
11. ASTM D3034 - Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings
12. ASTM D3212 - Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
13. ASTM F477 - Elastomeric Seals (Gaskets) for Joining Plastic Pipe
14. ASTM F949 – Poly (Vinyl Chloride)(PVC) Corrugated Sewer Pipe with Smooth Interior and Fittings

C. American Concrete Institute (ACI)
1. ACI301 - Structural Concrete for Buildings

1.4 SUBMITTALS

A. Product Data: Provide data on pipe materials, pipe fittings, and accessories. Provide shop drawings for precast inlets, catch basins and junction boxes.

B. Manufacturer's Certificate: Certify that products meet or exceed specified local requirements.

C. Project Record Documents
   1. Accurately record actual locations of pipe runs, connections, catch basins, cleanouts, and invert elevations.
   2. Identify and describe unexpected variations to subsoil conditions and location of uncharted utilities.

1.5 PROJECT CONDITIONS

A. Coordinate work with termination of storm sewer connection outside building including connection to municipal storm sewer system.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. Reinforced Concrete Pipe (RCP): ASTM C76, Class III unless noted otherwise on Drawings, installed with flexible plastic, bitumen gaskets at joints.
   1. Gaskets: AASHTO M 198 751, Type B or ASTM C 443, installed in accordance with manufacturer’s recommendations.
   2. Flared end sections shall be per ASTM C76 or AASHTO H170 (for sections with toe wall)

B. High Density Polyethylene Pipe (HDPE): AASHTO Designation M252 Type S, M294 Type S and MP7-97 Type S, smooth interior/annular exterior. Only permitted when specifically indicated on Drawings. Pipe shall be installed in accordance with pipe manufacturer's installation Guidelines for Culvert Storm Drainage Applications.
   1. Pipe Joints and fittings shall conform to AASHTO M252 and M294.
   2. Acceptable manufacturers: Advanced Drainage Systems, Inc. "ADS N-12", HANCOR, INC. "Hi-Q", or approved equal.

C. Spiral Rib Metal Pipe: ASTM A 760 Type 1R or Type IIR. Coatings shall meet requirements of ASTM A929 and shall be galvanized, aluminized, or bituminous coated as specified on Drawings. Only permitted when specifically indicated on Drawings.
   1. Pipe ends shall be re-corrugated and installed with semi-corrugated “Hugger” type bands and “O” ring gaskets in accordance with pipe manufacturer’s installation requirements.
   2. Pipe gauge shall be as specified on construction drawings or if no gauge is given then the minimum gauges are as follows: 15” to 42” diameter round pipe – 16 gauge (0.064”), 48” to 60” round pipe – 14 gauge (0.079”), 66” to 78” round pipe – 12 gauge (0.109”), 15” to 30” pipe arch – 16 gauge (0.064”), 36” to 42” pipe arch – 14 gauge (0.079”), and 48” to 78” pipe arch – 12 gauge (0.109”). Gauges for larger diameters shall be indicated on the drawings.

3. Installation shall be in accordance with ASTM A798 and A796 as they apply, manufacturer's requirements, and as indicated on the drawings.
4. Standard corrugated steel pipe as described in section E of these specifications shall not be substituted for any diameter of Spiral Rib Steel Pipe.
5. Manufacturer: Contech, Inc. "Ultra Flo or Ultra Flo II", Southeast Culvert, Inc. "Max Flow", St. Regis Culvert, Inc. "Max Flow", Thompson Culvert, Inc. "Max Flow", or approved equal.

D. Polyvinyl Chloride (PVC) Pipe: ASTM D3034, rated SDR 35 (or ASTM 949 for Profile Pipe) continually marked with manufacturer's name, pipe size, cell classification, SDR rating, and ASTM D 3034 classification. Only permitted when specifically indicated on Drawings.
1. Pipe joints: ASTM D 3212 using restrained gasket conforming to ASTM F477.

E. Corrugated Steel (Metal) Pipe (CSP or CMP): ASTM A 760, 16 gauge unless another gauge is indicated on Drawings. Galvanized, aluminized (Type 1R), or bituminous coated as specified on Drawings. Only permitted when specifically indicated on Drawings. Corrugated steel pipe may be round pipe, arch pipe, or slotted drainpipe as indicated on Drawings. Slotted drainpipe shall have 1.75-inches wide drain waterway openings and 6 inches minimum height drain guide
1. CSP, bands and appurtenances shall be uniformly coated inside and outside with a 0.05 inch minimum thickness bituminous coating in accordance with AASHTO M190. .
2. CSP shall be supplied with paved inverts or fully lined to provide a smooth interior, smooth flow lining only as indicated on the drawings.

F. Ductile Iron Pipe (DIP): ASTM A746
1. Fittings: Cast iron conforming to ASTM A74
2. Joint Material: Rubber gasket conforming to the requirements of ASTM C564 for compression joints.

G. Subdrains: Perforated, PVC or flexible corrugated plastic pipe as specified herein of the size indicated on the drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that trench cut and excavation is ready to receive work and excavations, dimensions, and elevations are as indicated on Drawings.

3.2 PREPARATION

A. Hand trim excavations to required elevations. Correct over excavation with bedding material.

B. Remove large stones or other hard matter that could damage piping or impede consistent backfilling or compaction.

C. Protect benchmarks, property corners, and other survey monuments from damage or displacement. If marker needs to be removed it shall be referenced by licensed land surveyor and replaced, as necessary, by same.

3.3 INSTALLATION - PIPE

A. The pipe shall be inspected for defects and cracks before being lowered into the trench, piece by piece. Any defective, damaged or unsound pipe or any pipe that has had its grade disturbed after laying shall be taken up and replaced. Open ends shall be protected with a stopper to prevent earth or other material from entering the pipe during construction. The interior of the pipe shall be free from dirt, excess water and other foreign materials as the pipe laying progresses and left clean at the completion of the installation.

B. Excavate pipe trench and place bedding material in accordance with Section 312000.

C. Installation shall commence at the lowest point for each segment of the route. RCP shall be laid with the groove or bell end upstream. Riveted CSP shall be placed with the inside circumferential laps pointing downstream. Repair damaged bituminous coating on CSP by applying bituminous material conforming to AASHTO M190.

D. Lay pipe to the required line and slope gradients with the necessary fittings, bends, manhole, risers and other appurtenances placed at the required location as noted on Drawings.

E. Do not displace or damage pipe when compacting.

F. No pipe shall be laid in water or when trench conditions are unsuitable for such work.

G. Joints:
   1. Joints shall be constructed as described herein and in accordance with manufacturer's installation instructions with the intent that they be made watertight.
   2. For RCP, the joint surface shall be cleaned and washed with water, if necessary, before the joints are made. For tongue and groove joints in smaller sizes, make joints butting the inside of the bell with a cement mortar before joining. The inside joint shall be wiped clean of excess mortar by brush or a squeegee drawn through the pipe as the laying operations progress. In the lager diameters, which permit the entry of a man, annular space between pipe sections shall be completely filled with mortar and finished off smooth with the inside surface of the pipe.
   3. CSP shall be joined by standard corrugated connecting bands. Keep dirt or gravel out from between the pipes and band so that corrugations fit snugly. While being tightened, the bands shall be tapped with a mallet to take up slack and insure a tight joint.
   4. PVC fittings shall be attached to the pipe by solvent welding according to the manufacturer's recommendations.

3.4 SUBDRAINS

A. Subdrains shall be installed in accordance with the details and at the locations shown on the drawings

3.5 INSPECTION AND TESTING

A. General
   1. Strom sewer systems and culverts, upon completion or at such time as directed, shall be cleaned, inspected and tested. The system or culvert shall have a true grade and line. Actual elevations shall be within 0.08 feet of the elevations given on the drawings.

2. After completion of the Work, or any part thereof, the job shall be tested to determine that it has been installed in accordance with the drawings and specifications. In general, the Work shall prove to be in good condition, installed in accordance with the drawings and specifications and ready for use.

B. Cleaning and Testing
   1. Visibly inspect and remove all debris and obstructions from storm pipe. Test for infiltration and exfiltration by hydrostatic testing per ASTM C969. Manholes and pipe shall conform to ASTM C969 leakage criteria.

C. Alignment Test
   1. After backfill has been placed and compacted to a depth not less than one foot above top of pipe, a visual inspection shall be made by flashing a light between manholes. Any displacement or misalignment of invert shall be corrected.

END OF SECTION